## NATIONAL HIGH AGNETIC FIELD LABORATORY

### 2020 Annual Report





1800 E. Paul Dirac Drive Tallahassee, FL 32310

NationalMagLab.org

#### 2020 Annual Report

Produced by

National High Magnetic Field Laboratory

DIRECTOR Gregory S. Boebinger

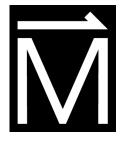
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> This document is available in alternative formats upon request. Contact Anke Toth for assistance via atoth@magnet.fsu.edu





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# DIRECTOR'S EXECUTIVE SUMMARY

It has become a cliché to say that 2020 was a year unlike any other, but as SARS-CoV2 spread across the globe in the spring, operations at the MagLab were impacted like many organizations around the world. Our staff began working remotely in March 2020 and, after new COVID-safety measures were implemented, on-site research activities were able to restart after only a brief disruption.

#### THE USER PROGRAM

Despite a global pandemic, the MagLab continued to serve scientists from across the globe in 2020, advancing society's understanding of new materials, energy solutions, and the science that underlies life. Nearly 1,500 researchers, students and technicians conducted experiments across the lab in 2020 – many remotely due to travel restrictions and social distancing measures.

To meet user needs despite COVID, the lab created new opportunities for researchers to access our fleet of world-record magnets. About eight percent of users sent samples to the lab to run their experiments. Some users worked seamlessly with on-site user support scientists through collaboration carts, specially-created mobile tools to allow geographically-distributed researchers the feeling of being on-site. Other users were able to remotely control their experiment, operating their magnet from a remote location. And still others were able to access MagLab data sets to conduct their own independent research.

Remarkably, the National MagLab's user community continued to expand with new researchers using the facility to investigate interdisciplinary scientific questions that span the spectrum – from physics to biology, chemistry to engineering. Of the 384 principal investigators in 2020, nearly 20 percent were new to the MagLab user facility that they accessed to conduct their research. More than 700 users, about 47 percent of the lab's total user community, were students and postdocs. More than 28 percent of the National MagLab's users who chose to identify were females and nearly 9 percent identified as a minority.

National MagLab users remained exceptionally positive about their experience in 2020. A user survey conducted in June continues to show overwhelming satisfaction:

- 96% external users are satisfied with the performance of the facilities and equipment
- 97% external users are satisfied with the assistance provided by technical staff
- 93% external users are satisfied with the proposal process

Across the National MagLab's seven user facilities, enhancements and upgrades were made in 2020 that improved the user experience and experimental environment. These enhancements included:

- The High B/T Facility expanded to encompass three separate laboratories, nearly doubling lab space. The new High Bay Convergence Laboratory features ground floor space for up to four high-field magnet stations and a mezzanine to support student training and instrumentation development. In 2020, this area was configured for two wide-bore NMRquality superconducting magnets - an 18.8T, 89mm (800MHz<sup>1</sup>H) magnet, expected on site in March 2021, and an existing 9.4T, 89mm (400MHz<sup>1</sup>H) magnet, which was moved to this space in 2020 and is expected to be operating in 2021.
- A new 75T duplex magnet at the Pulsed Field Facility was launched in February 2020. This duplex magnet features two independent coils, each powered by a different subsystem of the 16kV, 4MJ capacitor bank and a modular design that reduces the voltage needed and provides more design flexibility to maximize magnetic fields with a short cooling time (~1hr) between pulses.
- DC Field Facility created collaboration carts to give users access to a magnet cell during remote experiments. These carts consist of a computer, monitor, two high-definition cameras with pan, tilt and zoom functionality and a low power Bluetooth headset that

allow MagLab staff handsfree communication as they are working with remote users during their magnet time.

- An upgrade was made to the AMRIS NMR console for the 600MHz systems to enhance multireceive capabilities.
- In EMR, integration of an arbitrary waveform generator (AWG) capability and upgrade of the user interface were made on HiPER. The new AWG capability enables arbitrary shaped high-power waveforms, including chirped pulses spanning a 1GHz (94.0±0.5GHz) bandwidth, enabling wideband excitation and implementation of state-of-the-art pulse schemes (e.g., chirp echo Fourier transform EPR) akin to what is possible in NMR.
- In 2020, the ICR facility developed a new ion loading technique called "chimeric ion loading" that saves valuable acquisition time, decreases sample consumption, and improves top-down protein sequence coverage.
- AMRIS began construction of Low-E MAS probes at 800MHz to enhance high field capabilities.
- Three NMR probes were developed, including two for the SCH (3.2mm HX, middle- $\gamma$ , v<sub>x</sub> = <sup>15</sup>N-<sup>71</sup>Ga; 3.2mm HX, low- $\gamma$ , v<sub>x</sub> = <sup>103</sup>Rh-<sup>15</sup>N) and one for the 800 (1.3mm HX(Y), in testing).
- MagLab electrical engineers and scientific staff made significant progress on a power supply upgrade project, including development of a prototype MOSFET bank test rig to validate calculations and simulations of power output, response to control signals, thermal transfer and heat sink performance, frequency response and noise levels.
- The ICR facility reports ultrahigh resolving power ion isolation by SWIFT on a 21T Fourier transform ion cyclotron resonance (FTICR) mass spectrometer.
- The NMR 800#2 console was upgraded to a Bruker NEO, and the 900 console is in the process of being upgraded with a NEO console as well, along with a significant upgrade in the gradient and shim system (450V/300A) and shimming capabilities for *in vivo* MRI/S. With multiple channels and transceiver capabilities, this will offer enhanced capabilities in a new super-wide configuration to augment the existing microimaging and SSNMR applications

#### USER RESEARCH

In 2020, users published 485 peer-reviewed papers, many in significant journals like Science, Nature, Physical Review Letters, Energy Fuels, Analytical Chemistry, and the Proceedings of the National Academy of Sciences. A complete database of user publications can be found at https://nationalmaglab.org/research/publications-all/peer-reviewed-publications . Important discoveries include:

- The 32T all-superconducting magnet facilitated its first condensed matter NMR experiments on the potential quantum spin-nematic compound  $\beta$ -TeVO<sub>4</sub>.
- <sup>17</sup>O ssNMR was used for the identification and assignment of a "wire" of water molecules involved in hydrogen bonding with carbonyl groups in gramicidin-A, shedding new insight on their dynamics in the central channel of the protein.
- Using a technique called matrix-assisted laser desorption ionization (or MALDI) for the first time on the 21T ICR magnet, researchers were able identify and map the special distribution of tiny, distinct lipids from very thin slices of healthy rats' brains, demonstrating the ability to separate two molecules with a difference in molecular weight of 0.00179 daltons.
- Researchers were the first to discover a quantum fluid—fractional quantum Hall states, one of the most delicate phases of matter—in a monolayer 2D semiconductor, a finding that could provide a unique test platform for future applications in quantum computing.
- The existence of a spin diffusion barrier (*i.e.*, slower nuclear spin polarization diffusion around bis-nitroxides) was demonstrated for the first time under MAS-DNP conditions, using the MAS DNP NMR platform during 2020.

- ICR researchers showed that exposure to sun and water causes thousands of chemicals to leach from roads into the environment.
- Using the duplex magnet at Pulsed Field Facility, the Kondo (insulating) gap was closed, enabling the study of the high-field metallic state of YbB<sub>12</sub>. Comparing the frequency of the quantum oscillations in both the insulating and metallic state, researchers concluded that all observed oscillations were originating from the same quasiparticle band.
- AMRIS users cultured cells containing glucose to compare metabolism in healthy liver hepatocytes and a hepato-carcinoma cell line. Data suggests that deuterated water (HDO) production could be used as a surrogate for glucose uptake, which is the metric measured in FDG-PET diagnoses of cancer, without exposure to radioactive isotopes.
- In EMR, the first transition metal complexes featuring mixed fluorido-cyanido ligands, trans-[MIVF4(CN)2]<sup>2-</sup> (M = Re, Os) were isolated thanks to a novel synthetic approach relying on silicon-mediated fluoride abstraction.
- Using a new 'smart' technique developed by PFF scientists for measuring non-linear transport in pulsed magnetic fields, critical currents in cuprates, iron- and new nickel-based superconductors have been studied up to 65T.
- In an EMR study, the dynamical generation of spin currents using an antiferromagnetic material has been demonstrated for the first time, enabling spin pumping at sub-terahertz frequencies more than two orders of magnitude faster than ferromagnetic spintronics devices.
- A novel ultra-low temperature NMR experiment has been conducted at High B/T to observe Luttinger liquid physics in a one-dimensional system consisting of <sup>3</sup>He atoms confined to tubular nanostructured MCM-41.
- In an analysis of breast cancer cell lysate, ICR users performed collision-induced dissociation (CID) and electron-transfer dissociation (ETD) on each precursor on timescale compatible with chromatography, and improved mean sequence coverage dramatically (CID-only 15% vs chimeric 33%).
- Combining pulse magnetic fields and THz time-domain spectroscopy, PFF users were able to study the cyclotron resonance (CR) of holes in the normal state of high-quality thin films of optimally doped La<sub>2-x</sub>Sr<sub>x</sub>CuO<sub>4</sub>, the first measurement of a cyclotron mass in this family of cuprate superconductors.
- The Consortium for Top-Down Proteomics launched a study to assess the current state of top-down mass spectrometry (TD MS) and middle-down mass spectrometry (MD MS) for characterizing monoclonal antibody (mAb) primary structures, including their modifications. The total sequence coverage obtained for the ETD/PTR MS/MS data collected off the 21T FT-ICR MS system in the ICR facility was the highest achieved from a single experiment in the study.
- Using DC Field Facility's 35T resistive magnet coupled with an advanced cryogenic system and piezo cantilever to measure the magnetization of the material via torque, users were able to explore a topological semimetal by determining the electron-electron interactions in SrZnSb<sub>2</sub> through the mapping of the Fermi surface in high magnetic fields.
- ICR researchers collected water samples daily over a 6-day storm from small drainage areas of varying landcover to see how the concentration and type of carbon changed over the course of a storm. Results showed that the amount and type of carbon in the stream changed dramatically during the storm and originated from different areas of the landscape. The flow of water through the soil also changed during the storm and was related to the type and amount of carbon entering the stream. Storm events not only impact carbon entering the stream but also may impact its transfer to coastal marine ecosystems
- AMRIS users examined the effect of a ketogenic diet on de novo lipogenesis in the liver tissue of mice fed one of three diets: low fat, high fat, or HF plus increased branched-chain amino acids diet.

- Through the use of ultrafast spectroscopy, DC Field users discovered that aggregates of aromatic chromophores can act as molecular solenoids that enhance or quench observed magnetic field effects. Currents of several nanoamperes were shown to be induced in the aromatic light. This research opens a window into a new realm of potential materials that could be utilized for multifunctional magnetic technologies.
- Users performed measurements on a two-dimensional Wigner Crystal using a speciallydesigned rotator stage for measurements in a tilted magnetic field at ultra-low temperatures at the High B/T facility and observed the crystal transforming gradually through an intermediate state where it mixes with liquid. This research suggests that twodimensional Wigner Crystal to liquid transition is not a direct first order transition and that intermediate mixture phase formation may be a general aspect of strongly interacting low dimensional systems, providing insights to other quantum phase transitions in many-body electronic systems.

More user research as well as research highlights from our in-house research teams are featured on our website <u>https://nationalmaglab.org/research/publications-all/science-highlights-all</u> and in our news articles <u>https://nationalmaglab.org/news-events/news</u>.

#### ADVANCEMENTS IN MAGNET-MAKING

Thanks to a proposal funded by the National Science Foundation in late 2019 (NSF/DMR #1938789), the conceptual design of a REBCO-based all-superconducting 40T magnet with a bore size of 34mm continued in 2020. Despite COVID's impact on the 40T test coil schedule, the lab completed testing three coils this year including a *mini fatigue test coil* to investigate the HTS coil performance under fatigue operation, a *multitape insulated test coil* that was successfully tested up to a field of 11T in a 12T background field (23T total) to demonstrate two-in-hand coil-winding and fatigue lifetime, and a *resistive insulation* Pettern test coil to investigate the quench protection of a resistive-insulated coil with a controlled contact resistance between turns compared to an ideal no-insulation coil. Based on these test coils and additional screening current modeling and contact resistance control and quench protection work, a full design proposal has now been submitted the NSF's Mid-Scale research Infrastructure program for the Preliminary and Final Design Phases.

The 32T all-superconducting magnet completed commissioning and is now providing DC Field Facility users a sustained high field environment with lower field ripple and electronic noise than resistive or hybrid magnets.

At the Pulsed Field Facility, efforts are also under way for a 60T mid-pulse magnet to provide users with a three times longer pulse duration (300msec pulse length, FWHM ~ 70msec) than what is available with existing 65T magnets. This magnet is currently in the prototype and testing phase. Preliminary designs for an 85T duplex magnet that leverages an upgraded capacitor system are now complete, with expected final designs in 2021. In 2020 upgraded versions of the 100 T's coils 1 and 2 were fabricated using high-strength, nano-structured Cu-Nb conductor developed by the MagLab in collaboration with our commercial partner, Nano-Electro. This new conductor is approximately 50% stronger than the wires used in the existing version and will be used on the 100T when rotor repairs are complete.

Materials development for magnet applications continues to advance with important developments in Bi-2212, Fe-based, Nb<sub>3</sub>Sn superconductors, and qualification of REBCO from multiple suppliers, as well as reinforcing materials for pulsed and SC magnets. Tests of high-temperature superconducting REBCO tapes at 4.2K showed resistance to cyclic loading, demonstrating that it is a promising material for designing HTS magnets of the future. Engineers received \$1.5 million from the U.S. Department of Energy to fund continued research on niobium-tin (Nb<sub>3</sub>Sn). Additional collaborations with industry, academic and government groups, including the high-energy physics community, continues, particularly in the area of developing higher current-density LTS and HTS superconductors. The MagLab also continues to be one of the four

central players in the Magnet Development Program (MDP) funded by the DOE Office of High Energy Physics (HEP) to drive ultra-high field dipole magnet technology.

#### BROADENING PARTICIPATION & BUILDING THE STEM PIPELINE

Before COVID made in-person events impossible, the National MagLab hosted about 10,000 visitors to a special 25<sup>th</sup> anniversary Open House event in February 2020. Visitors enjoyed special time-themed demonstrations, were invited to a Travel-Through-Time Scavenger Hunt, and predicted the future in a Time Vault that will be opened at the MagLab's 50th Open House in 2045.

During the 2019-2020 school year, outreach was provided to more than 5,300 students in Florida. In lieu of in-person summer camps, the MagLab hosted a 10-week virtual Summer Exploration Series for middle and high school students that highlighted different research areas of the MagLab with live and asynchronous programming. The 2020 Middle School Mentorship and High School Externship Programs were both converted to a virtual format where nearly 30 students were able to have an impactful science experience while maintaining COVID safety protocols. Beyond traditional programs, the MagLab website and YouTube channel saw expanded audiences as COVID impacted in-person learning and changed where people accessed education-based content and YouTube videos had more than 33 million impressions and 2.2 million views. Educational research on the MagLab's SciGirls coding camp in 2020 also yielded a framework to better understand how to encourage girls and underrepresented minorities in STEM's most male-dominated field, computer science.

In 2020, 54 scientists and staff reported outreach to the community reaching nearly 2,000 people. MagLab staff also gave 164 lectures, talks and presentations to organizations around the country and the world, more than 67% which were conducted virtually due to COVID. The MagLab hosted an in-person Winter Theory School and Convergence in High Magnetic Fields symposium in January 2020 as well as a virtual User Committee Workshop and Applied Superconductivity Conference later in the year.

#### CULTIVATING A SAFE AND HEALTHY LAB ENVIRONMENT

This year, with strong support from our host institutions, the National MagLab's health and safety team were at the forefront as COVID mitigation measures were put into place to ensure the safety of users, staff, contractors and visitors. Working together with Public Affairs and key personnel from across the lab, the safety department created a MagLab-specific COVID training that all employees and staff were required to take before entry was permitted. A special committee was formed to review projects and personnel and grant access to the lab for key research duties. Specific COVID protocols have evolved throughout the year, but a focus on key health and safety measures like handwashing, staying home when you are sick and respecting others' personal space will remain.

In 2020, the MagLab strategically invested nearly \$50,000 for safety-related equipment, supplies, training and processes including personal protective equipment, equipment used to lockout/tagout and verify hazardous energy sources, fall protection, and COVID-related supplies. The MagLab developed a new safety device to ensure that the power supplies are disconnected and isolated from the magnet before any maintenance or construction work begins on the magnets without exposing workers to any sort of high voltage hazard. This new safety device enables technical work on magnet systems with uninsulated conductors by making certain that the power source is physically disconnected from the magnet.

#### LOOKING AHEAD

The MagLab will continue to provide access to world-unique high field environments to diverse users from around the world. Upgrades to the Pulsed Field Facility's power infrastructure will provide a new 30kV-1.2MJ capacitor bank by the end of 2021. Preliminary designs for an 85T duplex magnet using the upgraded capacitor system have been completed and will be further refined

to a final design in early 2021 with testing in early 2022. A 9.4T (400MHz) magnet in High B/T Facility's new High Bay Convergence Laboratory will host users in 2021 and a second instrument – a 18.8T (800Mhz) magnet – will arrive on-site in the coming months.

In the EMR facility, ongoing efforts aimed at commissioning an EPR capability in the 36T highresolution SCH magnet will continue in 2021 with a plan to commence EMR user operations in the SCH in 2022. Through a NIH P41 technology development grant, AMRIS is constructing a nextgeneration HTS cryoprobe that we anticipate will be available to users by the end of 2021.

A bank of chilled water pumps in the DC Field Facility will be replaced during the 2021 annual maintenance shutdown to supply additional water flow through the magnet cooling water heat exchangers and improve temperature stability of the magnet cooling water loops as the pumps turn on and off depending on the heat load.

A design proposal has now been submitted the NSF's Mid-Scale research Infrastructure program for the Preliminary and Final Design Phases of the 40T all-superconducting magnet. If this is successful, it will last five years, and an Implementation proposal will be submitted to the Mid-Scale program in 2025 for the construction of the magnet.

All MagLab user facilities and in-house research groups continue to advance the development of new instrumentation to serve our growing user community. Please explore the detailed information available in the individual chapters that follow and across our website at <a href="https://nationalmaglab.org/">https://nationalmaglab.org/</a>

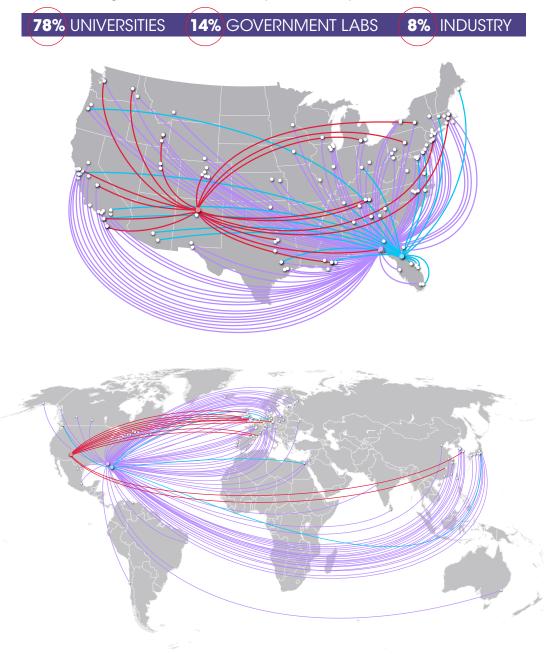
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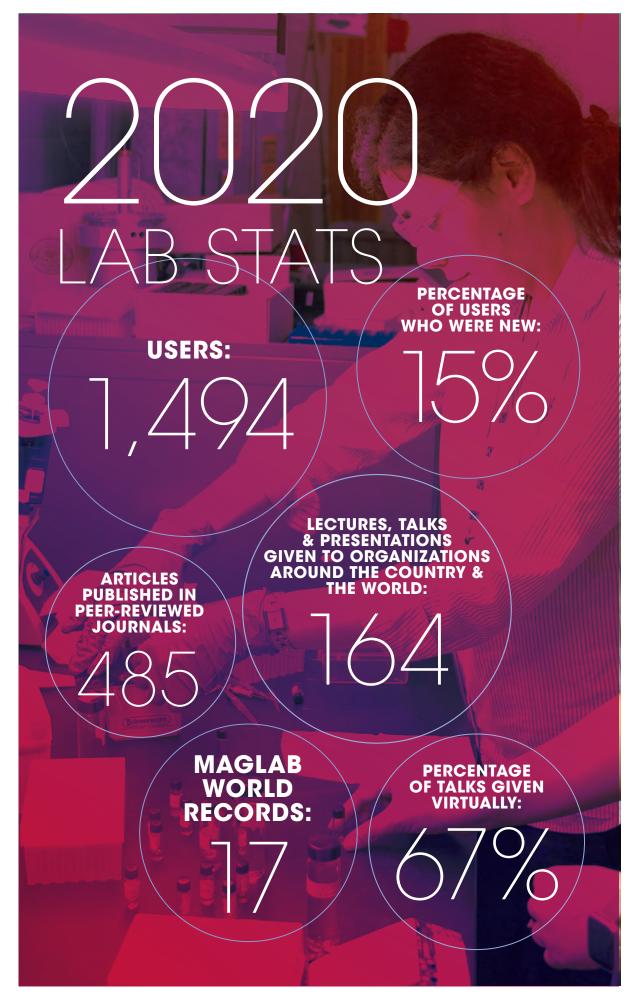


2020 MagLab Annual Report - Year at Glance

## SCIENCE KNOWS NO BOUNDARIES

Seeking the most powerful magnetic fields on Earth, scientists and engineers from around the world conduct their experiments at the National MagLab. In 2020, our **1,494** users represented **272** universities, government labs and private companies worldwide.

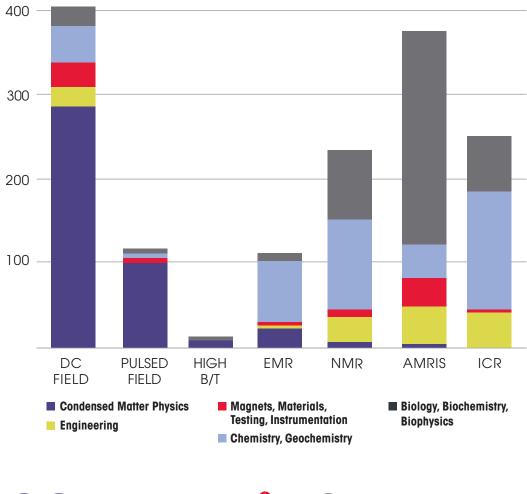




## WHO OUR USERS ARE

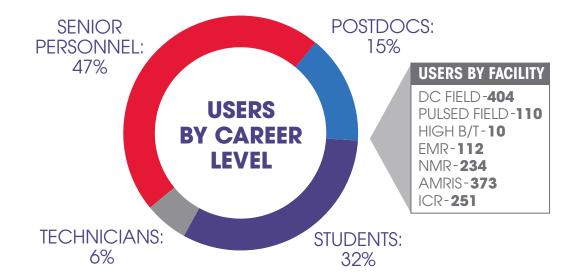
High magnetic fields are a powerful research tool across many disciplines leading to groundbreaking discoveries that impact your life. The lab comprises 7 distinct user facilities that offer our researchers a wide range of research capabilities:

- DC Field Steady, continuous magnetic fields up to 45 T
- Pulsed Field Short, ultra-powerful magnetic fields up to 100 T
- High B/T Magnetic fields up to 15 T combined with ultra-cold temperatures of 0.4 mK
- Electron Magnetic Resonance (EMR) Magnetic resonance techniques associated with the electron
- Nuclear Magnetic Resonance (NMR) Solid & solution state NMR & animal imaging
- Advanced Magnetic Resonance Imaging & Spectroscopy (AMRIS) High-resolution solution and solid-state, NMR, animal imaging & human imaging
- Ion Cyclotron Resonance (ICR) Ultra-high resolution and high mass accuracy Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometry

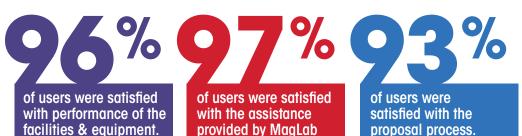


#### **2020 USERS BY DISCIPLINE**





## WHAT OUR USERS SAY



technical staff.

Data reflects external users only. All users were surveyed anonymously.



**Leah Schaffer** — University of Wisconsin – Madison Visiting the MagLab was one of my favorite weeks of grad school!! They showed me all the different magnets, helped me generate great data, and even took photos of me by my favorite tree while we waited for samples to centrifuge.



**Mikey Wojnar** — Northwestern University I am SO EXCITED for this paper - I have only the best memories of going to @NationalMagLab and @argonne (right before shutdown!) to collect data. I have had so much fun collaborating with and learning from all of these amazing scientists. The science is better because of it.



**Thomas A. Searles, PhD.** — Howard University Crazy to think last year this time I was @NationalMagLab doing a magnetoPL experiment on 2D heterostructures... yeah I still dabble in the lab... the run went extremely well not due to me but more the sample; need to go back when it's normal to finish that up .



## INVESTING IN THE FUTURE

The National MagLab is funded by the National Science Foundation and the state of Florida, making you a stakeholder in our science. In return for your investment, we are positively impacting the nation's economy and making critical discoveries that will lead to the technologies of tomorrow.

### BUDGET

#### TOTAL BUDGET: \$ 55,041,846

NSF CORE GRANT: 67% \$36,780,000

> Fiscal Year 2020 Funding

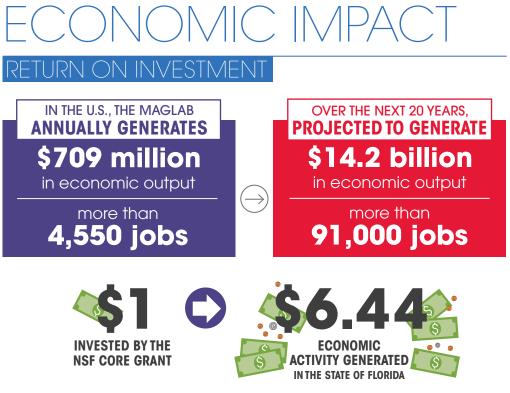
Physics & Materials Research: **48%** Magnets, Materials & Engineering: **22%** Chemistry: **10%** Biology & Biochemistry: **8%** Management & Administration: **10%** Education & Diversity: **2%** 

STATE OF FLORIDA: 23% \$ 12,768,577

AFFILIATED INDIVIDUAL INVESTIGATOR AWARDS\*: 10% \$ 5,493,269

\*New 2020 awards from funding other than the NSF core grant and state of Florida.

2020 MagLab Annual Report - Year at Glance



Source: The Center for Economic Forecasting, Florida State University, 2019

#### CROSS-SECTOR PARTNERS

Our researchers and staff develop partnerships and collaborations with private sector industries, universities, national labs and international organizations to help bring new technologies closer to the marketplace.

100+ PATENTS over the lab's lifetime

High magnetic field research can impact dozens of industrial sectors including **computer & electronic product manufacturing**, **clean energy**, and **pharmaceuticals**.

### MAGLAB STAFF

The MagLab employs a diverse workforce that includes scientists, machinists, engineers, administrators, writers and even artists.

#### Total MagLab Staff: 736

| 240                                                                                                                               | 92                                        | 109                                                                   | 28 | 63 | 156                                 | 48     |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|----|----|-------------------------------------|--------|
| <ul> <li>Senior Personnel: 240</li> <li>Other Professional: 92</li> <li>Support Staff - Technical/<br/>Managerial: 109</li> </ul> | <ul> <li>Postdo</li> <li>Gradu</li> </ul> | ort Staff - Cle<br>octoral: <b>63</b><br>ate Student:<br>graduate Stu | 15 | 6  | 40%<br>of MagLab stu<br>are female. | udents |

## SPARKING CURIOSITY

Whether in a traditional classroom setting or on our website, within the walls of our lab or in universities around the globe, the National MagLab is committed to sharing our passion for science. We are growing the next generation of scientists and inspiring all individuals about the magic of discovery in high magnetic fields.

Before Florida was impacted by COVID-19, the MagLab hosted an in-person Open House event in celebration of the lab's 25<sup>th</sup> anniversary with more than

VISITORS

28,000

YouTube subscribers added, bring our total subcriber number to over **130K!** 

K-12 students in virtual mentorship or camp programs, **56%** of whom were from underrepresented minority groups.

website pageviews, with views to education sections of the website increasing 45% in 2020 compared to 2019.

59

# 1. Laboratory Management

#### 1.1. ORGANIZATION

The Florida State University (FSU), the University of Florida (UF) and Los Alamos National Laboratory (LANL) jointly operate the National High Magnetic Field Laboratory (NHMFL or MagLab) for the National Science Foundation (NSF) under a cooperative agreement that establishes the Lab's goals and objectives. FSU, as the signatory of the agreement, is responsible for establishing and maintaining administrative and financial oversight of the Lab and ensuring that the operations are in line with the objectives outlined in the cooperative agreement.

The structure of the MagLab is shown in the three subsequent figures below. Figure 1.1 illustrates the external oversight and advisory committees, as well as the three internal committees that provide guidance to MagLab leadership.

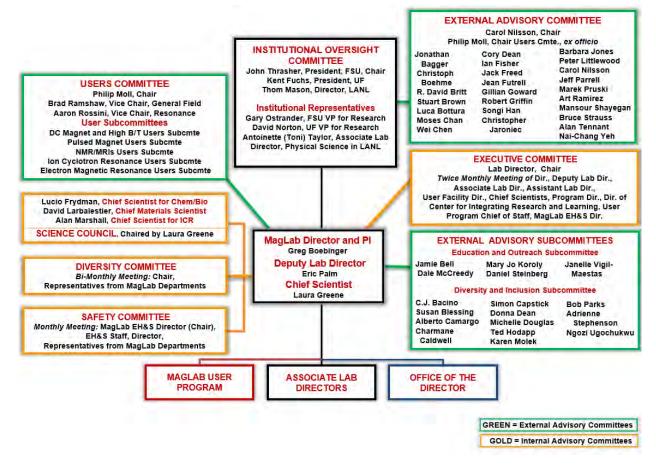


Figure 1.1: Advisory Committees of the MagLab, showing internal and external advisory committees (as of December 2020).

Greg Boebinger is the Director of the MagLab and PI of the cooperative agreement. Together, the Director, Deputy Laboratory Director, Eric Palm, and Chief Scientist, Laura Greene, function as a team to provide management oversight for the Laboratory. Lab Leadership — consists of the MagLab Director, Deputy Lab Director, Chief Scientists, Associate Lab Directors and MagLab Facility Directors. Robert Schurko became the new Director for NMR Facility replacing Tim Cross.

The Executive Committee meets monthly to discuss Lab-wide as well as program-specific issues. The Lab's scientific direction is overseen by the Science Council, a multidisciplinary "think tank" group of distinguished faculties from all three sites. Two external committees meet regularly

to provide critical advice on important issues. The External Advisory Committee, made up of representatives from academia, government and industry, offers advice on matters critical to the successful management of the Lab. The User Committee, which reflects the broad range of scientists who conduct research at the Lab, provides guidance on the development and use of facilities and services in support of the work of those scientists. These committees are further described below.

Figure 1.2 shows the structure of the user program with its seven user facilities – DC Field Facility, Pulsed Field Facility, High B/T Facility, Electron Magnetic Resonance Facility, Nuclear Magnetic Resonance and Magnetic Resonance Imaging at Florida State University and at University of Florida and Ion Cyclotron Resonance.

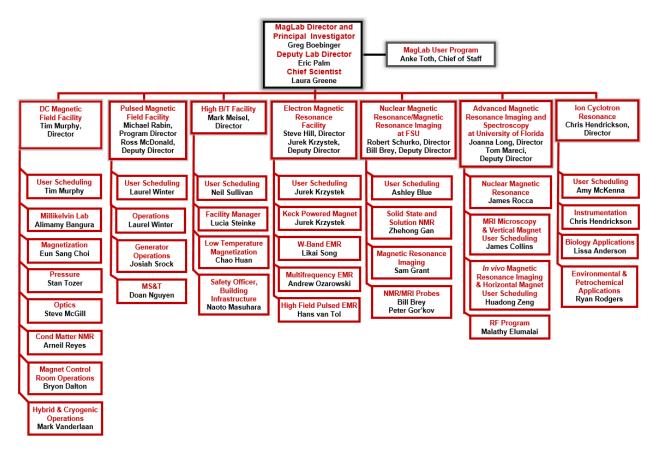


Figure 1.2: MagLab User Program (as of December 2020)

Figure 1.3 below displays the internal, operational organization of the Laboratory. It includes the seven user facilities, all Associate Lab Directors as well as the Office of the Director structure.

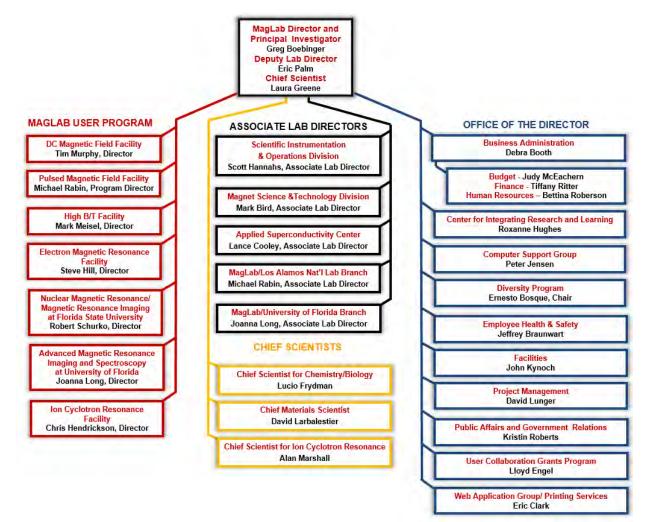


Figure 1.3: MagLab Organizational Chart (as of December 2020)

#### 1.2. EXTERNAL ADVISORY COMMITTEE

The External Advisory Committee is made up of representatives from academia, government and industry. This committee offers advice on matters critical to the successful management of the lab.

External Advisory Committee Chair

• Carol Nilsson—Swedish National Infrastructure for Biological Mass Spectrometry User Committee Chair (ex officio member of EAC)

Nat Fortune—Smith College

- Biology and Chemistry Subcommittee
  - R. David Britt—UC-Davis
  - Wei Chen—University of Minnesota
  - Jean Futrell—Battelle
  - Gillian R. Goward—McMaster University
  - Robert Griffin—MIT
  - Songi Han—UC-Santa Barbara
  - Christopher Jaroniec—Ohio State University
  - Marek Pruski—Ames Lab

Condensed Matter Subcommittee

- Christoph Boehme—University of Utah
- Stuart Brown—UC-Los Angeles
- Moses Chan—Penn State University
- Cory Dean—City College of New York
- Ian Fisher—Stanford University
- Barbara A. Jones—IBM Almaden Research Center
- Art Ramirez—UC-Santa Cruz
- Mansour Shayegan—Princeton University
- Nai-Chang Yeh—California Institute of Technology

Magnet Technology and Materials Subcommittee

• Luca Bottura—Magnets, Superconductors and Cryostats

Jeff Parrell—Oxford Superconducting Technology

Science Management

- Jonathan Bagger—TRIUMF
- Peter Littlewood—University of Chicago
- Bruce P. Strauss—U.S. Department of Energy
- Alan Tennant—Oak Ridge National Laboratory

#### 1.3. USER COMMITTEE

The MagLab's User Committee represents the MagLab's broad, multidisciplinary user community and advises the Lab's leadership on all issues affecting users of our facilities. The User Committee is elected from the user base of the MagLab. Each facility has a subcommittee elected by its users to represent their interests to the MagLab. DC Field and High B/T facilities have a single, combined subcommittee representing the two user facilities. Likewise, the NMR facilities at UF and FSU have a single, combined subcommittee. Pulsed Field, ICR and EMR facilities have their individual subcommittees. Each subcommittee then elects members to represent it on the User Executive Committee. This User Executive Committee elects a chair and two vice chairs. The DC Field/High B/T Advisory Committee, the Pulsed Field Advisory Subcommittee, the EMR Advisory Subcommittee, the NMR/MRI Advisory Committee and the representative from the ICR Advisory Committee met via zoom September 16-18, 2020, to discuss the state of the Laboratory and provide feedback to the NSF and MagLab management. The 2020 User Advisory Committee Report has been made available on our <u>website</u>.

DC Field/High B/T Advisory Subcommittee

- Nat Fortune, Chair—Smith College\*
- Philip Moll—Max Planck Institute\*
- Joseph G. Checkelsky—Massachusetts Institute of Technology
- Ben Hunt—Carnegie Mellon
- Jane Musfeldt—University of Tennessee
- Raivo Stern—National Institute of Chemical Physics & Biophysics
- Jairo Velasco—University of California, Santa Cruz
- Andrea Young—UC-Santa Barbara
- Matt Yankowitz—University of Washington

EMR Advisory Sub-committee

- Troy Stich—Wake Forest University\*
- Rodolphe Clerac—Centre de Recherche Paul Pascal
- Stergios Piligkos—University of Copenhagen
- Joshua Telser—Roosevelt University
- Joseph Zadrozny—Colorado State University

ICR Advisory Sub-committee

- Kristina Hakansson—University of Michigan\*
- Jack Beauchamp—California Institute of Technology

- Rene Boiteau—Oregon State University
- Ying Ge—University of Wisconsin
- Franklin Leach—University of Georgia
- Paul Thomas—Northwestern University

NMR/MRI Advisory Subcommittee

- Len Mueller—UC-Riverside\*
- Aaron Rossini—Iowa State University\*
- Christian Bonhomme—Laboratoire de Chimie de la Matière Condensée de Paris
- Brian Hansen—Aarhus University
- Vladimir Michaelis—University of Alberta
- Doug Morris—National Institutes of Health
- Dylan Murray—UC-Davis
- Thoralf Niendorf—Max Delbruck Center for Molecular Medicine
- Anant Paravastu—Georgia Tech

Pulsed Field Advisory Subcommittee

- Nicholas P. Butch—NIST Center for Neutron Research\*
- Adam Aczel—Oak Ridge National Laboratory
- Krzysztof Gofryk—Idaho National Laboratory
- Brad Ramshaw—Cornell University
- Zhiqiang Mao—Tulane University
- Priscila Rosa—Los Alamos National Laboratory

Note: \* Are members of the User Executive Committee

#### 1.4. PERSONNEL

As of January 1, 2021, the MagLab is comprised of 736 people who work at its three sites and are paid by NSF use grant, State of Florida funding, individual investigator awards, as well as home institutions and other sources. A list of MagLab personnel is presented in Appendix I.

#### Principal Investigators

- Gregory Boebinger (PI)—Director/Professor
- Joanna Long (Co-PI)—Program Director, AMRIS, UF
- Alan Marshall (Co-PI)—Chief Scientist for Ion Cyclotron Resonance
- Eric Palm (Co-PI)—Deputy Lab Director
- Michael Rabin (Co-PI)—Program Director, LANL

User Facility Directors

- Advanced Magnetic Resonance Imaging and Spectroscopy Facility (UF) Joanna Long
- DC Field Facility (FSU)—Tim Murphy
- Electron Magnetic Resonance Facility (FSU)— Stephen Hill
- High B/T Facility (UF)—Mark Meisel
- Ion Cyclotron Resonance Facility (FSU)—Chris Hendrickson
- Nuclear Magnetic Resonance (FSU)—Robert Schurko
- Pulsed Field Facility (LANL)—Michael Rabin

Of 736 people, senior personnel represent the largest group at 33%, followed by graduate students at 21%, technical support staff at 15%, other professionals at 12%, post docs at 9%, undergraduate students at 6% and clerical support staff at 4%. The total distribution appears in Figure 1.4.

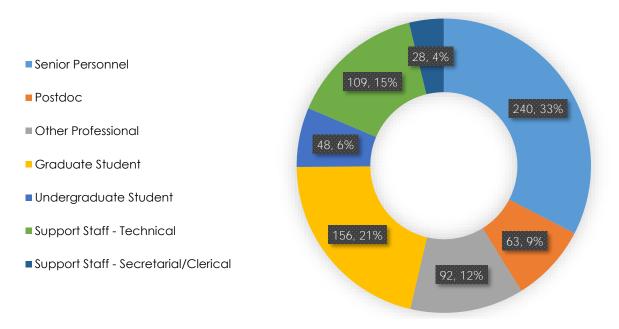


Figure 1.4: MagLab Position Distribution (as of January 1, 2021)

Overall distribution of diversity for all three sites of the MagLab includes: 47.4% white males, 21.9% Asian males and females, 18.1% white females, 6.3% black or African American, and 0.7% American Indian. The distribution by diversity appears in Figures 1.5 and 1.6.

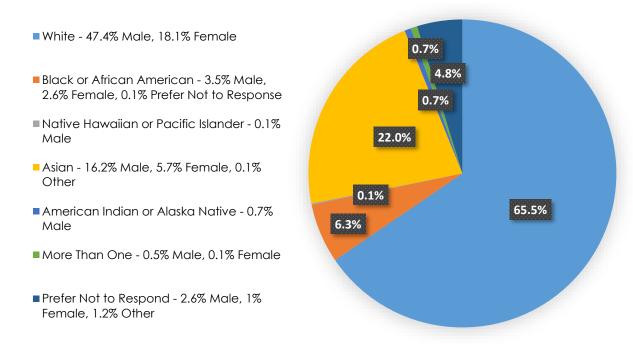


Figure 1.5: MagLab Distribution by Race (as of January 1, 2021).

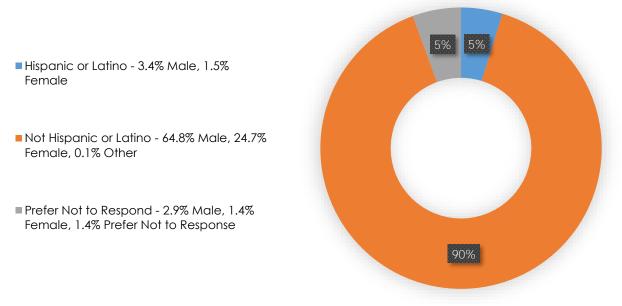


Figure 1.6: MagLab Distribution by Ethnicity (as of January 1, 2021).

#### 1.5. DIVERSITY ACTION PLAN

The MagLab is committed to diversity and inclusion in the STEM workforce at the MagLab and throughout the nation. To accomplish this goal, our efforts are focused on: outreach to underrepresented and underserved populations in STEM from K-early career scientists; utilizing best practices in our hiring strategies to improve the representation of underrepresented minority groups (including women) at the lab and in the STEM workforce; and creating a climate where all personnel feel that they have equal opportunities to career development and mentoring leading them to want to remain at the lab/within the STEM workforce (retention). As part of this strategic plan, the diversity committee structures its budget and subcommittees to align with these efforts. The MagLab Diversity Committee in 2020 can be found in Table 1.1 (\*new members):

| Greg Boebinger, Director of MagLab<br>Ernesto Bosque, Diversity Committee Chair |                                        |                  |                 |
|---------------------------------------------------------------------------------|----------------------------------------|------------------|-----------------|
| FSU                                                                             | Site:                                  | UF Site:         | LANL Site:      |
| Erick Arroyo *                                                                  | Amy McKenna                            | Malathy Elumalai | You Lai         |
| Ryan Baumbach                                                                   | Jennifer Neu                           | Mark Meisel *    | Kirk Post       |
| Alfie Brown                                                                     | Martha L. Chacon<br>Patino             |                  | John Singleton  |
| Whitney Brown *                                                                 | Zeljka Popovic<br>(Graduate Student) * |                  | Amanda Valdez * |
| Huan Chen *                                                                     | Bettina Roberson                       |                  | Laurel Winter * |
| Shalinee Chikara *                                                              | Kari Roberts                           |                  |                 |
| Jonathan Cooper<br>(Graduate Student) *                                         | Kristin Roberts                        |                  |                 |
| Dave Graf                                                                       | Komalavalli<br>Thirunavukkuarasu       |                  |                 |
| Elizabeth Green *                                                               | Anke Toth                              |                  |                 |
| Laura Greene                                                                    | Hans van Tol                           |                  |                 |

#### Table 1.1: 2020 MagLab Diversity Committee members

| Greg Boebinger, Director of MagLab<br>Ernesto Bosque, Diversity Committee Chair |          |          |            |
|---------------------------------------------------------------------------------|----------|----------|------------|
| FSU                                                                             | Site:    | UF Site: | LANL Site: |
| Jason Kitchen                                                                   | Kaya Wei |          |            |
| Walter Lee *                                                                    | Yan Xin  |          |            |
| Emma Martin<br>(Undergraduate) *                                                |          |          |            |

#### Outreach

The MagLab supported several outreach workshops in 2020 -

(1) Each year, the National Mentoring Community (NMC) holds a conference with resources and workshops for both mentors and mentees, with the purpose of fostering community and empowering mentors with the tools to more effectively support their students. The 2020 NMC conference, held in partnership with the National Society of Black Physicists and the National Society of Hispanic Physicists, took place from February 6 to 8 at the University of Central Florida in Orlando, with more than 120 attendees.

(2) Running on five consecutive years, the MagLab helped to sponsor and provide role models for the annual Santa Fe, NM, Expanding Your Horizons Workshop held in February 2020. Over 240 attendees, of which 69.9% were from underrepresented minorities in STEM.

#### Hiring

The Diversity Committee has two subcommittees that are responsible for overseeing recruitment and hiring procedures. The first of these is the Compliance Subcommittee, chaired by Jason Kitchen. The role of the Diversity Compliance Subcommittee is to help coordinate the efforts of faculty hiring committees in the search for diverse candidates, particularly from underrepresented-in-STEM groups. The Compliance Subcommittee meets with the chair of each hiring committee at the outset of a position search, screeens the position advertisement for gender bias verbiage, ensures that all members of a hiring committee have been trained for best practices in successfully staging diversity-promoting candidate searches, and that advertisements are sent to networks that reach underrepresented groups. Before hiring committees make a final offer to a candidate, they send the Compliance Subcommittee a summary of the candidate interviewing and selection process.

At the close of 2020, there remain eight active MagLab searches, including seven which started in 2019 and one from 2018. These searches were from the departments MS&T, ICR, NMR, and CIRL. In 2020, two of the active searches were completed. The first resulted in a promotion of a diverse Visiting Scientist member to a Research Faculty role, and among the nine candidates for the ladder position (for the role of Assistant in Research), two were diversity candidates and were both interviewed. Despite a hiring freeze across the lab for much of the year due to uncertainty related to the COVID pandemic, the careers section of the website earned 32,700 page views in 2020.

#### **Broadening Participation**

The Diversity Committee started a series of Town Hall Style Open Conversations, where all of our work force was invited to sign into a zoom meeting and discuss climate and work condition related topics. A list of the Open Conversations is listed below with the key topics for each in Table 1.2.

Additionally, a smaller focused workgroup has been formed to participate in the American Physical Society – Inclusion, Diversity, and Equity Alliance (IDEA). This team is comprised of 13 individuals across all three MagLab sites, ranging from Faculty, Scientific Staff, Graduate Students, and an Undergraduate Student. Shared leadership and other best approaches to improving diversity and equity efforts are shared and worked on across dozens of scientific institutions.

| Dates held | Main Topic                                                         | Hosts from                                                                                                                 |
|------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 7/9/2020   | General Open Discussion<br>How to Include Diversity in Recruitment | DC Fields and ICR                                                                                                          |
| 7/23/2020  | General Open Discussion<br>Why Diversity and Equity are Important  | CMS, Safety, and DC Fields                                                                                                 |
| 8/7/2020   | History of Diversity in STEM and Work/Life<br>Balance              | Graduate Students                                                                                                          |
| 8/21/2020  | Sexual Harassment and Title IX, Identifying and Addressing Issues  | CMS, DC Fields, and an invited host from<br>the FSU Title IX office as well as an invited<br>private practice psychologist |
| 11/4/2020  | Mentoring: What is it?                                             | High B/T, LANL, FSU Graduate and<br>undergraduate students                                                                 |

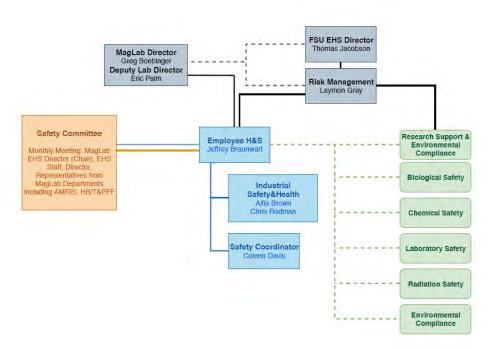
Table 1.2: Open conversation topics

The Diversity Committee also piloted additional support and an expansion of the InternFSU program to neighboring minority serving institutions, including Tallahassee Community College (TCC) and Florida Agricultural and Mechanical University (FAMU). In our pilot year, and before the pandemic lockdowns began, three students were supported, 2 from TCC and 1 from FAMU.

The MagLab recognizes the extra demands outside of a research career placed on caregivers of children and other dependents. For caregivers, travel to the MagLab in order conduct experiments or to conferences to disseminate research findings often incurs extra costs for dependent care. In place since 2011, the MagLab's Dependent Care Travel Grant (DCTG) program offers up to \$800 per year for travel expenses for MagLab scientists traveling to conferences or MagLab users traveling to any of the three MagLab facilities. One DCTG was awarded in early 2020.

#### 1.6. SAFETY

A central focus of all activities conducted at the MagLab is to ensure employees, visitors, users, and contractors are provided with a safe and educational environment. The Mag-Lab's Environmental, Health and Safety team works collaboratively with management, researchers, staff, and users, as well as with other public and private entities, to proactively mitigate hazards in our industrial, laboratory, and office



settings. The MagLab Figure 1.7: Environmental Health & Safety (EHS) Organization Chart Safety Department is

integrated with Florida State University's Central Environmental Health and Safety Department. This integration provides substantial support to existing safety programs at the MagLab. Areas of integration and support include Chemical Safety, Laboratory Safety, Biological Safety, Radiation Safety, Industrial Hygiene, Fire Safety, Environmental Compliance and Building Code Compliance (Figure 1.7). The MagLab uses Integrated Safety Management (ISM) to integrate safety, health requirements and controls into daily work activities to ensure the protection of the MagLab Community. The MagLab continues to foster a sustainable and strong Safety Culture. Examples of the activities that contribute to our commitment to a strong Safety Culture at the MagLab are listed below:

- a. Safety is viewed as an investment not a cost.
- b. Management drives and is actively involved in promoting our Safety Culture.
- c. Quarterly Safety Meetings are conducted by the Director of the MagLab to address lab-wide safety issues and initiatives.
- d. The Director of the MagLab and Director of Safety routinely walk through lab areas to engage researchers, staff, and users, and to observe ongoing work. New Employee Orientation and New



Employee safety training is provided to all incoming employees with their supervisor with specific emphasis on our ISM System. New employees are taught that safety is the top priority at the MagLab, to have a questioning attitude about their safety and about our Stop Work Policy and no-fault self-reporting near miss and accident policy.

#### Investments in Safety

Our investments in safety equipment and materials along with management support and employee involvement demonstrates our strong commitment to sensibly utilize resources in a manner that protect all MagLab personnel, property and the environment. In 2020, the MagLab strategically invested just under \$50,000 for safety-related equipment, supplies, training and processes. Some of the key investments included personal protective equipment, equipment used to lockout/tagout and verify hazardous energy sources, fall protection, and COVID-related supplies.

#### Safety Support and Coordination with FSU Main Campus Safety Team

Safety at the MagLab is supported by a dedicated on-site team as well the Florida State University (FSU) Environmental, Health and Safety Department team. The two teams work together to provide comprehensive integrated safety support to all activities at the MagLab. Machine Shop, Biosafety, Laboratory, Laser, and Radiation inspections were conducted and completed with team members from both groups. The two teams also work together to provide safety training.

#### Committees

Safety committees are an integral part of the MagLab's ISM. Committees meet to discuss and address safety concerns and provide program reviews.

The following is a list of committees.

- Directors Monthly Safety Committee (includes representative from UF and LANL Facilities)
- Safety Concerns Committee
- Lock/Tag Verification Committee
- Cryogen Safety Committee
- Laser Safety Committee

Meetings in 2020 took place via Zoom because of COVID and were very successful, and participation levels increased. Members of these committees also form subcommittees as needed based on the need to address specific safety issues.

#### Safety Highlights

#### COVID Training and Building Access

With the COVID pandemic in full swing, the MagLab needed to take extra precautions to protect its employees. There were mandated requirements by states, counties, and local municipalities,

and the MagLab was affected by all of these. Users and visitors were not allowed access during these mandates. However, essential personnel still needed to access the MagLab for specific and critical duties. The safety department, with the help of Public Affairs, created a MagLab-specific COVID training that all employees and staff were required to take before entry was given. The MagLab created a COVID team to review projects and personnel, and grant authorization to those who were given permission to come to the lab to perform research and their duties. Safety was an integral part of this team as the facility was on "lockdown," and the safety department acted as the "gate keeper" for training, entry, and COVID-related questions. These COVID safety protocols have evolved with time, and they are reviewed at the start of group meetings that are held on a weekly or bi-weekly basis. Some of these safety protocols are still in place and could change in the future.

#### Annual Maintenance Shutdown

During November and December, the MagLab performed its annual maintenance shutdown. This year was especially difficult to plan because of limitations on gatherings, the uncertainty of the schedule and learning how to work under pandemic rules. Beginning in June, planning meetings were held to discuss work plans, safety equipment needs, organization of lockout/tagout boards and contractor coordination. Jobs were selected and scheduled to minimize the number of personnel working in the same areas and to minimize interaction between staff and contractors.

Extensive annual maintenance occurred including helium liquefier maintenance, regeneration of the water treatment resin, breaker testing and exercising, transformer testing, capacitor yard maintenance and pump maintenance. The air handlers for the power supplies were completely overhauled, and the cooling tower had extensive wood replacement completed. The PVC helium vacuum system was replaced with stainless steel piping, which will improve recovery and reduce contamination of the helium. Lastly, several jobs were completed that would allow work on the PS Upgrade project during 2021 without interrupting operations.

The greatest challenge during the shutdown was to carefully coordinate all work activities among many workgroups to ensure safety remained the top priority. To facilitate safe work, each morning all workgroups met remotely over Zoom to review and discuss each group's planned work for the day, and lockout statuses and plans. Immediately after the online meeting, employees in charge of contractors briefed them on information relevant to their work. This facilitated communication among workgroups prior to initiating tasks to ensure jobs were safely coordinated and all safety hazards were communicated. Also discussed were any difficulties or lessons learned from the previous workday. During the shutdown, we had several instances where key employees either contracted COVID or were required to quarantine due to contact tracing. Fortunately, we were able to juggle the schedule or fill in for these employees to keep work moving safely forward. Although there were numerous interdependent work processes and workgroups involved with the shutdown, using ISM, all employees and contractors safely completed their assigned work activities.

#### Novel Safety System to Verify Absence of **Voltage on the MagLab's 20 Kiloamp / 720 Volt Resistive** Magnet Bus

Because the MagLab's resistive and hybrid magnets use high-current / high-voltage DC power supplies to energize our magnets, we must be absolutely sure that the power supplies are disconnected and isolated from the magnet before any maintenance or construction work begins on the magnets. The MagLab developed a new safety device to provide this capability without exposing workers to any sort of high voltage hazard. This new safety device enables technical work on magnet systems with uninsulated conductors by making certain that the power source is physically disconnected from the magnet.

It is important for the MagLab to comply with safety standards from the Occupational Safety and Health Administration (OSHA). The MagLab scientific user facility combines state-of-the-art scientific instrumentation with industrial scale infrastructure to produce the highest magnetic fields in the world. This results in unique and extraordinary equipment needs, often requiring in-house technological developments due to a lack of commercial, off-the-shelf solutions. The skill and expertise of MagLab user facility engineers made the development of this one-of-a-kind safety system possible. This safety system passed an external expert review.

#### User Facility Safety

The MagLab's User facilities (DC Field, Pulsed Field, High B/T, NMR, AMRIS, EMR and ICR) provide support to internal and external users. To facilitate their visit, users are assigned online training modules that are specific to the experiment they are conducting, and the hazards associated with each facility they will be working in. These are generally coordinated several weeks prior to their arrival if they are an external user. Internal users complete the required training prior to receiving authorization to start work. When users arrive at the facility, they receive hands-on training that is specific to each location and discuss any potential safety concerns with user support. While at each facility, users are assigned an in-house scientist and support technician to ensure both technical and safety needs are met. Non-routine and any particularly hazardous activities are completed by trained and experienced facility technicians to minimize risks to users. While the COVID pandemic has affected our user programs, these safety requirements are still in place and will continue to be in place along with COVID safety requirements and training.

#### 1.7. BUDGET

The National High Magnetic Field Laboratory, along with its seven user programs, is primarily funded by the National Science Foundation. Other operating funds are provided through the participating institutions: The Florida State University, the University of Florida, and the Los Alamos National Laboratory. Additionally, faculty and staff have been very successful in securing individual research funding for specific areas of research from a wide variety of sources, including federal, State, and private sectors.

The National Science Foundation Division/Directorate approved the MagLab's facilities award for 2018-2022 on March 23, 2018.

For the Calendar Year 2020, NSF provided an operating budget of \$36,780,000.

Table 1.3 represents the budget allocation and percentage of the total budget to each division of the MagLab, and Table 1.4 summarizes the MagLab's budget position as of December 31, 2020. The report includes our annual funding per our Cooperative Agreement.

| Division/Program                  | CY 2020 Total Funding (\$) | Budget (%) |
|-----------------------------------|----------------------------|------------|
| Operations/Safety                 | 1,041,175                  | 2.83%      |
| DC Field Facility                 | 7,353,648                  | 19.99%     |
| Magnet Science & Technology       | 5,144,835                  | 13.99%     |
| NMR                               | 1,500,093                  | 4.08%      |
| ICR                               | 1,730,000                  | 4.70%      |
| EMR                               | 910,864                    | 2.48%      |
| CIRL and REU                      | 570,061                    | 1.55%      |
| ASC                               | 2,210,154                  | 6.01%      |
| Electricity & Gases               | 4,945,588                  | 13.45%     |
| LANL                              | 8,780,333                  | 23.87%     |
| UF High B/T                       | 644,948                    | 1.75%      |
| UF - AMRIS                        | 918,352                    | 2.50%      |
| Diversity                         | 80,000                     | 0.22%      |
| User Collaboration Grants Program | 949,949                    | 2.58%      |
| Total                             | 36,780,000                 | 100.00%    |

#### Table 1.3: NSF Budget by NHMFL Division

| Expense Classification         | Budget (\$) | Disbursed and<br>Encumbered (\$) | Balance as of 12/31/2020 (\$) |
|--------------------------------|-------------|----------------------------------|-------------------------------|
| Salaries and Fringe            | 10,451,647  | 13,522,581                       | (3,070,934)                   |
| Equipment                      | 320,855     | 1,995,283                        | (1,674,428)                   |
| Subawards                      | 10,745,784  | 11,561,370                       | (815,586)                     |
| Other Direct Costs             | 7,043,054   | 4,836,173                        | 2,206,881                     |
| Subtotal                       | 28,561,340  | 31,915,407                       | (3,354,067)                   |
| Indirect Cost                  | 8,218,660   | 7,172,387                        | 1,046,273                     |
| Total Direct and Indirect Cost | 36,780,000  | 39,087,794                       | (2,307,794)                   |

#### Table 1.4: NSF Budget & Expenses - Calendar Year 2020

#### 1.8. MAGLAB COST RECOVERY REPORT

Seldom does the MagLab incur costs due to resources used for companies doing proprietary research. On occasion, companies will need access to the unique equipment at the MagLab, and they will contract for the use of said equipment. The MagLab has established procedures to accumulate and report costs continuously and consistently for all such contracts based on an agreed upon schedule of fees and costs to cover the use of such equipment that involves proprietary research. During 2020, the MagLab recovered a total of \$603.08 from private industry, Rosemount Nuclear Instruments, Inc., for the use of NSF-funded equipment/software during the period of performance of our Federal award.

#### 1.9. COVID RESPONSE

On June 18, 2020, the Office of Management and Budget issued Memorandum 20-26, Extension of Administrative Relief for Recipients and Applicants of Federal Financial Assistance Directly Impacted by COVID-19 due to Loss of Operations. This memorandum authorized federal award agencies to provide specific relief to recipients including allowability of salaries and other project activities (2 CFR § 200.403, 2 CFR § 200.404, 2 CFR § 200.405). The administrative relief authorized in this memorandum expires on September 30, 2020.

Additionally, Memorandum 20-26 reminded agencies of their existing flexibility to issue exceptions on a case-by-case basis in accordance with 2 CFR § 200.102, Exceptions. 2 CFR § 200.102 (b) states: "b) Exceptions on a case-by-case basis for individual non-Federal entities may be authorized by the Federal awarding agency or cognizant agency for indirect costs, except where otherwise required by law or where OMB or other approval is expressly required by this part." The MagLab, operating under the flexibility authorized in M-20-26, Allowability of Salaries and Other Project Activities (2 CFR § 200.403, 2 CFR § 200.404, 2 CFR § 200.405), was able to keep its employees in paid status utilizing remote work options, flex work hours and utilization of leave hours.

For those who were unable to perform work under the award, FSU allowed FFCRA through April 30, 2020. All of our workers were either able to work from home or were able to use FFCRA. Since this time, we have had our workers who could productively work from home do so, and those who could not have come in to work while wearing masks and appropriately social distancing. Supervisors have utilized flexible schedules to allow workers to maintain social distancing and also to accommodate other issues such as childcare, eldercare and school support needs.

#### 1.10. INDUSTRIAL PARTNERS AND COLLABORATIONS

The MagLab collaborated with dozens of companies, national/international labs, universities and community groups in 2020. In addition, several spinoff companies continued to operate in 2020.

#### INDUSTRY

Advanced Conductor Technologies, Boulder, CO: The Applied Superconductivity Center and the Magnet Science and Technology division of the MagLab are collaborating with Advanced Conductor Technologies on the development and testing of Coated Conductor Stranded Cable (CCSC), using multi-layer spiraling tapes around a core, for magnet applications. Danko van der Laan, Director of the company and associated with NIST/University of Colorado Boulder, is developing compact cables based on REBCO coated conductors, a high temperature superconductor. The ongoing collaboration on measurements of HTS cables at low temperature and high magnetic fields (4K and 20T in Cell 4) continues to set new benchmarks for peak current, current density, bend radius and ramp rates. (*MagLab contact: Ulf Trociewitz, ASC*)

ATI metals, Pittsburgh, PA: The Applied Superconductivity Center is collaborating with ATI metals in the development of new Nb alloys for the Nb<sub>3</sub>Sn superconducting wire fabrication to be used for accelerator magnets like the Future Circular Collider (FCC) to be built at CERN. (MagLab contacts: David C. Larbalestier, Chiara Tarantini, Shreyas Balachandran, ASC)

Bridge12 Technologies Inc., Framingham, MA: Bridge12 is a small business specialized in the design and manufacturing of active and passive high frequency microwave components. The EMR division is collaborating with Bridge12 on novel designs of high field in-situ EPR spectrometers, as well as working together on future development of high frequency gyrotrons for DNP. (MagLab contact: Stephen Hill and Thierry Dubroca, EMR)

Bruker EAS GmbH, Hanau, Germany: Bruker EAS is manufacturing accelerator quality Nb<sub>3</sub>Sn strands based on the powder-in-tube process that have the potential to provide the performance necessary for higher magnetic field upgrades to the Large Hadron Collider at CERN. The Applied Superconductivity Center collaborated with Bruker and CERN to optimize the performance of the wire utilizing the electromagnetic testing and advanced microstructural and microchemical analysis facilities at the MagLab. (MagLab contacts: Chiara Tarantini, Peter J. Lee and David C. Larbalestier, ASC)

Bruker Biospin Corp., Billerica, MA: The EMR and NMR groups have entered into a collaborative effort with Bruker Biospin regarding the Dynamic Nuclear Polarization (DNP) program. In particular, the effort aims at improving Bruker's recently acquired products (395GHz gyrotron, 600MHz/14.1T DNP probe) beyond their normal commercial uses by making technical modifications. The modifications allow the DNP instruments to be more user program friendly without voiding the warranty. (MagLab contact: Stephen Hill, EMR)

Bruker Biospin Corp., Billerica, MA: Investigators from MagLab facilities at UF and FSU collaborate with technical staff at Agilent on two NIH-funded projects to develop improved superconductive cryogenic probes for solution NMR. (MagLab contacts: William Brey, NMR and Matthew Merritt, AMRIS)

Bruker OST, Carteret, NJ: Bruker OST is manufacturing accelerator quality Nb<sub>3</sub>Sn strands based on the restacked-rod process that provide the production conductor for the High-Luminosity Upgrade of the Large Hadron Collider at CERN. The Applied Superconductivity Center oversees conductor production on behalf of the upgrade project, and ASC and the Magnet Science and Technology divisions perform quality verification utilizing the electromagnetic testing facilities at the MagLab. (MagLab contacts: Lance Cooley, ASC; Jun Lu, MS&T)

Bruker-OST, Carteret, NJ: Extensive collaborations exist between ASC and BOST on both Nb<sub>3</sub>Sn and Bi-2212 conductor development, aided by direct support of R&D on these materials from DOE-High Energy Physics to ASC PIs and to BOST through the Conductor Development Program managed out of Lawrence Berkeley National Laboratory. Through these collaborations, BOST has been able to develop the most advanced Nb<sub>3</sub>Sn and Bi-2212 conductors produced. (MagLab contacts: Lance Cooley, David C. Larbalestier, Eric Hellstrom, Peter J. Lee, Chiara Tarantini, Jianyi Jiang, ASC)

Criotec Impianti & ENEA, Italy: The MagLab is collaborating with Criotec Impianti, an Italian cryogenic systems manufacturing company, and ENEA, an Italian Fusion Energy Research Organization, to jacket the cable-in-conduit superconductor for the outsert coils of the series-connected hybrid magnets. This work includes the welding and inspection of the stainless-steel conduit, insertion of the cabled superconductor strands into the conduit, and compaction of the assembled conductor to a rectangular cross-section. (*MagLab contact: lain R. Dixon, MS&T*)

Danfoss Turbocor, Tallahassee, FL: Danfoss Turbocor Inc. is a company specializing in compressors, particularly the totally oil-free compressors. The compressors are specifically designed for the heating, ventilation, air conditioning and refrigeration (HVACR) industry and need high performance soft and hard magnet materials. The company and the laboratory have a joint research project on selection, characterization and development of permanent magnet materials and structural materials for high performance and environmentally friendly compressors. (MagLab contact: Ke Han, MS&T)

DMS South Bailey Tool and Manufacturing (BTM), Lancaster, TX: BTM is a specialty tool and die company that produces complicated metal components by seamless forming and additive manufacturing techniques. The MagLab is collaborating with BTM to investigate complex cavity resonator shapes using bronze and other materials that facilitate the formation of Nb<sub>3</sub>Sn superconductor under a grant from the US Department of Energy. The components delivered from BTM are coated with niobium and converted to Nb<sub>3</sub>Sn using thin-film coating facilities in the Applied Superconductivity Center. (MagLab contact: Lance Cooley, ASC)

Energy to Power Solutions, Tallahassee, FL: The MS&T division has partnered with Energy to Power Solutions and secured a Small Business Incentive for Research grant from the US Department of Energy to develop technology suitable for HTS split magnets suitable for fields higher than 20T. (MagLab contact: Iain R. Dixon)

HC Starck, Newton, MA: The Applied Superconductivity Center is collaborating with HC Starck in the development of new Nb alloys for the Nb<sub>3</sub>Sn superconducting wire fabrication to be used for accelerator magnets like the Future Circular Collider (FCC) to be built at CERN. (MagLab contacts: David C. Larbalestier, Chiara Tarantini, Shreyas Balachandran, ASC)

Hyper Tech Research Inc., Columbus, OH: Hyper Tech Research Inc. develops and manufactures MgB<sub>2</sub> superconducting wires for MRI applications. In this collaboration, the Magnet Science and Technology division measures critical current of MgB<sub>2</sub> wires developed by Hyper Tech Research. The critical current measurements are performed at 4.2K and in 0 – 10T magnetic fields. (*MagLab contact: Jun Lu, MS&T*)

Hyper Tech Research Inc., Columbus, OH: The Applied Superconductivity Center is collaborating with HTRI on the development of a new generation of Nb<sub>3</sub>Sn wires with high critical current density for the next generation of higher magnetic field accelerator magnets as part of the US-Magnet Development Program. (MagLab contacts: David C. Larbalestier, Chiara Tarantini, Shreyas Balachandran and Peter J. Lee, ASC)

Mevion Medical Systems, Littleton, MA: Mevion is a pioneer in the development of proton radiation therapy systems for the non-invasive treatment of cancer. The center of the systems is the proton accelerator that utilizes low temperature superconductors. The MagLab provides engineering support to Mevion by assisting in qualification testing of full-scale high current superconductors in background fields at low temperatures. The tests require the MagLab's unique test facility designed for tests of large conductors in a 12T split solenoid superconducting magnet system. (MagLab contact: Bob Walsh, MS&T)

nGiMat LLC, Lexington, KY: nGiMat LLC is a small business specializing in manufacturing oxides nanopowders, and insulation of superconducting wires. MagLab collaborates with nGiMat LLC on a small business innovation research grant funded by US Department of Energy. The goal of this research is to improve the quality of ceramic insulation for Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8-x</sub> superconducting wire. (MagLab contact: Jun Lu, MS&T)

Nikon, Melville, NY: The MagLab maintains close ties with Nikon on the development of an educational and technical support microscopy website, including the latest innovations in digitalimaging technology. As part of the collaboration, the MagLab is field-testing new Nikon equipment and developing new methods of fluorescence microscopy. (MagLab contact: Eric Clark, Optical Microscopy)

Olympus Corp., Tokyo, Japan: Investigators at the MagLab have been involved in collaboration with engineers at Olympus to develop and test new optical microscopy systems for education and research. In addition to pacing the microscope prototypes through basic protocols, the Optical Microscopy group is developing technical support and educational websites as part of the partnership. (MagLab contact: Eric Clark, Optical Microscopy)

Oxford Instruments, Abingdon, UK: Oxford Instruments delivered a 15T large-bore low temperature superconductor magnet to the MagLab that was combined with 17T YBCO-coated conductor coil developed by the MagLab to create the first 32T all-superconductor magnet. In case of a quench, the LTS and HTS coils interact in a complex manner. The quench protection systems for the individual coil sets are inter-dependent. This could not be handled by routine specifications in a standard vendor relationship. Therefore, Oxford Instruments and the MagLab worked closely together to develop quench protection for the combined system to ensure compatibility of the coil sets and developed a numerical code to model quench in combined YBCO-LTS magnets. Additionally, Oxford Instruments Nanoscience worked with MagLab personnel to specify, design and construct a custom top-loading dilution refrigerator for the 32T magnet system. Coupling the ultra-low temperatures of a dilution refrigerator with the 32T superconducting magnet creates a unique system for scientists to explore material properties. (*MagLab contact: Tim Murphy, DC Field*)

Oxford Instruments Superconducting Technology, Carteret, NJ: Oxford Instruments Superconducting Technology (OST) is one of the major manufacturers of superconducting wires. In this collaboration, the Magnet Science and Technology division measures hysteresis loss of Nb<sub>3</sub>Sn wires developed by OST. The hysteresis loss measurements are performed at 4.2K and in 0 - 5TK magnetic fields by a vibrating sample magnetometer. (*MagLab contact: Jun Lu, MS&T*)

Phoenix NMR, LLC, Loveland, CO: Phoenix NMR used the NMR Dynamic Nuclear Resonance facility to test a commercial DNP probe. (*MagLab Contact: Fred Mentink, NMR*)

Revolution NMR LLC, Fort Collins, CO: Revolution NMR has licensed from FSU the Low-E probe technology developed at MagLab in order to fabricate static NMR probes for biological (protein) samples. Additionally, the MagLab's NMR instrumentation program and Revolution NMR collaborate on the development of stators for magic angle spinning NMR. (MagLab contact: Peter Gor'kov, NMR)

SuperPower Inc., Schenectady, NY: The Applied Superconductivity Center and the Magnet Science and Technology division of the MagLab are collaborating with SuperPower Inc. on the characterization of YBCO coated conductors. This material has the potential to transform the field

of high-field superconducting magnet technology and is in an early stage of commercialization. The MagLab will work to improve our understanding of this product in support of the MagLab 32T project as well as to provide guidance to SuperPower on enhancing the quality of their product. The MagLab has also taken the lead in encouraging a Coated Conductor Round Table of users of coated conductors at which much information about the long length performance of coated conductors has been shared. (MagLab contacts: David C. Larbalestier, Dmytro Abraimov and Jan Jaroszynski, ASC)

SupraMagnetics Inc., Plantsville, CT: The Applied Superconductivity Center participated in the development of a superconducting Nb<sub>3</sub>Sn wire that uses artificial flux-pinning centers to achieve high critical current densities. The MagLab provides microstructural and microchemical support for this work. (MagLab contact: Peter J. Lee, ASC)

Thomas Keating LtD, UK: The EMR group has entered into a partnership with Thomas Keating (TK) LtD in the UK as part of its program aimed at developing a new characterization tool, Dynamic Nuclear Polarization Nuclear Magnetic Resonance (DNP - NMR) at high fields (14.1T / 600MHz). TK draws on tool-making skills to design and develop quasi-optical Terahertz systems and subsystems. (MagLab contact: Stephen Hill, EMR)

ThermoFisher Scientific, Waltham, MA: The ICR Facility is collaborating with ThermoFisher Scientific and the University of Virginia (Charlottesville, VA) to use advanced control of proton transfer reactions to manipulate ion charge states for improved sensitivity (e.g., for proteomics and other biological applications). Further, this collaboration seeks to couple the latest Thermofisher Scientific mass spectrometry platforms with the Maglab's high field Fourier Transform ion cyclotron resonance (FT-ICR) instruments. (MagLab contact: Chris Hendrickson, ICR)

Urban Mining Company, San Marcos, TX: Scientists and engineers from Urban Mining Company came to the MagLab to study the complete magnetization loop of the rare-earth permanent magnet alloys which they are developing. Urban mining specializes in recovering rare-earth magnetic material from recycled electronics and processing that material into new magnets for use in industry. (MagLab contact: Tim Murphy, DC Field)

Virginia Diodes Inc., Charlottesville, VA: VDI is a technology company specialized in high frequency microwave sources and detectors. The EMR division collaborates with VDI on the development of microwave sources for high-sensitivity high-field EPR spectroscopy. These new sources allow the MagLab to stay at the forefront of high field EPR instrumentation. The development of high-power solid-state sources for DNP at very high magnetic fields (>30T) is also being planned. (MagLab contact: Stephen Hill and Thierry Dubroca, EMR)

Waters Corporation, Miford, MA: The ICR and Future Fuels Institute are a Waters Corporation, Center of Innovation and collaborate on advances in instrumentation for biological and petroleum applications. Instrument and ion source advances are provided to both facilities before their commercial release and allow for applications development well before mainstream introduction. (*MagLab Contact: Ryan Rodgers, ICR*)

Zeiss Micro Imaging, Thornwood, NY: The Optical Microscopy group at the MagLab is negotiating a contract with Zeiss on the development of an educational and technical support microscopy website, including the latest innovations in digital imaging technology. As part of the collaboration, microscopists are field-testing new Zeiss equipment and developing new methods of fluorescence microscopy. (MagLab contact: Eric Clark, Optical Microscopy)

#### NATIONAL OR INTERNATIONAL LABORATORIES AND INSTITUTES

Advanced Photon Source, Argonne National Laboratory, Lemont, IL: The Applied Superconductivity Center is collaborating APS to perform Extended X-ray absorption fine structure (EXAFS) characterization on Nb<sub>3</sub>Sn superconducting wires in order to locate the substitution sites of the dopants and to correlate them with the superconducting performance. (MagLab contacts: Chiara Tarantini, ASC)

CERN, Geneva, Switzerland: The Large Hadron Collider (LHC) at CERN uses a 27km ring of superconducting magnets based on Nb-Ti to accelerate particles in the world's largest and most powerful collider, but plans to increase the energy capability of LHC will require higher magnetic fields. Moreover, the planned Future Circular Collider (FCC) at CERN will be realized in a 100km ring of Nb<sub>3</sub>Sn and HTS magnets. The Applied Superconductivity Center is collaborating with CERN to fabricate, characterize and optimize a new generation of accelerator quality Nb<sub>3</sub>Sn strands that have the potential to provide the performance necessary for the LHC upgrades and the FCC realization. (MagLab contacts: David C. Larbalestier, Chiara Tarantini and Peter J. Lee, ASC)

Dana-Farber Cancer Institute, Boston, MA: Current collaboration between Dana-Farber Cancer Institute and the Magnetic Lab is aimed at determining the molecular details of HIV envelope protein gp41 using electron paramagnetic resonance methods. Other goals include characterization of antibody-induced structural changes of gp41 and developing optimized vaccine immunogens by structural approaches. (*MagLab contact: Likai Song, EMR*)

EUCARD2 (European Collaboration for Accelerator R&D), Geneva, Switzerland: EUCARD2 is a European Framework collaboration of about 10 European labs aimed at developing kiloamp high temperature superconductor cables for future application to a high energy LHC. The European emphasis is on Roebel cables of REBCO coated conductors, but an equally attractive cable for accelerator purposes is a round wire cable made in the Rutherford style out of Bi-2212 (Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8-x</sub>). This conductor has been developed at the MagLab under DOE-HEP support in the context of the Bismuth Strand and Cable Collaboration (BSCCo) that unites the MagLab, BNL, FNAL, LBNL and OST in a team developing this material for accelerator use. The MagLab is now the US point of contact for collaborations between EUCARD2 and the US program. (MagLab contacts: David C. Larbalestier, ASC)

Fermilab, Batavia, IL: The Applied Superconductivity Center is collaborating with Fermilab on the development of a new generation of Nb<sub>3</sub>Sn wires with high critical current density for the next generation of higher magnetic field accelerator magnets as part of the US-Magnet Development Program. (MagLab contacts: David C. Larbalestier, Chiara Tarantini, Shreyas Balachandran and Peter J. Lee, ASC)

Fermi National Accelerator Laboratory (FNAL), Batavia, IL: Applied Physics and Superconducting Technology Division, Magnet Systems Department of FNAL manages Nb<sub>3</sub>Sn wire procurement for LHC high luminosity upgrade, MS&T physical property measurement lab is contracted by FNAL to measure critical current and residual-resistance-ratio of Nb<sub>3</sub>Sn wires as a part of the quality verification program. This collaboration started in 2015 and will continue through the end of 2021. (MagLab contact: Jun Lu, MS&T)

Facility for Rare Isotope Beams (FRIB), East Lansing, MI: FRIB at Michigan State University collaborated with MS&T physical property measurement lab on high critical current measurement of NbTi wires up to 3000A. (*MagLab contact: Jun Lu, MS&T*)

Fusion and Fission Energy and Science Division, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN: The MS&T's Electro-Mechanical Properties Lab is one of the United States' primary materials research and qualification laboratories that specializes in low temperature superconductor and structural materials testing in support of high-field superconducting magnets. The MagLab has a long-term relationship with ORNL and its US-ITER program to provide engineering support that will continue in the post-ITER fusion program era. The funding for this research is provided by US-DOE and ORNL. (*MagLab contact: Bob Walsh, MS&T*)

Helmholtz Zentrum Berlin, Berlin, Germany: The MagLab has partnered with the Helmholtz Zentrum Berlin (HZB) to develop the highest field magnet worldwide for neutron scattering at HZB. In March 2007, HZB (formerly the Hahn-Meitner Institute) signed an agreement with Florida State University Magnet Research and Development Inc. The magnet is intended to provide 25T on-axis using 4.4MW of DC power and have upstream and downstream scattering angles of 30 degrees. The magnet reached 26T on October 16, 2014. Since then it has been moved from the test site into the neutron guide hall and served the first users in July 2015. We are now discussing an agreement for assistance with ongoing operations and maintenance. (MagLab contact: Mark D. Bird, MS&T)

HL-LHC Accelerator Upgrade Project (AUP), Geneva, Switzerland: The AUP is the US contribution to the High-Luminosity Upgrade of the Large Hadron Collider. All the magnets are Nb<sub>3</sub>Sn; there is no HTS. AUP will deliver new quadrupole magnets, 20 magnets x 4 coils = 80 coils measuring 4.2m long at 11.4T field and 1.9K, that intensify the focus of the CERN proton beams at the ATLAS and CMS intersection regions, and new crab cavities that rotate the beam slightly and ensure that collisions are head-on even when the focusing magnets are highly converging. These new elements will make physics happen 10 times faster than before (new physics being proportional to luminosity). The Hi-Lumi project in European accounting is around CHF 2.2 billion, AUP cost is \$225 million, and MagLab oversees a \$25 million component to procure 10 tons (7 tons have been delivered as of Feb 2021) of the highest-performing Nb<sub>3</sub>Sn conductor ever made, and verify its guality by testing critical current and other properties. The AUP is supported by the DOE Office of Science. The AUP team consists of six US laboratories and two universities: Fermilab, Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory, Thomas Jefferson National Accelerator Facility (all DOE national laboratories), the National High Magnetic Field Laboratory, Old Dominion University and the University of Florida. (MagLab contacts: Lance Cooley and David C. Larbalestier, ASC)

International Thermonuclear Experimental Reactor (ITER International Organization), Cadarache, France; US-ITER Project Office, Oak Ridge, TN; University of Twente, Enschede, the Netherlands: The Applied Superconductivity Center played a major role in helping ITER-IO understand the properties of the cables being wound into the Central Solenoid (CS) and the Tokamak Field (TF) coils. A central task has been the disassembly and metallographic analysis of the prototype Cable-in-Conduit-Conductors (CICCs) needed for TF and CS coils after testing in the SULTAN facility in conditions designed to simulate ITER operations. Many of these conductors Toroidal Field (ITER Organization) and Central Solenoid (US-ITER) CICCs typically suffered significant performance degradation during cyclic loading and occasional warm-up and cool-down cycles. The tests performed at the MagLab were able to identify many of the causes for this degradation and were instrumental in developing new cable patterns that resolved the degradation. This work was collaborative with groups at CEA-Cadarache, the University of Twente in the Netherlands and US-ITER. (MagLab contacts: Peter J. Lee and David C. Larbalestier, ASC)

International Thermonuclear Experimental Reactor (ITER), US-ITER Project Office, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN: The United States is part of an exciting international collaboration to demonstrate the feasibility of an experimental fusion reactor that is under construction in France. The MS&T's Mechanical Properties Lab is the US-ITER primary materials research and qualification laboratory supporting the US effort. The Tokamak machine consists of three types of very large, complex superconducting magnets that all utilize Cable-in-Conduit Conductors (CICC) as the main structural components. Another important component for stress management of the Central Solenoid is a massive CS pre-compression structure (Tie Plates). The

conduit and tie plate alloys, and their welds, are being studied and characterized here to ensure their performance and reliability. The funding for this research is provided by US-DOE, US-ITER Project Office at ORNL. In addition, MS&T's physical property measurement lab has been preparing Nb<sub>3</sub>Sn wire samples as witness for heat treatment ITER central solenoid modules. The MagLab subsequently measures critical current of these heat treatment witness samples. (MagLab contacts: Bob Walsh & Jun Lu MS&T)

Japan Proton Accelerator Research Complex (J-PARC), Japan: The Applied Superconductivity Center ASC is collaborating with the Japan Proton Accelerator Research Complex J-PARC to perform neutron-diffraction experiments on RRP® Nb<sub>3</sub>Sn wires to find the origin of the strain irreversibility cliff in these conductors and to identify the different phases present in the conductor after heat-treatments. This collaboration also includes Kozo Osamura from the Research Institute for Applied Sciences RIAS (Kyoto, Japan) and Shutaro Machiya from Daido University (Nagoya, Japan). Work from this collaboration will expand to also include other conductors currently being developed such as Nb<sub>3</sub>Sn containing additional pinning centers. (MagLab contact: Najib Cheggour and Peter J. Lee, ASC)

Jefferson Lab, Newport News, VA: Recently, Nitrogen and Titanium doping have emerged as highly effective methods of improving the quality factor on Nb SRF cavities; the Applied Superconductivity Center is working with scientists at Jefferson Lab to evaluate the interaction between prior cold-work and doping treatment of Nb samples and their influence on the superconducting properties. Doping is carried out at Jefferson Lab and superconducting property measurements, including magneto optical imaging area carried out at the MagLab. (MagLab contact: Peter J. Lee, ASC)

Jefferson Lab, Newport News, VA: Jefferson Lab are developing the next generation of Nb film coated Cu RF cavities, and the Applied Superconductivity Center is assisting with the microstructural characterization of single-cell Cu cavities fabricated using a cathodic-arc-discharge (CAD) coating of Nb onto Cu. (*MagLab contact: Peter J. Lee, ASC*)

Key Laboratory of Electromagnetic Processing of Materials, Northeastern University, Shenyang, China: The collaboration between the Northeastern University and the MagLab is related to the magnetic field impact on fabrication of high strength conductors and magnetic materials. Two graduate students visited the MagLab between 2019 and 2020. They published three joint papers between 2019 and 2021. (MagLab contact: Ke Han, MS&T)

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea: Professor **Hyoungsoon Choi's group at the Korea Institute of Science and Technology (KAIST) has developed** a co-operative agreement with Professor Yoonseok Lee and the National High Magnetic Field Laboratory's High B/T Facility for the study and development of the design of coolant materials used in nuclear demagnetization refrigerators. The collaboration focuses on the techniques and expertise required to produce high residual resistant ratios for the metallic materials used for the coolants and the associated components. KAIST is a leading center for ultra-low temperature research in Korea. (MagLab contacts: Yoonseok Lee, High B/T)

Large Accelerator Project for the HiLumi upgrade of the CERN LHC, Brookhaven National Lab, Upton, NY: Accelerator magnets based on Nb<sub>3</sub>Sn wires are required to provide the increased magnetic fields for the next LHC upgrade. The Applied Superconductivity Center is collaborating with Brookhaven National Lab to understand the design and heat treatment optimization of accelerator magnet quality strand fabricated by the internal Sn process with a view to driving high current density strands to smaller filament sizes. Close collaboration with the R&D billets being manufactured for LARP under the Conductor Development Program of DOE High Energy Physics is a key part of the work. This work concluded in 2017 when the Hi-Lumi Upgrade project formally began. (MagLab contacts: Chiara Tarantini, Peter J. Lee and David C. Larbalestier, ASC)

Lawrence Berkeley Laboratory, Accelerator, Berkeley, CA: The Applied Superconductivity Center (ASC) is collaborating with the Lawrence Berkeley National Laboratory (LBNL) to test strain properties of high-performance RRP® Nb<sub>3</sub>Sn wires to be used in the LBNL Test Facility Dipole Project (TFD). This collaboration will explore the strain sensitivity of a specific Nb<sub>3</sub>Sn conductor to help LBNL researchers decide early in the project whether this conductor is suitable for TFD. (*MagLab contact: Najib Cheggour, ASC*)

Lawrence Berkeley National Laboratory (LBNL), Berkeley, CA: Division of Accelerator Technology and Applied Physics collaborated with MS&T physical property measurement lab in thermal properties measurements of a polymer composite material that is used in development of the accelerator magnets. (MagLab contact: Jun Lu, MS&T)

Lawrence Berkeley Laboratory, Accelerator Technology & Applied Physics Division, Berkeley, CA: MagLab - MS&T's Electro-Mechanical Properties group specializes in low temperature structural materials testing in support of DOE High-Luminosity LHC Accelerator Upgrade Project (AUP). The MagLab performs low temperature mechanical tests and microstructural evaluation of structural aluminum alloys and composites that are critical to the safe/reliable operation of large accelerator magnets being constructed for the project. (MagLab contact: Bob Walsh, MS&T)

Lawrence Livermore National Laboratory, Livermore, CA: The Applied Superconductivity Center and the Magnet Science and Technology division of the MagLab are collaborating with researchers at Lawrence Livermore National Laboratory to develop cavity resonators and magnets for the Advanced Dark Matter Experiment. Fabrication and microstructural characterization facilities in the ASC are used to investigate Nb<sub>3</sub>Sn and other superconducting coatings for use in cavities. Magnet Science and Technology consultation related to very large and high field detector magnets is ongoing. (*MagLab contacts: Lance Cooley, ASC; Mark D. Bird, MS&T*)

Los Alamos National Laboratory Community Programs Office, Los Alamos, NM: CIRL works closely with our counterpart, the Los Alamos National Laboratory Community Programs Office. Over the last year, the MagLab has developed a partnership to share information and resources on our educational activities. The community programs office has a large staff that oversees more than 15 different educational/ community outreach programs including the Bradbury Museum. (MagLab contact: Carlos R. Villa, Educational Programs)

Los Angeles County Museum of Natural History, Los Angeles, CA: The collaboration between the IVPP and the MagLab is related to the investigation of Late Cenozoic Vertebrate Paleontology and Paleoenvironments of the Tibetan Plateau (China). Stable isotopic compositions of the samples collected in this project are analyzed in the Geochemistry Laboratories in the MagLab. (MagLab contact: Yang Wang, Geochemistry Program)

School of Mechanical Engineering and Automation, Fuzhou University, Fuzhou, China: The collaboration between the Fuzhou University and the MagLab is related to the characterization of high strength conductors. (*MagLab contact: Ke Han, MS&T*)

South Florida Water Management District (SFWMD), West Palm Beach, FL: The collaboration between the SFWMD and the MagLab is related to the investigation of land-use and change on food web structure and mercury cycling in the Everglades. Isotopic compositions of the samples collected in this project were analyzed in the Geochemistry Laboratories in the MagLab. (MagLab contact: Yang Wang, Geochemistry Program)

Thomas Jefferson National Accelerator Facility, Newport News, VA: Large-grain Nb has become a viable alternative to fine-grain Nb for the fabrication of superconducting radio-frequency cavities. The MagLab collaborated with engineers at Jefferson Lab to evaluate the effect of thermal processing and grain size on the mechanical properties of Nb. The mechanical properties evaluation was carried out at MS&T's Mechanical Properties Lab. (*MagLab contact: Bob Walsh, MS&T*) Nitrogen surface treatments has emerged as a highly effective method of improving the quality factor on Nb SRF cavities; the Applied Superconductivity Center is working with scientists at Jefferson Lab to evaluate the interaction between prior cold-work and doping treatment of Nb samples and their influence on the superconducting properties. Doping, heat treatment and cavity testing are carried out at Jefferson Lab, and superconducting property measurements, including magneto optical imaging, as well as microstructural and microchemical analyses are carried out at the MagLab. (*MagLab contact: Peter J. Lee, ASC*)

US Magnet Development Program (MDP), Berkeley, CA: The US Magnet Development Program aggressively pursues the development of superconducting accelerator magnets that operate as closely as possible to the fundamental limits of superconducting materials and at the same time minimize or eliminate the need to break in a magnet in a series of steps to achieve its design field strength. MDP looks forward 15-30 years at accelerators that might be built. CERN is already thinking about a Future Circular Collider at 10x the energy than the present LHC, i.e. > 100TeV, in the 2050 timeframe. An important thing about the FCC is that it is constrained by mountains, and to get to 100TeV, the envisioned Nb<sub>3</sub>Sn technology, which as a limit at ~16T, must be replaced by or combined with HTS to get to 20T. However, while MDP partners closely with CERN, the technology being developed is generic, and it is important to note that the physics reach of an accelerator scales with the ring diameter and the field strength. MagLab's major developments to date include pioneering Bi-2212 magnet technology and its high-pressure, high-temperature reaction and demonstrating several Bi-2212 coils, demonstrating REBCO cables, and leading the national conductor development effort. LBNL serves as the host institution for the MDP organization. (MagLab contacts: Lance Cooley and David C. Larbalestier, ASC)

Woods Hole Oceanographic Institution (WHOI), Falmouth, MA: The collaboration between WHOI and the MagLab is related to ocean crust formation. WHOI is providing samples and analyses of abyssal peridotites, which are analyzed for Hf, Nd and Osisotopic composition. The MagLab also participates in seagoing expeditions. One has been to the mid-Atlantic Ridge; another is planned to the Marion Rise on the southwest Indian Ridge. Samples collected from these expeditions will be analyzed at both the MagLab and WHOI. (MagLab contact: Vincent Salters, Geochemistry Program)

Woods Hole Oceanographic Institution (WHOI), Falmouth, MA: As part of FSU's Gulf Research Initiative Consortium, the MagLab collaborates with Christopher Reddy and Robert Nelson at WHOI in characterization of petroleum oil spills at the molecular level, by gas chromatography x gas chromatography and FT-ICR mass analysis. Characterization of the 2010 Macondo wellhead oil has been completed, and current research focuses on subsequent physical, chemical, and biological changes as the spill propagates into the environment. (*MagLab contact: Ryan Rodgers, ICR*)

## UNIVERSITIES

Florida State University, College of Education, Tallahassee, FL: The Center for Integrating Research & Learning works closely with faculty from the FSU College of Education to network and strengthen programs on campus and at the lab. The MagLab utilizes the expertise of FSU faculty for research projects and recruits graduate students from FSU departments to conduct research on CIRL programs. (MagLab contact: Roxanne Hughes, Educational Programs)

Michigan State University, Lansing, MI: The Applied Superconductivity Center is collaborating with Michigan State University on a DOE funded project to study the impact of grain boundaries and associated microstructural defects on the performance of superconducting cavities using the advance microstructural, microchemical, and electromagnetic characterization techniques and expertise available in the MagLab. (*MagLab contact: Peter J. Lee, ASC*)

Nagoya University, Nagoya, Japan & Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany: The Applied Superconductivity Center is collaborating with Nagoya University and the Karlsruhe Institute of Technology in the investigation of iron-based superconducting thin films in order to establish their intrinsic properties and determine their potential for applications using electromagnetic characterization techniques also in high field and expertise available in the MagLab. (MagLab contact: Chiara Tarantini, ASC)

Osaka City University, Japan: The EMR group received joint funding with the University of Modena in Italy and Osaka City University in Japan through an International Program sponsored by the Air Force's Asian Office of Aerospace Research and Development (AOARD). This joint program focuses on quantum properties of molecular magnets. A cooperative agreement between Osaka City University and Florida State University has been established in order to formalize this collaboration. (*MagLab contact: Stephen Hill, EMR*)

Radboud University, Nijmegen, The Netherlands: The MagLab has partnered with the High Magnetic Field Lab in The Netherlands to develop a 45T hybrid magnet using only 24MW of power. The project was funded by the Dutch government in 2006, and in 2012 an agreement was signed for the MagLab to play a leading role in the development of the Nb<sub>3</sub>Sn cable-in-conduit superconducting coil for this magnet system. This will be the fourth hybrid outsert to be developed at the MagLab (MagLab 45T, HZB, FSU SCH, Nijmegen), and the Dutch lab will benefit from our extensive experience. When complete, it is expected to be one of three 45T systems worldwide. The CICC coil has been delivered to Nijmegen. The Nijmegen lab is building the cryostat and resistive coils. (MagLab contact: Mark D. Bird, MS&T)

Shanghai University, Shanghai, China: The collaboration between the Shanghai University and the MagLab is related to the solidification of metallic materials. Two scientists from Shanghai University visited the MagLab in 2019 as visiting scholars for one year to do research on microstructure of high strength materials. They have published five joint papers between 2019 and 2020. (MagLab contact: Ke Han, MS&T)

St. Andrews University, UK: The EMR group has an ongoing partnership with St. Andrews University in the UK, involving the development of a high-power (1kW) high-frequency (94GHz) pulsed EPR spectrometer (HiPER) for its user program. (*MagLab contact: Stephen Hill, EMR*)

Texas A&M University, College Station, TX: Texas A&M University has fabricated Nb and Ta sheets, rods and tubes with ultra-fine grain size and controlled textures useful for Nb<sub>3</sub>Sn wires and SRF cavities by using the Equal Channel Angular Extrusion (ECAE) process; the Applied Superconductivity Center has provided microstructural characterization of this material. (MagLab contact: Shreyas Balachandran, Peter J. Lee, ASC)

Tokyo University of Agriculture and Technology, Japan: The Applied Superconductivity Center is collaborating with TUAT in the investigation of iron-based superconducting bulks in order to establish their intrinsic properties and determine their potential for applications using electromagnetic characterization techniques also in high field and expertise available in the MagLab. (MagLab contact: Chiara Tarantini, ASC)

University of Cambridge, UK: The MS&T division is collaborating with the University of Cambridge to

develop high-current coils based on high temperature superconductors driven by a flux pump. This collaboration involves Cambridge developing flux pumps that are able to provide more energy to the load than traditional systems and the MagLab developing high-current HTS coils. (MagLab contact: Thomas Painter)

University of Colorado Boulder, Boulder, CO: The NIST-Boulder electromechanical testing facilities were the primary location for the determination of the strain sensitivity of a wide range of superconducting wires, and these important instruments have been transferred to the Applied Superconductivity Center so that this critical work can be continued. (*MagLab contact: Najib Cheggour, ASC*)

University of Edinburgh, UK: The EMR group received funding through a joint program between the National Science Foundation and the Engineering and Physical Sciences Research Council in the UK, enabling an International Collaboration with the Chemistry Department at the University of Edinburgh, Scotland. This joint program involved the development of high-pressure/High-field EPR techniques. (*MagLab contact: Stephen Hill, EMR*)

University of Modena, Italy: The EMR group received joint funding with the University of Modena in Italy and Osaka City University in Japan through an International Program sponsored by the Air Force's Asian Office of Aerospace Research and Development (AOARD). This joint program focuses on quantum properties of molecular magnets. (*MagLab contact: Stephen Hill, EMR*)

University of Oxford, UK: The Applied Superconductivity Center is collaborating with University of Oxford in the investigation of doped Nb<sub>3</sub>Sn superconducting wires in order to determine by atom probe tomography the elemental distribution of dopants and their effect on the superconducting properties. (MagLab contact: Chiara Tarantini, ASC)

University of Texas, Arlington, TX: The Applied Superconductivity Center is working with Choong-Un Kim and his research group to understand electrochemical methods to apply refractory metals to copper and copper alloys. Kim's team have unique expertise in preparing non-aqueous methods that ensure very little oxygen is incorporated into the refractory metals, using expertise developed for semiconductor inter-connections. The MagLab's microstructural and electromagnetic characterization facilities are used to evaluate the quality of coatings and their properties, including potential use as a superconducting material in a cavity resonator. (MagLab contact: Lance Cooley, ASC)

## COMMUNITY GROUPS AND EDUCATIONAL GROUPS

American Physical Society – Committee on the Status of Women in Physics, College Park, MD: This committee works to improve the representation and experiences of women in physics. The MagLab has engaged with this group for external reviews and advice. In addition, Dr. Hughes has served as a member of the committee and continues to help with Site Visits. (MagLab contact: Roxanne Hughes, Educational Programs)

American Physical Society - Forum on Outreach and Engaging the Public, College Park, MD: The Forum's goal is to increase the public's awareness of physics. CIRL works with this group to utilize best practices and engage in international discussions around physics outreach. (*MagLab contact: Roxanne Hughes, Educational Programs*)

Big Bend/Leon Association of Science Teachers (BLAST), Tallahassee, FL: The Big Bend/Leon Association of Science Teachers (BLAST) is a group that brings together formal and informal science educators to establish lines of communication among all persons involved in science education in the North Florida community and foster life-long interest in the sciences. They do this by coordinating services most conducive to outstanding science educators, including hosting

workshops and presentations that aim to increase the knowledge and skills of science teachers. Additionally, they recognize outstanding achievements in science instruction and provide monetary support for science teacher and student projects. (MagLab contact: Carlos R. Villa, Educational Programs)

CAISE - Center for the Advancement of Informal Science Education (CAISE), Washington, DC: CAISE works in collaboration with the National Science Foundation (NSF) Advancing Informal STEM Learning (AISL) Program to strengthen and advance the field of professional informal science education and its infrastructure by providing resources for practitioners, researchers, evaluators and STEM-based professionals. CAISE also facilitates conversation, connection and collaboration across the ISE field — including in media (TV, radio and film), science centers and museums, zoos and aquariums, botanical gardens and nature centers, cyberlearning and gaming, and youth, community, and out of school time programs. The Center for Integrating Research & Learning (CIRL) has worked with CAISE to provide advice for reaching Principal Investigators and improving the evaluation of broader impacts. (MagLab contact: Roxanne Hughes, Educational Programs)

Community Classroom Consortium, Tallahassee, FL: The Community Classroom Consortium (CCC) is a coalition of more than thirty cultural, scientific, natural history and civic organizations in North Florida and South Georgia that provide educational experiences and resources to the public, especially K-12 teachers and students. Representatives from CIRL and Public Affairs represent the Lab on the board of this organization and as general members. (MagLab contact: Kari Roberts, Educational Programs)

Florida Afterschool Network, Tallahassee, FL: The Florida Afterschool Network (FAN) is an organization that is working toward creating and sustaining a statewide infrastructure to establish collaborative public and private partnerships that connect local, state, and national resources supporting afterschool programs that are school-based or school-linked; develop quality afterschool standards that are endorsed and promoted by statewide stakeholders and through Florida Afterschool Network; and promote public awareness and advocate for policy that expands funding, quality improvement initiatives and accessibility of afterschool programs. The Center for Integrating Research & Learning is a member of the advisory council for this organization. (MagLab contact: Carlos R. Villa, Educational Programs)

Florida Association of Science Teachers (FAST), Tallahassee, FL: FAST is a diverse group of teachers, scientists, science educators, science supervisors, curriculum designers, administrators and educational business partners who have a common goal of improving education for students in the state of Florida. FAST provides a way for all members to keep up with what is happening in education in Florida and across the United States. (MagLab contact: Carlos R. Villa, Educational Programs)

Future Physicists of Florida, Tallahassee, FL: Future Physicists of Florida is an organization dedicated to recognizing talented middle school math and science students and providing educational guidance to these students to prepare them for careers in physics and engineering. CIRL is a partner in the organization. (*MagLab contact: Carlos R. Villa, Educational Programs*)

Inclusive Graduate Education Network (IGEN), College Park, MD: The MagLab has worked with IGEN to beta test a mentor training for mentors at national labs. MagLab staff will be able to participate in the final curriculum to strengthen the quality of mentorship at the MagLab. (MagLab contact: Roxanne Hughes or Kari Roberts, Educational Programs)

Leon County Schools, Tallahassee, FL: CIRL works closely with Leon County Schools (LCS) through our K-12 outreach and our middle school mentorship program. In 2014, CIRL staff worked with Title I elementary school teachers from LCS to develop and facilitate a year-long teacher professional development that culminated in a STEM challenge for students. (MagLab contact: Roxanne Hughes or Carlos R. Villa, Educational Programs)

Los Angeles County Museum of Natural History, Los Angeles, CA: The collaboration between the IVPP and the MagLab is related to the investigation of Late Cenozoic Vertebrate Paleontology and Paleoenvironments of the Tibetan Plateau (China). Stable isotopic compositions of the samples collected in this project are analyzed in the Geochemistry Laboratories in the MagLab. (MagLab contact: Yang Wang, Geochemistry Program)

National Girls Collaborative Project, Seattle, WA: This is a national nonprofit organization that works to improve girls' interest in and access to STEM programs and careers. CIRL has utilized their publications and webinars for best practices in STEM education. CIRL's research has also informed their work. (MagLab contact: Roxanne Hughes or Kari Roberts, Educational Programs)

National Postdoc Association, Washington, DC: The National Postdoc Association (NPA) advocates for postdoctoral scholars at a national level and coordinates an annual meeting of postdoctoral scholars, their mentors and postdoctoral affairs staff. Florida State University is an affiliate member, so all postdocs at the FSU branch receive complementary membership to the NPA. Additionally, representatives from the lab attend the annual meeting regularly to stay up-to-date on the latest issues and initiatives related to postdoctoral affairs. The NPA provides direct support to postdocs through professional development and a virtual career center. (MagLab contact: Kari Roberts, Educational Programs)

SciGirls National, Saint Paul, MN: This program is run by Twin Cities Public Television and provides both programming and resources for educators and girls to increase their interest and sense of belonging in STEM. CIRL utilizes these resources to train our summer camp educators and local teachers. In addition, CIRL's research has informed the SciGirls program and curriculum. (MagLab contact: Roxanne Hughes, Educational Programs)

Supporting Teachers to Encourage the Pursuit of Undergraduate Physics (STEP UP), Miami, FL: **STEP** UP is a national community of physics teachers, researchers and professional societies. They have designed high school physics lessons to empower teachers, create cultural change, and inspire young women to pursue physics in college. It is supported by NSF, APS Physics, AAPT and FIU. (MagLab contact: Carlos R. Villa, Educational Programs)

WFSU-TV, Tallahassee, FL: The Center for Integrating Research & Learning partners with WFSU-TV, the area's public television station, to administer SciGirls. The program includes two summer camps for middle school girls with an interest in science. The collaboration between the MagLab and WFSU-TV has resulted in a successful partnership that has lasted over a decade. (MagLab contact: Roxanne Hughes, Educational Programs)

### SPIN OFFS OF RESEARCH LABORATORIES AND CORPORATIONS

Center for Advanced Power Systems (CAPS), Tallahassee, FL: The Center for Advanced Power Systems (CAPS) is a multidisciplinary research center organized to perform basic and applied research to advance the field of power systems technology. CAPS emphasis is on application to electric utility, defense, and transportation, as well as developing an education program to train the next generation of power systems engineers. The research focuses on electric power systems modeling and simulation, power electronics and machines, control systems, thermal management, cyber-security for power systems, high temperature superconductor characterization and electrical insulation research. (MagLab contact: Greg Boebinger)

Future Fuels Institute, Tallahassee, FL: The Future Fuels Institute (FFI) was established to enhance the existing Ion Cyclotron Resonance (ICR) Program at the MagLab to deal specifically with bio- and

fossil fuels, particularly for heavy oils and synthetic crudes. Supported by sponsoring companies and collaborative entities (instrument companies, universities, and research institutes), the FFI works to develop and advance novel techniques for research applications and industrial problem solving. Recent research has focused on biofuels and recycling efforts for petroleum-based materials (plastics). The institute also serves as a training center for fuel-related science and technology. It is currently part of an international joint laboratory (iC2MC), funded by Total Global. (MagLab contact/ Director: Ryan Rodgers)

High-Performance Materials Institute (HPMI), Tallahassee, FL: The High-Performance Materials Institute (HPMI) is a multidisciplinary research institute for research and education in the field of advanced materials. Currently, HPMI is involved in four primary technology areas: High-Performance Composite and Nanomaterials, Structural Health Monitoring, Multifunctional Nanomaterials Advanced Manufacturing and Process Modeling. Over the last several years, HPMI has proven a number of technology concepts that have the potential to narrow the gap between research and practical applications of nanotube-based materials. These technologies include magnetic alignment of nanotubes, fabrication of nanotube membranes or buckypapers, production of nanotube composites, modeling of nanotube-epoxy interaction at the molecular level, and characterization of SWNT nanocomposites for mechanical properties, electrical conductivity, thermal management, radiation shielding and EMI attenuation. (*MagLab contact: Greg Boebinger*)

MagCorp, Tallahassee, FL: MagCorp is a new Tallahassee company that facilitates access to the world's leading magnetic experts to solve real world industrial problems. MagCorp was created to meet industry needs for feasibility studies, prototyping, and product development while eliminating the confusion that can come from partnering with academic institutions and research foundries. MagCorp is the world's one-stop shop for magnet science solutions and is the essential conduit between the private & government sectors and the National High Magnetic Field Lab. Leveraging completely new client & partner facing business models, MagCorp has already begun to attract industry to Tallahassee and put it on the map as the emerging magnetic capital of the world. (MagLab contact: Greg Boebinger)

MAXIKAT, Inc., Tallahassee, FL: Maxikat is a spinoff company that performs data analysis for petroleum industry. It was formed in 2015. (*MagLab contact: Vladislav Lobodin*)

Omics LLC, Tallahassee, FL: Omics LLC is a spinoff company that serves the data analysis and interpretation needs of the high-resolution mass spectrometry market. It was formed more than fifteen years ago and has grown over the years to address a wider analytical community. (MagLab contact: Ryan Rodgers)



# 2.1. USER PROGRAM

### Proposal Review Process

Across all seven facilities, proposals for magnet time are submitted online via https://users.magnet.fsu.edu and reviewed in accordance with the MagLab User Proposal Policy. In brief, each user facility has a User Proposal Review Committee (UPRC) comprised of at least seven members, with more external members than internal. UPRC memberships are treated confidentially by the laboratory but are available for review by NSF and MagLab advisory committees. Proposal reviews are conducted in strict confidence and are based on two criteria: (1) the scientific and/or technological merit of the proposed research and (2) the "broader impacts" of the proposed work. They are graded online according to a scale, ranging from "A" (Proposal is high quality and magnet time must be given a high priority) to "C" (Proposal is acceptable and magnet time should be granted at MagLab discretion) to "F" (Proposal has little/no merit and magnet time should not be granted). The Facility Directors merge the UPRC recommendations with the availability and scheduling of specific magnets, experimental instrumentation, and user support scientists and make recommendations for magnet time assignments to the MagLab Director. The MagLab Director is responsible for final decisions on scheduling of magnet time based on these recommendations. All 2020 User Proposals can be found in Appendix V.

# User Funding Opportunities

### Dependent Care Travel Grant

The MagLab recognizes the extra demands outside of a research career placed on caregivers of children and other dependents. For caregivers, travel to the MagLab to conduct experiments or to conferences to disseminate research findings often incurs extra costs for dependent care. In place since 2011, the MagLab's Dependent Care Travel Grant (DCTG) program offers up to \$800 per year for travel expenses for MagLab scientists traveling to conferences or MagLab users traveling to any of the three MagLab facilities. One DCTG was awarded early in 2020.

## First Time User Support

The MagLab is charged by NSF with developing and maintaining facilities for magnet-related research that are open to all qualified scientists and engineers through a peer-reviewed proposal process. Facilities are generally available to users without cost. In an effort to encourage new research activities, first-time users are provided financial support for travel expenses. International users are provided \$1,000 of support and domestic users are provided \$500 of support for their travel costs. This funding is provided by the State of Florida and is available for Tallahassee user facilities only.

### Visiting Scientist Program

In 2020, the number of requests to and approvals for the Visiting Scientist Program were limited by the COVID pandemic. The Program provided financial support of \$7,400 for two research projects on a competitive basis. To apply for support from the Visiting Scientist Program, interested researchers are required to submit an application and a proposal that will be reviewed by appropriate facility directors and scientist at the MagLab. All requests for support must be submitted online at <a href="https://vsp.magnet.fsu.edu/">https://vsp.magnet.fsu.edu/</a>

# User Collaboration Grants Program (UCGP)

The NSF charged the MagLab with developing an internal grants program that utilizes the MagLab facilities to carry out high quality research at the forefront of science and engineering, and advances the facilities and their scientific and technical capabilities. UCGP, established in 1996, stimulates magnet and facility development and provides intellectual leadership for research in magnetic materials and phenomena.

The UCGP strongly encourages collaboration between MagLab scientists and external users of MagLab facilities. Projects are also encouraged to drive new or unique research, serving as seed money to develop initial data leading to external funding of a larger program. In accord with NSF policies, the MagLab cannot fund clinical studies.

A total of 23 UCGP solicitations have now been completed with a total of 590 pre-proposals being submitted for review. Of the 590 proposals, 310 were selected to advance to the second phase of review, and 140 were funded (24% of the total number of submissions). The UCGP has been highly successful as a mechanism for supporting outstanding projects in the various areas of research pursued at the laboratory. It uses a two-stage proposal review process handled by means of a web-based system. Proposal review is done by a combination of internal and external reviewers. Details of the process and review criteria are available on the <u>website</u>.

### 1. 2020 UGCP Solicitation and Awards

The most recent solicitation, announced in March 2020, is complete, and its awards were issued in January 2021.

Of the 13 pre-proposals received the committee recommended that 10 pre-proposals move to the full proposal state. Of the 10 full proposals, five were awarded. A breakdown of the review results is presented in Tables 2.1 and 2.2.

| Research Area                        | Pre-Proposals<br>Submitted | Pre-Proposals<br>Proceeding to Full<br>Proposal | Projects<br>Funded |
|--------------------------------------|----------------------------|-------------------------------------------------|--------------------|
| Condensed Matter Science             | 5                          | 5                                               | 3                  |
| Biological & Chemical Sciences       | 5                          | 4                                               | 2                  |
| Magnet & Magnet Materials Technology | 3                          | 1                                               | 0                  |
| Total                                | 13                         | 10                                              | 5                  |

### Table 2.1: UCGP Proposal Solicitation Results - 2020

### Table 2.2: UCGP Funded Projects from 2020 Solicitation.

| Principal<br>Investigator | MagLab<br>Institution | Project Title                                                                                             | Funded    |
|---------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------|-----------|
| Ali Bangura               | FSU                   | Probing exotic quasiparticles in calorimetric and thermal transport experiments at ultra-low temperatures | \$220,394 |
| Chad Weisbrod             | FSU                   | Data Independent Acquisition-Mass Spectrometry Using<br>Ultra-High Magnetic Field FT-ICR                  | \$195,094 |
| Thomas Mareci             | UF                    | Cryo-cooled MR Coils for Low-Gamma NMR Imaging and Spectroscopy at High Magnetic Fields.                  | \$209,839 |
| Lucia Steinke             | FSU                   | Probing exotic quasiparticles in calorimetric and thermal transport experiments at ultra-low temperatures | \$191,850 |
| Xiao-Xiao Zhang           | FSU                   | Probing dark exciton dynamics in monolayer semiconductors under high magnetic field                       | \$200,000 |

## 2. Future Solicitations

No solicitation will be offered in 2021. The next solicitation announcement is planned to occur around April of 2022 with funding in early 2023.

### 3. Results Reporting

To assess the success of the UCGP, reports were requested in January 2020, on grants issued from the five solicitations which had start dates from 2015 through 2020. At the time of the reporting, some of these grants were in progress, and some had been completed. For this "retrospective" reporting, Pls were asked to include external grants, MagLab facilities enhancements, and publications that were generated by the UCGP. Since UCGP grants are intended to seed new research through high risk initial study or facility enhancements, principal investigators (Pls) were allowed and encouraged to report results that their UCGP grant had made possible, even if these were obtained after the term of the UCGP grant was complete. Reports from 25 awards were included in the results given here.

The PIs reported:

- 30 Lab enhancements, which are listed in Table 2.3 below.
- At least partial support for four undergraduate researchers, 43 grad students and 18 postdocs.
- 21 funded external grants, which were seeded by results from UCGP awards. The total dollar value of the external grants was \$41.8M. Grants to MagLab institutions and those of user-collaborators were included.
- 139 publications, many in high profile journals, including six in JACS, one in Nature, nine in Nature Communications, one in Nature Quantum Materials, three in Nature Physics, four in Physical Review Letters, three in PNAS and one in Science.

 Table 2.3: Facility Enhancements Reported from 2014-2019 UCGP Solicitations

| Enhancement and Available Date                                                        | Users * |
|---------------------------------------------------------------------------------------|---------|
| Software to model proteins of bacteria from isotopically depleted media (1/20)        | 1       |
| PEPPI-MS for eluting proteins from polyacrylamide gels                                | 2       |
| GUPPI software for proteonomic analysis                                               | 1       |
| 3 GPa proximity detectors (7/19)                                                      | 1       |
| Tunnel diode oscillator to 7 GPa (12/19)                                              | 1       |
| Modified 1800 C tube furnace for molten metal flux growth of uranium compounds (1/15) | 7       |
| Development of capabilities for hazardous substance handling (1/15)                   | 4       |
| System for continuous flow 97% para enrichment at 30K (12/19)                         | 3       |
| Time-domain THz spectroscopy using TOPTICA Teraflash system (11/17)                   | 3       |
| 0.75mm 100kHz Magic-Angle Spinning Hxy triple-resonance probe (6/19)                  | 2       |
| Coil winder for AC susceptibility (10/16)                                             | 5       |
| Hybrid piston cylinder cell (10/16)                                                   | 2       |
| Two-element surface quadrature 1H coil and linear 1H birdcage coil (12/14)            | 2       |
| Diffusion-weighted relaxation-enhanced spectroscopy (8/16)                            | 5       |
| Chemical Shift saturation transfer relaxation-enhanced spectroscopy (8/16)            | 1       |
| High-temperature, high-resolution NMR (11/16)                                         | 9       |
| Two-channel homodyne pulsed NMR spectrometer (9/17)                                   | 1       |
| Customized Razorbill piezo for uniaxial strain, for 31T (6/19)                        | 3       |
| Piezoelectric strain device for pulse fields                                          | 1       |
| Torque magnetometer for critical current measurements (10/20)                         | 2       |
| FPGAs for faster resistive critical current measurement                               | 1       |
| Superconducting transformer for 45kA test of superconducting cable (9/20)             | 1       |
| Pulsed field set up for thin film samples in exchange gas (3/16)                      | 2       |

| Lloore * |
|----------|
| Users *  |
| 2        |
| 14       |
| 7        |
| 1        |
| 1        |
| 3        |
| 12       |
|          |

\* Number of external users (PIs or private companies only) reported to have used the enhancement.

## Annual User Survey

The MagLab conducted its tenth annual user survey between June 1, 2020, and June 30, 2020. This annual survey assists all seven facilities in responding to user needs, improving facilities and services, and guides the MagLab in setting priorities and planning for the future. This request was sent to all MagLab User Principal Investigators (PI) and to their collaborators who received magnet time between June 1, 2019, and March 1, 2020, including PIs who sent samples where the experiment was performed by laboratory staff scientists. Due to COVID impacts, the MagLab only surveyed users through March 1 instead of the usual end of May. From 1,006 eligible users, we received feedback from 243 (24.2%) users. 20% of all external users responded to the survey. All user responses were treated as confidential. Figures 2.1-2.7 exclude internal responses.

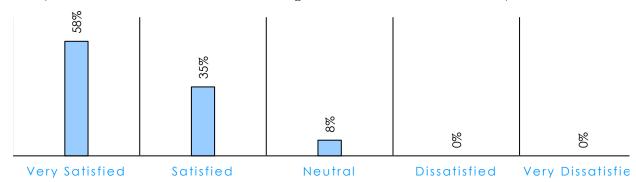


Figure 2.1: 93% of external users were satisfied or very satisfied with the proposal process (e.g., submission, review).

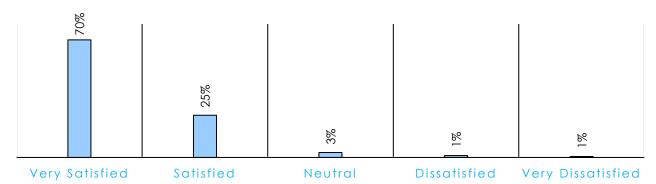


Figure 2.2: 95% of external users were satisfied or very satisfied with the availability of the facilities and equipment.

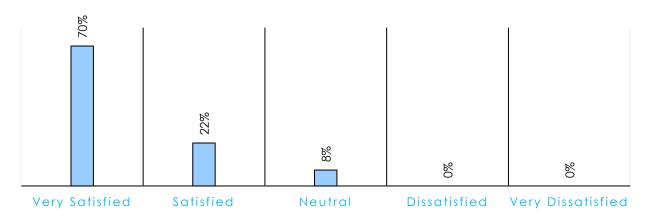


Figure 2.3: 92% of external users were satisfied or very satisfied with user friendliness of training and safety procedure.

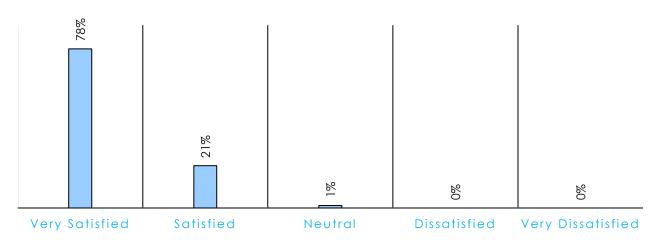


Figure 2.4: 99% of external users were satisfied or very satisfied with the overall safety at the MagLab.

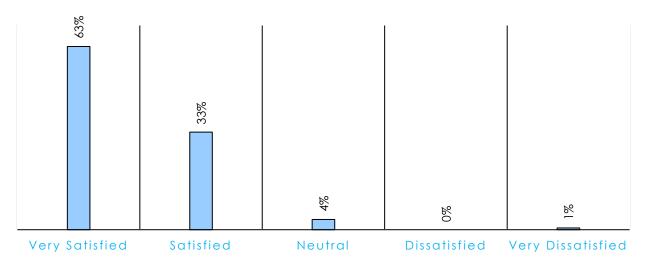


Figure 2.5: 96% of external users were satisfied or very satisfied with the performance of facilities and equipment (e.g., were they maintained to specifications for intended use, ready when scheduled, etc.).

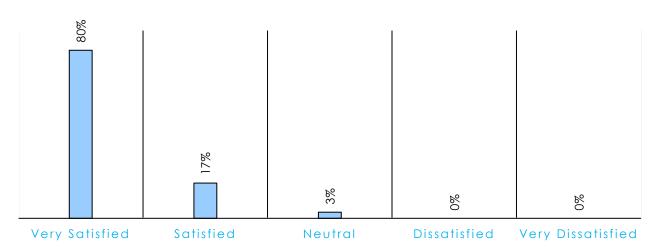


Figure 2.6: 97% of external users were satisfied or very satisfied with the assistance provided by MagLab facilities technical staff.

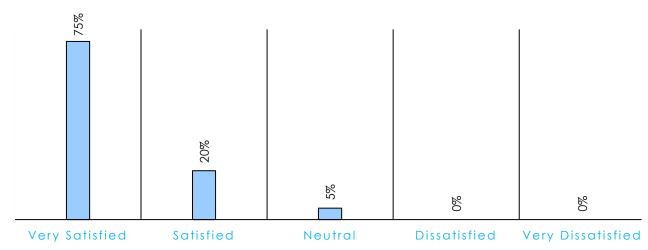


Figure 2.7: 95% of external users were satisfied or very satisfied with the assistance provided by MagLab facilities administrative staff.

### 2.2. SEVEN USER FACILITIES

The geographical distribution of our users' organizations can be found on our website.

### 1. AMRIS Facility

The AMRIS Facility at the University of Florida supports nuclear magnetic resonance spectroscopy (NMR) and magnetic resonance imaging (MRI) studies of chemical compounds, biomolecular systems, tissues, small animals, large animals, and humans. We offer fourteen systems with different magnetic fields and configurations to users for magnetic resonance experiments. AMRIS has fourteen professional staff members to assist users, maintain instrumentation, build new coils and probes and help with administration.

### Unique Aspects of Instrumentation Capabilities

Several AMRIS instruments offer users unique capabilities: the 750MHz wide bore provides outstanding high-field imaging for excised tissues and small animals, as well as diffusion measurements with gradient strengths up to 30T/m; the 11.1T horizontal MRI has a large 400mm bore size and gradient strengths up to 1.5T/m; the 600MHz 1.5-mm HTS cryoprobe is the most mass-sensitive NMR probe in the world for <sup>13</sup>C detection and is ideal for natural products research; the 5T DNP polarizer enables both fundamental studies of DNP mechanisms down to 1.2K as well as *in vivo* metabolism measurements when coupled to either the 4.7T or 11.1T systems. The 3.35T DNP polarizer enables perfused organ studies in the newly installed wide bore 600MHz system. These systems support a broad range of science, including natural product identification, membrane protein structure determination, cardiac studies in animals and humans, and correlation of neural structures with brain function and chemistry (Table 2.4).

| <sup>1</sup> H Frequency | Field (T), Bore (mm)        | Homogeneity | Measurements                         |
|--------------------------|-----------------------------|-------------|--------------------------------------|
| 800MHz                   | 18.8, 63                    | lppb        | Solution/solid-state NMR and HR-MAS  |
| 800MHz                   | 18.8, 54                    | lppb        | Solution NMR (Cryoprobe)             |
| 750MHz                   | 17.6, 89                    | lppb        | Solution/solid-state NMR and MRI     |
| 600MHz                   | 14.1, 51                    | 1ppb        | NMR, microimaging, hyperpolarization |
| 600MHz                   | 14.1, 89                    | lppb        | NMR and hyperpolarization            |
| 600MHz                   | 14.1, 54                    | lppb        | Solution NMR (CryoProbe)             |
| 600MHz                   | 14.1, 54                    | lppb        | Solution NMR (HTS Cold Probe)        |
| 500MHz                   | 11.7, 54                    | lppb        | Solution/solid-state NMR             |
| 470MHz                   | 11.1, 400                   | 0.1ppm      | DNP, MRI and NMR of animals          |
| 212MHz                   | 5.0, 89                     | lppm        | DNP polarization                     |
| 200MHz                   | 4.7, 330                    | 0.1ppm      | DNP, MRI and NMR of animals          |
| 143MHz                   | 3.35, 52                    | lppm        | DNP polarization                     |
| 128MHz                   | 3.0, 900 (600 for subjects) | 0.1ppm      | MRI/S of humans, large animals       |
| 128MHz                   | 3.0, 900 (700 for subjects) | 0.1ppm      | MRI/S of humans                      |

#### Table 2.4: NMR & MRI Systems in the AMRIS Facility at UF in Gainesville

### Facility Developments and Enhancements

Full user operations were offered on the 600MHz wide bore (89mm) and 800MHz narrow bore (54mm) systems installed in November 2019. A specialized QNP switch, enabling <sup>19</sup>F/<sup>1</sup>H or <sup>19</sup>F/BB experiments on the WB600, and a 5mm cryoprobe on the 800 system ensure these high field NMR systems offer the latest in sensitivity and pulse sequence capabilities. All of our NMR systems can be run remotely by users and two systems now have sample changers to enhance user throughput. A 3.0T Philips Ingenia Elition X, 70cm bore MRI scanner was installed in May 2020, as a

direct replacement for a previous 60cm Philips system. It features a 70cm bore and includes the latest acquisition techniques for human MRI research, including multinuclear capabilities, functional MRI (fMRI), advanced diffusion imaging (dMRI), magnetic resonance elastography (MRE), spectroscopy (MRI/S), and whole-body scanning. The extra space better accommodates in-bore equipment and provides a more comfortable environment for subjects. Throughout 2020, all high field systems ( $\geq$ 11.7T) were kept in operation with users sending samples to our staff, and experiments collected through remote access to the operating systems.

## Major Research Activities and Discoveries/Research Highlights

In spite of the challenges posed by the COVID pandemic, our users were able to continue to collect data through the tireless efforts of AMRIS staff who provided on-site support while users mailed samples to us. Local araduate students and postdoctoral fellows continued developing DNP and in vivo spectroscopy techniques for metabolic studies. Many users pursued quantitative studies for metabolomics and structural biology. AMRIS facility users reported 43 peer-reviewed publications and 15 theses and dissertations for 2020. Two notable examples are listed below.

### [<sup>2</sup>H<sub>7</sub>]Glucose and Deuterium MR Can Detect Cancer Metabolism by Formation of HDO

Rohit Mahar, Patrick Donabedian, and Matthew E. Merritt, Department of Biochemistry and Molecular Biology, College of Medicine, University of Florida, Gainesville, FL, USA

Funding: NHMFL NSF DMR-1644779 (G. Boebinger) & the State of Florida, NIH P41-122698,

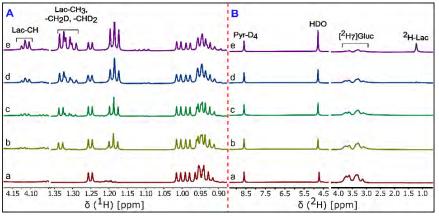
5U2CDK119889, and NIH R01-105346

P.L. R. Mahar, Donabedian, and M.E. Merritt, HDO production from [2H7]glucose Quantitatively Identifies Metabolism, Warburg Scientific Reports, 10, 8885 (2020).

doi.org/10.1038/s41598-020-65839-8

Cancer is typically diagnosed and staged tomography with radiolabeled fluorodeoxyglucose, or

[18F]FDG-PET. The use of radioactive isotopes prevents its serial use in staging cancer



using positron emission Figure 2.8: (top) Metabolism of [2H7]glucose, with red dots marking the presence of <sup>2</sup>H, and larger dots indicating two <sup>2</sup>H atoms. HDO can be produced at multiple steps in the glycolytic pathway. Some enzymes promote exchange as opposed to one way flux, which amplifies HDO production; (bottom, left) <sup>1</sup>H NMR spectra showing the production of deuterated lactate as detected in the <sup>1</sup>H spectrum; (bottom, right) <sup>2</sup>H NMR spectrum showing glucose consumption, <sup>2</sup>H-lactate production, and HDO production.

progression or in the pediatric population. Magnetic resonance imaging (MRI) is not often recognized as a metabolically sensitive technique, but with the addition of stable isotopes, like deuterium, the chemical selectivity of MR allows for quantitative assessment of metabolic flux, important to distinguishing cancerous cells and understanding cancer progression.

We cultured cells in media containing [<sup>2</sup>H<sub>7</sub>]glucose to compare metabolism in healthy liver hepatocytes and a hepato-carcinoma cell line (HUH-7). Figure 2.8 (top) shows the metabolic pathways in glycolysis that produce deuterated water (HDO). Using <sup>1</sup>H (bottom-left) and <sup>2</sup>H (bottom-right) NMR spectroscopy we monitored the production of deuterated lactate and HDO from the glucose. The signal from natural abundance HDO is observed at the beginning of the experiment with the signal increasing as deuterated glucose is consumed. [2H7]glucose metabolism produces at least twice the number of <sup>2</sup>H spins for detection compared to a [6,6-<sup>2</sup>H<sub>2</sub>]glucose tracer previously used in humans. Metabolism can be assessed by imaging the highest intensity peak in the spectrum, offering an optimal signal-to-noise ratio.

This initial data suggests that HDO production could therefore be used as a surrogate for glucose uptake, which is the metric measured in FDG-PET diagnoses of cancer, without exposure to radioactive isotopes.

Assessing Lipid Synthesis with <sup>2</sup>H Magnetic Resonance in a Model of Non-Alcoholic Fatty Liver Disease (NAFLD)

M.S. Muyyarikkandy<sup>1</sup>, M. McLeod<sup>2</sup>, M. Maguire<sup>1</sup>, R. Mahar<sup>2</sup>, N. Kattapuram<sup>1</sup>, C. Zhang<sup>1</sup>, C. Surugihalli<sup>1</sup>,

V. Muralidan<sup>1</sup>, K. Vavilikolanu<sup>1</sup>, C.E. Mathews<sup>2</sup>, M.E. Merritt<sup>2</sup>, and N.E. Sunny<sup>1</sup>

<sup>1</sup> University of Maryland, College Park, MD; <sup>2</sup> University of Florida, Gainesville, FL

Funding: G.S. Boebinger (NSF DMR-1644779); N. Sunny and M.E. Merritt (NIH R01DK112865)

Muyyarikkandy MS, McLeod M, Maguire M, et al. Branched chain amino acids and carbohydrate restriction exacerbate ketogenesis and hepatic mitochondrial oxidative dysfunction during NAFLD. The FASEB Journal. 2020;00:1–18. <u>https://doi.org/10.1096/fj.202001495R</u>

Non-alcoholic Fatty Liver Disease (NAFLD) is a metabolic dysregulation of fatty acid synthesis and oxidation that leads to lipid accumulation in the liver. NAFLD is a burgeoning world health issue, with a current estimate of 25% incidence in the USA. Initial stage NAFLD is innocuous, but in

a sub-population of ~10%, it can progress from simple steatosis to non-alcoholic steatohepatitis, which can lead to liver failure and the need for transplant.

Prior work focused primarily on the metabolic effects of increasing levels of circulating fatty acids on the accumulation of hepatic lipid stores. Here, we further examine the effect of a ketogenic diet on de novo lipogenesis (DNL) in the liver tissue of mice fed one of three diets: low fat (LF), high fat (HF), or HF plus increased branched-chain amino acids (HF-Kt) diet (as shown in Figure 2.9, top).

The chemical selectivity of deuterium magnetic resonance (DMR) allows detection of site specific <sup>2</sup>H enrichment in liver fats after exposure to 1% D<sub>2</sub>O added to the drinking water for four days. DNL is accurately determined by the enrichment achieved at the methyl position of the fatty acids (labeled a). This methyl peak can only be labeled if the entire fatty acid was synthesized from the

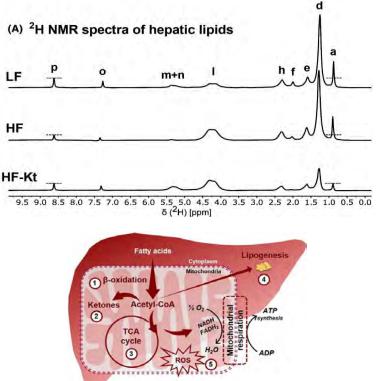


Figure 2.9: (top) DMR spectra of extracted hepatic fatty acids shows that treatment with a ketogenic (HF-Kt) diet slows DNL (peak a) when compared to low fat (LF) and high fat (HF) diets. (bottom) Overall hepatic metabolism is significantly altered by the diet. Despite the beneficial effects on DNL, the HF-Kt diet causes increased reactive oxygen species (ROS) production in the liver. most basic starting element, acetyl-CoA. This data shows addition of a ketogenic diet in the context of high fats significantly slows the DNL process.

Using MR estimates of DNL, as well as mass spectrometry-based estimates of TCA cycle turnover (bottom panel), we can directly assay the changes in central hepatic metabolism. While the HF-Kt diet slows DNL, it also has complicated multi-factorial effects on hepatic energy homeostasis. Future work will develop DMR for in vivo use.

### Facility Plans and Directions

In spite of the COVID pandemic and continued challenging budgetary climate, our users have consistently and successfully pursued federal funding to support their research programs in addition to assisting the AMRIS facility in writing proposals to upgrade instrumentation. The successful partnership of the MagLab user program with individual investigator research grants also provides constant scientific motivation for our technology development. In 2020 we were awarded an NIH grant to upgrade the NMR console on one of our 600 MHz systems; the console will be installed in spring 2021 to enhance our multireceive capabilities. We also began construction of Low-E MAS probes at 800MHz to enhance our high field capabilities. Through our NIH P41 technology development grant we are constructing a next-generation HTS cryoprobe that we anticipate will be available to users by the end of 2021.

#### Outreach to Generate New Proposals-Progress on STEM and Building User Community

As a result of the COVID pandemic, most of the typical AMRIS outreach venues for 2020 were inaccessible due to restricted access for anyone immediately outside the bubble of essential staff. These restrictions were in place in Gainesville starting March 13 through year end. Online outreach was possible for locations where employees were approved to return to their worksites starting in June, provided individuals could comply with all masking and distancing requirements. Although our outreach numbers were reduced by 2/3 of their normal values due to the COVID pandemic, we were still able to reach more than 875 individuals at 13 locations throughout the year. If there is a positive impact we can take away from this pandemic, it made us realize just how well virtual platforms can help us to expand our outreach and user programs beyond those individuals in our immediate travel area.

Prior to the shutdown period, our AMRIS Research and Outreach Coordinator, Amy Howe, visited 23 classrooms at five schools within a 60-mile radius of Gainesville, reaching 379 students with in-classroom, hands-on education about magnets and the scientific method. All these local schools were classified as Title 1 schools for 2020, so our events were able to reach a diverse population of students. Other Alachua County Schools' events, such as the carnivals, science career nights, and STEM/STEAM family events, were cancelled following the COVID shutdown. Therefore, we did not have our normal opportunities to converse with greater numbers of K-12 students and family members.

Tours of the AMRIS Facility were also extremely limited, since news of the potential pandemic began to spread as early as mid-January 2020. Prior to the official policies restricting visitor access, we were able to accommodate four local high school students for a tour with AMRIS-affiliate Glenn Walter, offered as part of the Florida Regional Junior Science, Engineering, and Humanities Symposium (JSEHS). We also had 21 undergraduate biochemistry students in three groups tour the facility in early February, as organized through Director Joanna Long and our staff members Huadong Zeng and James Collins. Unfortunately, their school semester was pushed online less than one month later, so these students were not able to return for in-person use of our magnet systems; these facility access restrictions remained in effect throughout the remainder of calendar year 2020. Some of these students may have been approved for on-site research projects, but they were not tracked as part of our outreach activities.

Also in February, we hosted an exhibit booth at the Biophysical Society annual conference event in San Diego, CA, where Amy Howe was able to speak with approximately 200 undergraduate, graduates, and professional members, specifically those interested in high magnetic fields and magnetic resonance research. Back in Gainesville, staff scientists James Collins and Jim Rocca, along with facility engineer Malathy Elumalai, hosted an exhibit booth at the UF College of Medicine Research Poster Showcase, where they spoke with approximately 50 undergraduates who were there to present their research projects; the attendance at this event was less than half of that for previous years, likely due to the increasing concerns regarding COVID spread within the state of Florida.

Because of COVID, we were unable to hold the Women in Science and Engineering (WiSE) Girls Spring Break Camp, which would otherwise have been a week long day-camp that brings middle school girls from the surrounding Alachua County to the University of Florida to learn about a variety of different science careers through hands-on activities. AMRIS typically hosts these girls for one day during that week but was unable to do so when all in-person activities on campus were cancelled starting in March.

We also cancelled our very popular, in-person RF Coil Building Workshop at the AMRIS Facility. Normally, five participants travel here for a 5-day activity course to learn the physics behind MRI, RF coil theory, and how to build MRI RF coils. We developed video modules that will be used to hold this workshop as an online tutorial session in 2021; these videos will continue to be updated and used as preparatory modules for future workshop participants, assuming that this will return to an in person event as soon as visitor policies allow us to do so. Our summer 2020 REU program was similarly cancelled.

As we adapted to the pandemic, we pursued virtual outreach methods and videoconferencing. A 5-minute video tour was posted onto our facility website to reach visitors who could not travel to the facility. AMRIS and HBT collaborated to hold a "Quantum Spin Coherence Workshop" just prior to the MagLab 2020 Users Committee Meeting, during which we debuted our facility tour video and taught a group of 160 graduate students, postdocs, and professionals about quantum spin techniques. Throughout the summer and fall, staff hosted several short, informal tutorial and training sessions for new users introducing them to NMR and covering biomolecular NMR techniques and practices. These sessions ranged from 2-4 hours and enabled students to work in real time on operating the instruments and collecting data. School outreach activities in Fall 2020 resumed via virtual workshops. Amy Howe delivered classroom material kits for her magnet demos that could be sterilized between uses. She worked with the schools to offer interactive outreach to an additional 67 students in 4 classrooms through Zoom sessions. This method of contact is likely to continue beyond 2020, as an outreach option for students in physically remote or health-sensitive situations that would otherwise restrict visitor access.

### Facility Operations Schedule

The AMRIS facility normally operates year-round, except during the last week of December when the University of Florida is shut down. Vertical instruments for *ex vivo* samples are scheduled 24/7, including holidays and weekends. Horizontal instruments operate primarily 8-12hrs/day, 5days/week due to the difficulty in running animal or human studies overnight. Due to the COVID pandemic, the University was closed from March 23 through June 1 to everyone except essential personnel for mandatory maintenance procedures. Beginning in late May, COVID testing was made available for faculty, students, and staff applying to return to work on campus. A slow ramp up of on campus operations proceeded throughout the fall. Due to AMRIS staff being classified as essential personnel and their ability to operate instruments remotely, NMR operations were able to continue at ~80-90% of our normal levels. All experiments involving animal or human subjects

were on hold from March until July. Operations the remainder of the year were at  $\sim$ 50% of our normal levels. No external user travel to our facility was allowed the remainder of the year.

# 2. DC Field Facility

The DC Field Facility in Tallahassee serves a large and diverse user community by providing continuously variable magnetic fields in a range and quality unmatched anywhere in the world. The DC Field user community is made up of undergraduate students, graduate students, post docs and senior investigators from around the United States, and the world. State-of-the-art instrumentation is developed and coupled to these magnets through the efforts of our expert scientific and technical staff. The users of the DC Field Facility are supported throughout their visit by the scientific, technical and administrative staff to ensure that their visit is as productive as possible. The interaction between the MagLab scientific and technical staff with the students, post docs and senior investigators who come to the DC Field Facility to perform their research results in a continuous mix of scientific ideas and advanced techniques that are passed both to and from users.

### Unique Aspects of Instrumentation Capabilities Table 2.5: DC Field Magnets

| FLORIDA-BITTER and HYBRID MAGNETS                                                                          |                            |                                                                                                                                                                                             |  |
|------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Field, Bore, (Homogeneity)                                                                                 | Power (MW)                 | Supported Research                                                                                                                                                                          |  |
| 45T, <b>32mm, (25ppm/mm)</b><br>41.5T, <b>32mm, (25ppm/mm)</b><br>36T, <b>40mm, (1ppm/mm)</b> <sup>2</sup> | 30.4<br>32<br>14           | Magneto-optics – ultra-violet through fa<br>infrared; Magnetization; Specific heat;<br>Transport – DC to microwaves;<br>Magnetostriction; High Pressure;<br>Temperatures from 3mK to 1500K; |  |
| 35T, <b>32mm (x2)</b><br>31T, <b>32mm to 50mm<sup>1</sup> (x2)</b>                                         | 19.2<br>18.4               | Dependence of optical and transport<br>properties on field, orientation, etc.;<br>Materials processing; Wire, cable, and                                                                    |  |
| 25T, <b>32</b> mm bore (with optical access ports) <sup>3</sup>                                            | 27                         | coil testing. NMR, EMR, and sub/millimeter wave spectroscopy.                                                                                                                               |  |
| SUPERCONDUCTING MAGNETS                                                                                    |                            |                                                                                                                                                                                             |  |
| Field (T), Bore (mm)                                                                                       | Sample<br>Temperature      | Supported Research                                                                                                                                                                          |  |
| 32T, <b>34</b> mm                                                                                          | 14mK – 300K                | Magneto-optics – ultra-violet through far<br>infrared, Magnetization, Specific heat,                                                                                                        |  |
| 18/20T, <b>52</b> mm<br>18/20T, <b>52</b> mm                                                               | 20mK – 1K<br>0.3K – 300K   | Transport – DC to microwaves,<br>Magnetostriction; High pressure,<br>Temperatures from 20mK to 300K,                                                                                        |  |
| 17.5T, <b>47</b> mm                                                                                        | 4K – 300K                  | Dependence of optical and transport<br>properties on field, orientation, etc. Low                                                                                                           |  |
| 10T, <b>34</b> mm <sup>3</sup><br>9⊺, <b>25</b> mm <sup>4</sup>                                            | 0.3K – 300K<br>2.0K – 325K | to medium resolution NMR, EMR, and sub/millimeter wave spectroscopy.                                                                                                                        |  |
| 7T, <b>7</b> mm <sup>4</sup>                                                                               | 2.0K – 325K                |                                                                                                                                                                                             |  |

<sup>1</sup> A coil for modulating the magnetic field and a coil for superimposing a gradient on the center portion of the main field are wound on 32mm bore tubes.

- $^{\rm 2}\,{\rm Higher}$  homogeneity magnet for magnetic resonance measurements.
- <sup>3</sup> Optical ports at field center with 4 ports each 11.4° vertical x 45° horizontal taken off of a 5mm sample space.
- $^{4}$  Quantum Design PPMS and MPMS user "on-ramp" magnet systems.

Table 2.5 lists the magnets in the DC Field Facility. The MagLab leads the world in available continuous magnetic field strength, number of high field DC magnets available to users and accessibility for scientific research. The 45T hybrid magnet is the highest field DC magnet in the world, which is reflected in the number of proposals from Pls located internationally. The 41.5T resistive magnet is the highest field resistive magnet in the world. The 36T Series Connected hybrid magnet features two configurations: a 40mm bore, with 1ppm homogeneity for chem/bio NMR experiments and a 48mm bore with 20ppm homogeneity for condensed matter physics experiments in a top-loading cryogenic system. The 35T, 32mm bore and 31T, 50mm bore resistive magnets are coupled to top loading cryogenic systems that have impressive performance, flexibility and ease of use. The 25T Split-Helix magnet is the highest field direct optical access / scattering magnet in the world. With 4 optical ports located at field center each having a 11.4° vertical x 45° horizontal taken off of a 5mm opening, the ability to perform ultrafast, time resolved and x-ray scattering experiments are now a reality at high magnetic fields. The 32T, 34mm bore all-superconducting magnet saw its first use by an external user in 2020 for condensed matter NMR experiments on a quantum spin-nematic compound.

# Facility Developments and Enhancements

## Progress on Power Supply Upgrade Project

In spite of the COVID laboratory shutdown MagLab electrical engineers and scientific staff were able to make significant progress on the power supply upgrade project during the several months when remote work was the only option. When the lab was able to bring a limited number of staff back the design and drawings for the prototype MOSFET bank test rig were submitted to the machine shop and assembly of the completed parts began in late fall. This prototype test bank, shown in Figure 2.10, allows our engineers and scientists to test a single bank of MOSFET modules with granular detail. This is done to



Figure 2.10: MOSFET bank testing setup.

validate calculations and simulations of power output, response to control signals, thermal transfer and heat sink performance, frequency response and noise levels.

### **Communications Carts**

The COVID pandemic forced the DC Field Facility to make a number of changes to how we operate. One of the biggest changes is enabling users to run their high field experiments while remaining at their home institutions. Prior to the pandemic, research groups would travel to the MagLab for experiments as this is the optimum way to ensure measurements proceed as expected and address issues with sample preparation as they arise. Additionally, the students and postdocs gain valuable experience in experimental techniques during their time at the MagLab. In order to continue a partial level of user operations, during COVID travel restrictions, Alexey Suslov put together a combination of equipment and software that would give users audio and video access to a magnet cell during the experiment with the hands-on work performed by MagLab scientists and technicians. These carts, Figure 2.11, consist of a computer + monitor, two

high-definition cameras with pan, tilt and zoom functionality and a low power Bluetooth headset that allows the MagLab staff handsfree communication as they are working with the users during magnet time. The prototype cart very quickly became an indispensable part of experimental setups, and two additional carts were built and placed into service. We anticipate the communication carts to remain useful in the future as they can be used by Pls and members of the research group that do not travel to the MagLab for experiments.

32T Superconducting Magnet (SCM-32T) sees its first user experiment.

The 32T all-superconducting magnet was used for condensed matter NMR experiments on the potential quantum spin-nematic compound  $\beta$ -TeVO<sub>4</sub>. This material was chosen since an initial set of data had previously been collected in the 36T series connected hybrid (SCH) which allowed the users to fill in gaps in the data taken in the SCH and MagLab scientists were able to compare the performance of the 32T magnet to the SCH. The 32T all-superconducting magnet performed well and the data



Figure 2.11: Remote participation communication cart.

taken, Figure 2.12, matched with and was complementary to the prior work done in the SCH. Due to travel restrictions resulting from the COVID pandemic, the experiment was performed by MagLab scientists Arneil Reyes and Liz Green with remote participation from National Institute of Chemical Physics and Biophysics, Estonia by the user, Raivo Stern.

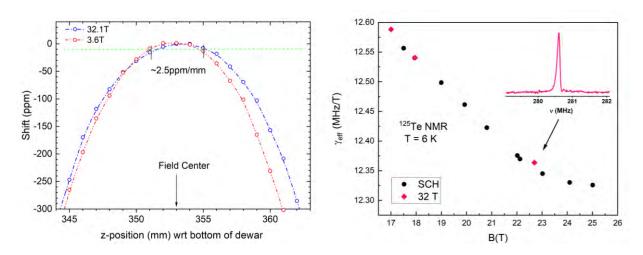


Figure 2.12: (Left) Magnet field profile in the z-axis at 32.1T and 3.6T by use of 63Cu NMR. (Right) 125Te spectral line and effective gamma with respect to magnetic field. Black circles are from the 36T Series Connected Hybrid while the pink diamonds are from the 32T.

### Major Research Activities and Discoveries/ Research Highlights

The scientific directions taken by the users of the DC Field Facility touched on several topics in condensed matter physics, materials science, chemistry and biology in 2020.

Non-magnetic aromatic molecules which form molecular solenoids in high fields were studied in the 25T Split-Helix magnet. Through the use of ultrafast spectroscopy users from Princeton University

discovered that aggregates of aromatic chromophores can act as molecular solenoids, Figure 2.13, that enhance or quench observed magnetic field effects. Currents of several nanoamperes were shown to be induced in the aromatic light. This research opens a window into a new realm of potential materials that could be utilized for multifunctional magnetic technologies. This work was published in the Proceedings of the National Academies of Science.

The exploration of a topological semimetal in high magnetic fields by determining the electron-electron interactions in SrZnSb<sub>2</sub> was accomplished through the mapping of the Fermi surface in high magnetic fields. The work by users from the University of California utilized one of the DC Field Facility's 35T resistive magnets coupled with an advanced cryogenic system and piezo

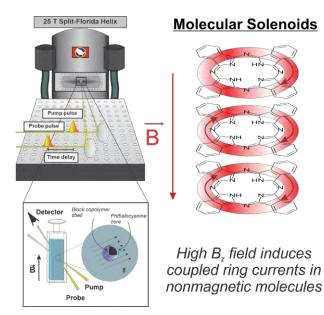
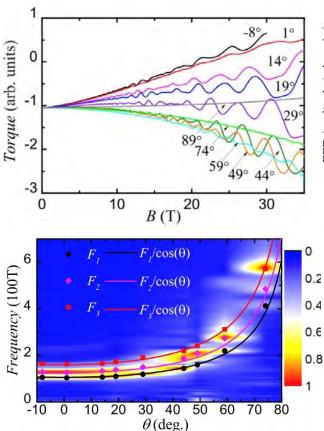


Figure 2.13: Schematic of experimental setup and induced currents in molecular rings.

cantilever to measure the magnetization of the material via torque. Results from some of the measurements are shown in Figure 2.14. Two of the four observed orbits were found to be topologically non-trivial with the most likely explanation being that the charge carriers in these



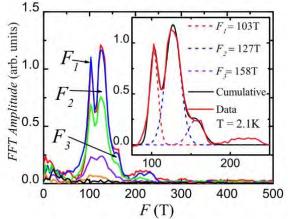


Figure 2.14: a) Raw quantum oscillation data as
a function of angle. b) Fast Fourier transform of raw data at fixed angle showing the
temperature dependence of the electron orbits.
c) Frequency dependence of the electron orbits
as a function of angle.

two orbits are Dirac quasiparticles. Topological semimetals and other topological materials comprise an exciting new area of research in condensed matter physics because they host a variety of quantum mechanical states which are observable on a macroscopic scale and are stable to high temperatures. Thus, topological materials raise the possibility of exploiting quantum mechanics to make devices with new functionalities that work at room temperature. The results of this work were published in *Physical Review B*.

## Facility Plans and Directions

The bank of six secondary chilled water pumps will be replaced during the 2021 annual maintenance shutdown. These pumps circulate the 40F water produced by the chillers through the magnet cooling water heat exchangers. The current pumps have reached the end of their service lifetimes and we will need to be able to supply additional water flow through the magnet cooling water heat exchangers once a second 34MW water-cooled magnet is added. Eight new pumps will be installed and will feature soft-start capability which brings the pump speed up slowly, extending the life of the pump and improving temperature stability of the magnet cooling water loops as the pumps turn on and off depending on the heat load.

Power supply upgrade project. Following successful testing of the 1 and 3-bar MOSFET banks, MagLab Engineers and Scientists will assemble and test a <sup>1</sup>/<sub>4</sub>-power version of a full-size active filter in cell 13. This will allow full-feature testing of all the active filter subsystems as well as the Model 42 power supply controller. The completion of these tests will mark an important milestone in the project as it will fully validate the system design and mark the beginning of the construction phase.

# Outreach to Generate New Proposals-Progress on STEM and Building User Community

Both the DC Field Facility and its users were greatly impacted by the COVID pandemic in 2020. In addition to the shutdown of the MagLab facilities, nearly all of our users' laboratories at their home institutions were shut down for some period of time during 2020. This greatly hindered their ability to take advantage of available magnet time when the DC Field Facility was able to resume operations. This impacted both our current user base and our ability to reach out to potential new users as travel was not possible. Normally we host a booth at the annual APS March Meeting, but due to the unfolding COVID pandemic the March Meeting in Denver was cancelled as were a significant number of other conferences that MagLab staff would normally travel to.

Appendix 2, Table 10, shows the DC Field Facility attracted 20 new PIs in 2020. Of that number 13 were new to the MagLab. This is in addition to the 41 new PIs reported last year (2019) and 51 reported in 2018.

The annual DC Field Facility MagLab User Summer School had to be cancelled due to the lockdown order that was in effect in the early summer and the travel ban which followed. In 2021 we will hold a remote version featuring the lectures and discussions between attendees and staff. We plan to resume hands-on practical exercises and in-person events in 2022.

# Facility Operations Schedule

At the heart of the DC Field Facility are the four 14MW, low noise, DC power supplies. Each 20MW or 28MW resistive magnet requires two power supplies to run, the 45T hybrid and the 41.5T resistive magnets each require three power supplies, and the 36T Series Connected Hybrid requires one power supply. Thus, the DC Field Facility operates in the following manner: in a given week there can be four resistive magnets + five superconducting magnets operating or the 45T hybrid/41.5T resistive, series connected hybrid, two resistive magnets and five superconducting magnets. The water-cooled DC resistive and hybrid magnets operated for 28 weeks in 2020 with a 5-week shutdown for infrastructure maintenance and upgrades from November 16 to December 20 and a 1-week shutdown period for the university mandated holiday break from December 21, 2020 to

January 4, 2021. The five superconducting magnets operated for 43 weeks out of the year with staggered maintenance periods as required. The daily operation schedule for the resistive and hybrid magnets is as follows: 7 hours/day on Monday and 21 hours/day Tuesday-Friday. The superconducting magnets operate 24 hours/day 7 days/week.

The effects of the COVID pandemic resulted in a shutdown of the superconducting and watercooled magnets from April 6 until June 1 when limited superconducting magnet operations were restarted with a limited personnel presence. The week of July 20 limited water-cooled magnet operations were started, and full superconducting and 50% water-cooled magnet operations were commenced on July 27. This coincided with our ability to populate the facility with 50% of our normal workforce.

# 3. EMR Facility

Electron Magnetic Resonance (EMR) covers a variety of magnetic resonance techniques associated with the electron. The most widely employed is Electron Paramagnetic/Spin Resonance (EPR/ESR), which can be performed on anything that contains unpaired electron spins. EPR/ESR has thus proven to be an indispensable tool in a large range of applications in physics, materials science, chemistry, and biology, including studies of impurity states, molecular clusters, molecular magnets; antiferromagnetic/ferromagnetic compounds in bulk, as well as thin films and nanoparticles; natural or induced radicals, optically excited paramagnetic states, electron spin-based quantum information devices; transition-metal based catalysts; and for structural and dynamical studies of metalloproteins, spin-labeled proteins, and other complex biomolecules and their synthetic models.

### Unique Aspects of Instrumentation Capabilities

The EMR facility at the MagLab offers users several home-built, high-field, and multi-high-frequency instruments covering the continuous frequency range from 9GHz to ~1THz. Several transmission probes are available for continuous-wave (CW) measurements, which are compatible with a range of magnets at the Lab, including the highest field 45T hybrid. Some of the probes can be configured with resonant cavities, providing enhanced sensitivity as well as options for *in-situ* rotation of single-crystal samples in the magnetic field, and the simultaneous application of pressure (up to ~3GPa). Quasi-optical (QO) reflection spectrometers are also available in combination with high-resolution 12 and 17T superconducting magnet systems; a simple QO spectrometer has also been developed for use in the resistive and hybrid magnets (up to 45T). EMR staff members can assist users in the DC field facility using broadband tunable homodyne and heterodyne spectrometers as well. Moreover, frequency coverage up to ~180THz (6,000cm<sup>-1</sup>) is now possible through collaboration with staff in the DC field facility using broadband Fourier transform infrared spectrometers to acquire EPR spectra in the frequency domain – so-called far-infrared magneto-spectroscopy (FIRMS).

In addition to CW capabilities, the MagLab EMR group boasts the highest frequency pulsed EPR spectrometer in the world, operating at 120, 240, 336GHz, and now 316 and 395GHz with < 100ns time resolution. A quasi-optical 94GHz spectrometer (HiPER) with 1ns time resolution was recently upgraded for high power (1kW) operation. A commercial Bruker Elexsys 680 operating at 9/94GHz (X-/W-band) is also available upon request. This unique combination of CW and pulsed instruments may be used for a large range of applications in addition to EPR, including the study of optical conductivity, electron cyclotron resonance and Dynamic Nuclear Polarization.

Finally, the EMR group collaborates with the NMR program in developing instrumentation for high-field DNP-enhanced NMR studies of solids and solution samples at fields up to 14.11. The centerpiece of this installation is a quasi-optical EPR spectrometer based on a 395GHz high-power CW gyrotron source.

### Facility Developments and Enhancements

The pandemic inevitably curtailed efforts directed towards facility enhancements during 2020. One of the main casualties was the planned development and testing of a 970GHz / 36T EPR setup for use in the Series Connected Hybrid (SCH) resonance magnet. These efforts have been set back by about a year, with further delays anticipated due to the backlog of magnet time requests to the DC facility in 2021. As of May 2021, development of the new capability has been completed, and we hope to test the system towards the end of 2021 or early in 2022.

One project that was not significantly affected by the pandemic was the integration of an arbitrary waveform generator (AWG) capability and upgrade of the user interface on HiPER. Software development for the user interface was contracted out to Femi Instruments, LLC, a company specializing in the development of standardized user interfaces for EPR spectrometers,

and the work was performed in collaboration with two postdocs in the EMR group, Jonathan (Jon) Marbey and Krishnendu (Krish) Kundu. Apart from about six weeks in March and April, Krish and Jon were able to work unimpeded on HiPER through much of 2020, practicing social distancing by alternating tasks, which included running user experiments in parallel with development and testing. The main goal of this upgrade involves replacing the original pulse generating front-end of the spectrometer with a completely separate and independent multiplier chain fed by a Keysight 12 bit, 12GSa/s AWG. As of May 2021, the integration and software development has been completed and is now ready for user operations.

The new AWG capability on HiPER enables generation of arbitrary shaped high-power waveforms, including chirped pulses spanning a 1GHz (94.0±0.5GHz) bandwidth, enabling wideband excitation and implementation of state-of-the-art pulse schemes, e.g., chirp echo Fourier transform EPR, akin to what is possible in NMR. Initial demonstrations of these new capabilities were presented at the International Magnetic Resonance Conference on Methods and Applications (ICONS-Discussions, 2021), February 10-12, 2021.

The hiring of postdoc Marcus Giansiracusa, as planned in the Facility Plans section of our 2019 report, was unfortunately delayed and ultimately canceled due to COVID; His travel from the UK and eventual appointment proved impossible. Fortunately, Jonathan Marbey completed his graduate studies in April 2020, and he was immediately appointed as an EMR postdoc. In this capacity, he was able to fulfill many of the duties that would have been assigned to Marcus. This also provided employment to Dr. Marbey at a time when securing a postdoc elsewhere would have been impossible (see further details below). Jon recently moved on to a new postdoctoral position at the Laboratory for Physical Sciences at the University of Maryland.

### Major Research Activities and Discoveries

43 peer-reviewed journal articles were reported by our users during the past year, up from 29 the previous year, which was impacted by disruption in operations due to construction in the EMR lab during 2018 and 2019. As usual, the quality of publications in 2020 was exceptionally high, including articles in the following journals: Science (1); Nature Chemistry (1); J. Am. Chem. Soc. (3); Angew. Chem. (1); Chem. Sci. (1); Phys. Rev. Lett. (2); J. Phys. Chem. Lett. (1); Chem. Comm. (1); Inorg. Chem. (10); Dalton Trans. (1); Physical Review (3); J. Phys. Chem. C (1); and Inorganic Chemistry Frontiers (2). Projects in the facility spanned a range of disciplines, from applied materials research to studies of proteins.

The EMR Program has also continued to support efforts associated with several major centertype research initiatives and international collaborations involving multiple universities. These include: the DOE funded Energy Frontier Research Center for Molecular Magnetic Quantum Materials (M<sup>2</sup>QM) based at the University of Florida (PI and Director – Hai-Ping Cheng; Associate Director – Stephen Hill), with co-PIs at the University of Central Florida, Florida State University, UTEP, Caltech and Los Alamos National Laboratory; an AFOSR funded Multidisciplinary University Research Initiative focusing on Terahertz Electronics Based on Antiferromagnets, headquartered at the University of Central Florida (PI – Enrique del Barco), with co-PIs at New York University, Oakland University, The Ohio State University, UC Riverside and UC Santa Cruz; and an AFOSR funded international network focusing on Molecular Quantum Technologies involving Florida State university, the University of Modena and Reggio Emilia in Italy, and Osaka City University in Japan. In particular, M<sup>2</sup>QM supports an EMR postdoc, Daphne Lubert-Perquel, and two graduate students working in the EMR group.

The EMR Director also successfully applied to the NSF during 2020 for funding to support a trilateral international collaboration involving FSU, University College Dublin in Ireland (Professor Grace Morgan), and Queens University Belfast in Northern Ireland (Professor Steven Bell). This threeyear project, entitled Molecular Magnetoelectric Materials, will support joint research activities and exchanges of personnel. We have selected three 2020 scientific achievements to highlight in the next section of this report. The highlighted work, published in Angewandte Chemie, Science and the Journal of the American Chemical Society, involved a truly international mix of users from Bordeaux (France), Sun Yat-Sen University (China), the Technical University of Denmark, the University of Basque Country (Spain), IIS Bangalore (India), UC Berkeley, the University of Central Florida, UC Santa Cruz, UC Riverside, the Norwegian University of Science and Technology, Northeastern University (China), Max Planck Institute for Coal Research and the Bulgarian Academy of Sciences.

### **Research Highlights**

High-Field EPR Studies of Anisotropic Molecular Magnetic Building Blocks: The fundamental coordination chemistry of 4d and 5d transition metal ions remains much less explored and underdeveloped in comparison to the lighter 3d congeners. However, recent results showing the promise of heavier transition metal ions in advanced inorganic and molecule-based materials has sparked interest in engineering their physical properties, notably their magnetic anisotropy.

This study reports the first transition metal complexes featuring mixed fluorido-cyanido ligands,  $trans-[M^{IV}F_4(CN)_2]^2$  (M = Re, Os), which were isolated thanks to a novel synthetic

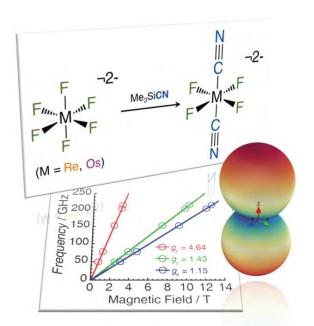


Figure 2.15. (top) Schematic illustrating the novel silicon-mediated fluoride abstraction method, resulting in *trans*- $[M^{IV}F_4(CN)_2]^2$ . (lower left) Frequency vs. field plot of HF-EPR peak positions from which the anisotropic Landé *g*-tensor (lower-right) can be deduced for the M = Re<sup>IV</sup> spin S =  $3/_2$  compound.

approach relying on silicon-mediated fluoride abstraction (see Figure 2.15 – top). A strong and significant enhancement of the magnetic anisotropy for the Re<sup>IV</sup> complex, as compared to the parent [ReF<sub>6</sub>]<sup>2–</sup> anion, is demonstrated by combined analysis of high-field electron paramagnetic resonance (HF-EPR) spectroscopy (see lower part of Figure 2.15) and magnetization measurements.

This ligand field engineering methodology paves the way toward the realization of new transition metal complexes and building-blocks featuring extremely strong magnetic anisotropy for the design of high-performance moleculebased magnetic materials.

This work research was led by researchers at the University of Bordeaux in France, in collaboration with scientists at Sun Yat-Sen University (China), the Technical University of Denmark, the University of Basque Country (Spain), IIS Bangalore (India), UC Berkeley.

Citation: J.-L. Liu, K.S. Pedersen, S.M. Greer, A. Mondal, S. Hill, F. Wilhelm, A. Rogalev, A. Tressaud, E. Durand, J.R. Long, R. Clérac, Access to Heteroleptic Fluorido-Cyanido Complexes with a Large Magnetic Anisotropy via Fluoride Abstraction, Angew. Chem. 59, 10306 – 10310 (2020); DOI: 10.1002/anie.201914934

High-Field Spin-Charge Interconversion at sub-Terahertz Frequencies: Injection of spin currents into a ferromagnetic material can induce spin dynamics that can be employed to control its magnetic state, allowing spintronics operations at gigahertz frequencies. The reciprocal effect, spin pumping, converts magnetization dynamics into spin currents in an adjacent material. Both effects have been used interchangeably to advance the field of spintronics.

In this study, the dynamical generation of spin currents using an antiferromagnetic material has been demonstrated for the first time, enabling spin pumping at sub-terahertz frequencies – more than two orders of magnitude faster than ferromagnetic spintronics devices. The unique

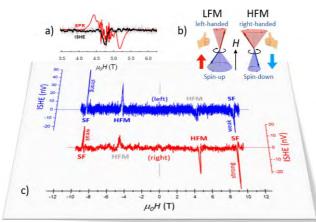


Figure 2.16 (a) Spectroscopic (EPR) and electrical (Inverse spin Hall effect - ISHE) signals measured in a thinfilm heterostructure composed of an antiferromagnet (MnF<sub>2</sub>) and a heavy metal (Pt) using right-handed circularly polarized electromagnetic waves at a frequency of 0.4THz. (b) Illustration of the two main chiral modes of the uniaxial antiferromagnet MnF2. (c) Side-byside comparison of the electrical signals observed for different circular polarization handiness (right and left) of the electromagnetic waves. The high-frequency (HFM) antiferromagnetic mode can right-handed be selectively induced by changing the handedness of the circularly polarized electromagnetic waves or the polarity of the applied magnetic field.

spectrometers available in the EMR facility at the MagLab were essential for this work since the typical spin dynamics of antiferromagnets lie in the terahertz range (see Figure 2.16), while magnetic tuning of these dynamics within antiferromagnetic ordered phases requires high magnetic fields.

The demonstration of coherent subterahertz spin pumping using antiferromagnets opens the door to devices operating at frequencies that are two to three orders of magnitude higher than current spintronics technologies, with broader impacts in a diverse range of applications, from magnetic recording to medicine and communications.

This work was led by researchers at the University of Central Florida, in collaboration with scientists at UC Santa Cruz, UC Riverside, the Norwegian University of Science and Technology, Northeastern University (China).

Citation: P. Vaidya, S. A. Morley, J. van Tol, Y. Liu, R. Cheng, A. Brataas, D. Lederman, and E. del Barco, Subterahertz spin pumping from an insulating antiferromagnet, Science 368, 160 – 165 (2020).

Strong Magnetic Coupling in Ni<sub>4</sub> Clusters through Direct Metal-Metal Bonds: Magnetic molecules that retain their magnetization below a characteristic blocking temperature  $(T_B)$  – so-called single-molecule magnets (SMMs) – are of great interest for future information storage technologies. Prior attempts at coupling multiple anisotropic magnetic ions have involved weak superexchange interactions mediated via non-magnetic bridging atoms. This study demonstrates direct metal-metal orbital overlap in a series of M<sub>4</sub> (M = Ni, Cu) clusters, resulting in itinerant electron magnetism similar to metallic ferromagnets.

High-field electron paramagnetic resonance (HFEPR) measurements were performed on neutral and cationic forms of  $[Ni_4(NP^{\dagger}Bu_3)_4]^{0/+}$  ( $^{\dagger}Bu = tert$ -butyl, see Figure 2.17 below) in order to accurately ascertain the spin ground states and interaction parameters associated with these new SMMs. High-fields and frequencies were essential due to very large spectral splittings resulting from strong magnetic anisotropy.

The combination of HFEPR and magnetic data with correlated electronic structure calculations provides fundamental insights into the electronic itinerancy and strong ferromagnetic coupling in molecules featuring direct metal-metal orbital overlap. As such, these investigations suggest new strategies for designing SMMs with strongly coupled giant spin ground states and enhanced blocking temperatures.

This work was led by researchers at the University of California, Berkeley, in collaboration with scientists at Max Planck Institute for Coal Research and the Bulgarian Academy of Sciences.

Citation: K. Chakarawet, M. Atanasov, J. Marbey, P. C. Bunting, F. Neese, S. Hill, J. R. Long, Strong Electronic and Magnetic Coupling in  $M_4$  (M = Ni, Cu) Clusters via Direct Orbital Interactions Between Low-Coordinate Metal Centers, J. Am. Chem. Soc. 142, 19161 – 19169 (2020); DOI: 10.1021/jacs.0c08460

# Facility Plans and Directions

Our 2021 plans involve two new hires. The first will permanently fill the Visiting Research Faculty position currently occupied by Thierry Dubroca. This position will support ongoing collaborative efforts between the EMR and NMR groups in support of a highfield Dynamic Nuclear Polarization user program. The position will be advertised during the summer, with a start date in

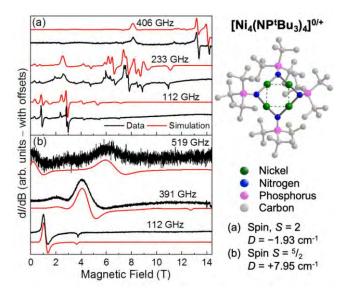


Figure 2.17: (Left) Multi-frequency, derivative-mode (dl/dB, where *I* is transmitted intensity) HFEPR spectra for powder samples of (a) neutral and (b) cationic [Ni<sub>4</sub>(NP<sup>t</sup>Bu<sub>3</sub>)<sub>4</sub>]<sup>0/+</sup>; spectral simulations are included with the experimental data. (Right) Molecular structure along with the deduced spin states and axial zero-field splitting parameters, *D*, a measure of the associated magnetic anisotropy.

the early fall. In addition, a postdoctoral position supported on an external grant will also be filled in July 2021, by Dr. Elvin Salerno. Dr. Salerno completed his PhD as an NSF Fellow at the University of Michigan with Prof. Vincent Pecoraro. He also recently completed an International Chateaubriand Fellowship at Universite Paris-Saclay with MagLab user Talal Mallah.

As noted above, ongoing efforts aimed at commissioning an EPR capability in the 36T highresolution SCH magnet will continue in 2021. This effort is being spearheaded by EMR Engineer, Bianca Trociewitz, together with Research Faculty Jurek Krzystek and Thierry Dubroca. Our current plan involves commencing user operations in the SCH during 2022.

### Outreach to Generate New Proposals-Progress on STEM and Building User Community

In spite of the pandemic, operations continued during 2020, with users sending samples so that measurements could be performed by EMR Staff Scientists. Although recruiting efforts were hampered due to limitations on travel, significant efforts were made to let users know that the MagLab EMR program remained open for business. As can be seen from the Facility Operations Schedule below, spectrometer usage remained strong. Moreover, it was still possible to recruit several new users during the year. The total number of proposals that received magnet time during 2020 was 45 (down from 62 in 2019), of which 8 PIs were first time users, meaning that >20% of our users were new to the program. Meanwhile, the EMR program assisted 121 individual researchers in 2020 (down from 161 in 2019), of which 19 were first time users. Of course, no users visited the facility after March 2020. Prior to this, a PhD student from the University of Copenhagen spent a month at the facility as part of a formal exchange program. This visit was sadly cut short when travel restrictions were put into place.

Members of the EMR group continue to make aggressive efforts to advertise the facility at regional, national, and international workshops and conferences, as well as via seminars at universities around the globe. Most of these activities during 2020 were held virtually, and the EMR

Director gave five virtual presentations in 2020 highlighting the MagLab, with several more in 2021. These presentations gave particular emphasis on the fact that users could send samples.

Members of the EMR group also served on the organizing committees for the following events: the pre-pandemic Conference on Magnetism in North America (MAGNA) held at St. Simons Island, Feb. 21 – 24, 2020; the 2020 International Conference on Molecule-based Magnets (ICMM), organized by the University of Manchester, UK, which will now be held virtually in June 2021; the 2020 Pacifichem conference in Honolulu, Hawaii, which has been delayed until December 2021; and the 2020/2021 Rocky Mountain Conferences on Magnetic Resonance, which were eventually cancelled.

Finally, the EMR Director has been very active in assisting current and potential future users in the development of research proposals to US (and overseas) funding agencies, for continued support of activities requiring use of the MagLab EMR facilities. These efforts have been particularly intensive during the past year due to the strong emphasis on quantum sciences, an area of intense activity for many EMR users. Some of these activities have the potential to support MagLab EMR personnel and can also be expected to bring many new users to the facility.

## Facility Operations Schedule

As noted elsewhere in this report, operations in the EMR program were obviously impacted due to the pandemic during 2020. However, overall activity was maintained at roughly 75% compared to recent years through users sending their samples for measurement by MagLab EMR staff and students. In order to handle the increased volume and frequency of sample shipments, several new cryogenic shipping dewars were purchased in order to handle the increasing number of sensitive samples under study by EMR users. This enabled multiple users to ship samples during a given timeframe, for parallel study on different instruments within the facility.

Overall, the EMR user facility was down for about 10 weeks from March to May, with activities ramping up during the summer, reaching close to 100% normal operation in the fall. The workhorse 17T homodyne spectrometer operated for a total of 170 days during 2020, an increase compared to 2019 (135 days) due to the construction that took place in the EMR lab that year. However, it is down from ~300 days in a normal year, i.e., ~60% of normal operation. Meanwhile, the 12.5T heterodyne spectrometer logged 124 days of usage, down from an average of ~180 days in recent years, i.e., usage was about 66% of normal operations.

A total of 238 days was logged on the high-power pulsed 94GHz EPR spectrometer, HiPER, essentially unchanged from 236 days in 2019 and slightly down from the 258 days reported in 2018. This instrument is in a different location from the lab that was impacted by construction in 2020 and operated at close to 100%. It should be noted that 81 days were devoted to testing, maintenance and methods development. However, this is quite typical of a normal year due to the significant methods development associated with this unique, cutting-edge spectrometer. Indeed, significant in-house methods development was included in the plan when integrating HiPER into user operations, as much of the cost of the instrument was covered by funding separate from the MagLab core. Therefore, HiPER essentially operated at normal (100%) capacity during 2020.

The commercial Bruker E680 spectrometer logged 170 days during 2020, down from 234 days in 2019, i.e., 73% of normal usage. While much of the reduction was due to reduced operations at the height of the pandemic, this ageing instrument also suffered a component failure that took time to repair due to the impacts of the pandemic on the vendor. The instrument is shared between the FSU Biology Department and the EMR user program. Only 30% of the machine time was originally designated for the MagLab user program. However, just 53 days were allocated to local users, maintenance and methods development in 2020. Consequently, almost half of a full year (including weekends and holidays) was made available to external users, significantly exceeding the original 30% allocation.

Finally, we note that the Mössbauer instrument was taken out of service in 2018 and is no longer available to users (see 2018 annual report). As a whole, the four instruments offered by the EMR User Program were significantly oversubscribed by ~36% in 2020, i.e., 960 days were requested and only 704 total days allocated.

# 4. High B/T Facility

# Unique Aspects of Instrumentation Capabilities

The High B/T Facility, located on the University of Florida campus, offers users a safe, diverse, and inclusive atmosphere for performing research in high magnetic fields (up to 16.5T) and at ultralow temperatures (down to 0.5mK) with an ultraquiet electromagnetic interference (EMI) environment. The Microkelvin Laboratory, the historic core of the High B/T Facility, is a separate, specially designed and built building with Tempest-quality shielded rooms to specifically afford access to the extremes of ultralow temperatures and high magnetic fields. Two demagnetization cryostats, one employing a  $PrN_5$  + Cu stage while the other uses a pure Cu stage, provide the main access to the unique environments. A third bay, scheduled to open in 2022, is being modernized to provide access to these extremes of parameter space to provide users with a nimble environment required for the study of modern quantum materials and devices.

# Facility Developments and Enhancements

During 2020, and despite the pandemic and its protocols, the High B/T Facility expanded to encompass three separate laboratories, increasing the lab space from 5700ft<sup>2</sup> to almost 9000ft<sup>2</sup>. The High Bay Convergence Laboratory (HBCL) is a new MagLab asset, provided in 2020 by UF to the MagLab's High B/T and AMRIS Facilities (Figure 2.18). The HBCL features ground floor space for siting up to four high-field magnet stations and a 2000ft<sup>2</sup> mezzanine to support student training

and instrumentation development. In 2020, the HBCL was being configured to operate two wide-bore NMR-quality superconducting magnets, an 18.8T, 89mm (800MHz<sup>1</sup>H) magnet, purchased by UF and arriving on site in March 2021 and an existing 9.4T, 89mm (400MHz<sup>1</sup>H) magnet, which was moved to this space in 2020 and was expected to be operating in 2021.

Located in the Physics Building (NPB), the locations for four superconducting magnets are shown, and the 9.4T instrument is in place while the 18.8T magnet is being assembled. The yellow stripes indicate space to be kept clear for delivery, movement, and safety. At the left end of the lab is the high bay region (~28ft x 50ft with a 22ft high ceiling) that is equipped with a 10-ton crane. The rest of the space has a 14ft high ceiling and a mezzanine above to support work benches for student training and instrumentation development.

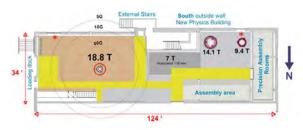


Figure 2.18: MagLab High Bay Convergence Lab (HBCL) at UF. Located in the Physics Building (NPB), the locations for four superconducting magnets are shown, and the 9.4T instrument is in place while the 18.8 T magnet is being assembled. The yellow stripes indicate space to be kept clear for delivery, movement, and safety. At the left end of the lab is the high bay region (~28ft x 50ft with a 22ft high ceiling) that is equipped with a 10-ton crane. The rest of the space has a 14ft high ceiling and a mezzanine above to support work benches for student training and instrumentation development.

In March 2020, a Fast-Turnaround Facility, which was located in Williamson Hall adjacent to the Microkelvin Laboratory, was operating down to 50mK and providing magnetic fields up to 10T. This instrument was available for sample and signal verification tests to confirm the appropriate dynamic range required for the experiment. Due to the pandemic and scheduling constraints, this instrument was closed and is being relocated to the main Physics Building, near the HBCL (Figure 2.19), and revitalized to provide temperatures to below 20mK while in magnetic fields of 10 or 16T, depending on the arrangements still being configured.



Figure 2.19: An August 2020 view of the future location of the Fast-Turnaround Facility in NPB B135. A 10ft deep, 3ft wide floor pit is visible.

# Major Research Activities and Discoveries

Incipient formation of Wigner Crystal in Strongly Interacting Two-dimensional Holes (Richard L.J. Qiu, Chieh-Wen Liu, Xuan P.A. Gao, Case Western Reserve University; Loren N. Pfeiffer and Ken W. West, Princeton University; and Andrew J. Woods, Alessandro Serafin, and Jian-Sheng Xia, MagLab HBT and UF Physics)

In two-dimensional electron systems, the ground state is expected to be an ordered electronic crystal (or Wigner crystal) when the Coulomb repulsion energy is strong enough. Identifying the twodimensional quantum Wigner crystal and understanding how this unique quantum state transitions to the electron liquid phase have been a long-standing challenge in condensed matter

physics. Low density two-dimensional holes in high mobility GaAs quantum wells were used to increase the Coulomb to Fermi energy ratio to 20-30, approaching the theoretical limit of the Wigner Crystal. The sample was measured in the MagLab High B/T facility on a specially designed rotator stage for measurements in a tilted magnetic field at ultra-low temperatures to separately control the perpendicular and parallel magnetic fields to investigate the spin and orbital effects on the interaction driven Wigner crystallization (Figure 2.20). The two-dimensional Wigner Crystal was observed as a reentrant insulating phase (RIP) from magneto-resistance data. The Wigner Crystal transforms gradually through an intermediate state where it mixes with liquid, and spin

polarization is found to enhance the Wigner Crystal formation. This research suggests that twodimensional Wigner Crystal to liquid transition is not a direct first order transition and suggests that intermediate mixture phase formation may be a general aspect of strongly interacting low dimensional systems, providing insights to other quantum phase transitions in many-body electronic systems.

Quantum Fluids in one-dimension: NMR Studies (Huan Chao, Johnny Adams, and Neil Sullivan, MagLab HBT and UF Physics; Donald Candela, University of Massachusetts, Amherst) A novel ultralow temperature NMR experiment has been conducted to observe Luttinger liquid physics in a one-dimensional system consisting of <sup>3</sup>He atoms confined to tubular nanostructured MCM-41. The tubes had characteristic lateral dimensions of 24 Å and were coated with a monolayer of <sup>4</sup>He to further restrict the behavior to one-dimension. The experiment focused on low linear densities near n= 0.1 (Å)<sup>-1</sup> corresponding to a Fermi temperature  $T_F \approx 0.1$ K.

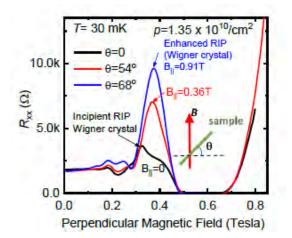


Figure 2.20: For two-dimensional holes not yet crystallized into a Wigner Crystal, a small peak due to the incipient reentrant insulating phase (RIP) is observed in the magneto-resistance data. A parallel magnetic field enhances the RIP and pushes the system towards WC by polarizing the spin.

This quantum regime is known as a "Bose gas" for which unique Luttinger dynamics are predicted with NMR spin lattice relaxation rates varying linearly with temperature. No other simple gas-like system has this property at very low temperatures. The low densities pose a challenge to attain the sensitivity needed at low temperatures and the ultra-quiet environment of the High B/T Facility was critical for this experiment. A unique double-resonance NMR probe (see Figure 2.21) was developed for the experiment and allowed for the study of the dynamics at more than one Larmor frequency. This probe can also be used to study other nuclei added to the sample such as <sup>195</sup>Pt or <sup>63</sup>Cu for thermometry.

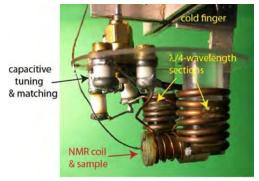


Figure 2.21: Ultra-low temperature doubleresonance probe that was operated on Bay 2 for the study of one-dimensional <sup>3</sup>He.

characteristic feature of the reduced One dimensionality observed at low temperatures was a non-exponential NMR relaxation. This behavior is not unexpected for one-dimensional systems for which general arguments [B. Cowan, Nuclear Magnetic Resonance and Relaxation, Cambridge University Press, 1997] show that the transverse correlation functions for simple dipolar magnetic interactions (that vary as  $r_{\rm H}^{-3}$ ) lead to relaxation rates of the form  $\exp[-(t/\tau)^{1/2}]$ , where t is time and  $\tau$  is an associated time constant. It is noteworthy that a simple exponential relaxation is expected only in three-dimensions. The experimental results at low temperatures do reveal a stretched exponential  $\exp[-(t/\tau)^{\alpha}]$  with the exponent  $\alpha$  varying from 0.8 at 2T<sub>F</sub> to 0.4 at 0.5T<sub>F</sub> but rising on further cooling to 1.0 at 0.05T<sub>F</sub>. A stretched exponential relaxation was also observed by Matsushita et al. [Y. Matsushita et al., J. Low Temp. Phys. 183,251 (2016) and QFS 2019 unpublished] for <sup>3</sup>He at higher temperatures but constrained to FSM-16. The relaxation times reach a maximum at a temperature near  $2T_F$  as expected in an ideal one-dimensional system because there are just two Fermi points at  $k_{\rm F}$  (rather than a Fermi line or surface as in higher dimensions).

### Facility Plans and Directions

Table 2.6 summarizes the present and future capabilities, which are described later in this section. Proposals for magnet time may be submitted at any time, and contact/discussions with staff is recommended prior to submission. Users work with the staff scientists to mount and tune the experiments on site, and when the experiments begin, most users have the staff perform the instant-to-instant steps while the users are consulting from off-site locations. This arrangement is particularly effective when the experiments span long periods of time due to the nature of these experiments at the extremes of parameter space.

A new Assistant Scientist line was provided by the University of Florida as part of the initiative to open the third bay in the Microkelvin Laboratory. The search for this non-tenure accruing faculty position was authorized in Fall 2019, and the recommendations of the search committee were presented to the faculty in early January 2020. In early February 2020, Rasul Gazizulin, then a member of the CNRS low temperature and high magnetic field team in Grenoble, France, accepted the position. Although his original start date was anticipated in early November 2020, a combination of conditions arising from the pandemic and the evolving Visa polices has delayed his arrival, which is now anticipated in 2021.

Table 2.6: The instrumentation available in the MagLab High B/T Facility tabulated, and their unique combination of temperature, magnetic field, and techniques are highlighted. Specialty shielding and filtering of the equipment provides the ultraquiet electromagnetic interference environment.

| Equipment                                                              | Features                                                                                                                                                                                                 | Supported Research                                                                                                                               |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Bay 3: 16.5T<br>superconducting magnet,<br>20mm dia. sample space      | Temperatures ≤ 1mK, by 8T<br>demag of PrNi <sub>5</sub> + Cu stage.                                                                                                                                      | Magnetization, quantum transport,<br>torsional oscillator, viscosity, specific<br>heat, dielectric, MEMS                                         |
| Bay 2: 8T superconducting<br>magnet, 32mm dia.<br>sample space         | Temperatures ≤ 0.5mK, by 8T<br>demag of Copper stage.                                                                                                                                                    | NMR, quantum transport,<br>ultrasound, capacity, pressure cell,<br>thermal transport                                                             |
| Bay 1: 8T superconducting<br>magnet, 32mm dia.<br>sample space         | Added 2020, Update/Revisions in progress, specs TBA for "nimble" instrument, to open 2022.                                                                                                               | Planned: quantum transport with rotation, novel magnetometry, scanning probes                                                                    |
| Annex: 10 T<br>superconducting<br>magnet, 25mm dia.<br>sample space    | Retired March 2020 – Renovated<br>and revitalized version to NPB 135,<br>near HBCL, for 2021 operation.<br>Temperatures ≤ 20mK in 10T / 16T<br>for fast- turnaround sample/cell<br>transfer to Bays 1-3. | Exploratory, novel technique<br>development, sample/cell<br>verification prior to use on Bays 1-3                                                |
| High Bay Convergence<br>Lab: 18.8T and 9.4T<br>(89mm, room-temp bores) | Added 2020, providing AMRIS<br>and High B/T teams common<br>space and resources. 9.4T to<br>operate in 2021 and 18.8T to<br>operate in 2022.                                                             | Probe development for DNP NMR<br>imaging, new refrigeration with<br>enhanced magneto-caloric effect,<br>materials growth far from<br>equilibrium |

# Outreach to Generate New Proposals-Progress on STEM and Building User Community

In February 2020, Mark Meisel and Naoto Masuhara led a facility tour for 14 high school students as part of the Florida Regional Junior Science, Engineering, and Humanities Symposium. High B/T Scientist Lucia Steinke was the representative at "Talk Science with Her" as part of the United Nations International Women's Week, an event to celebrate the achievements of women in the sciences. Lucia spoke directly with at least 45 people over the two-hour event.

In March 2020, the pandemic perturbed the typical in-person, outreach activities for the rest of the year. Nevertheless, Lucia Steinke successfully recruited and engaged a second year UF Physics graduate student who is now a member of her research team. Similarly, Mark Meisel engaged two UF Physics undergraduates in data analysis activities via online only interactions, with one student starting in Summer 2020 and the other in the Fall 2020. Both students continued their work through December 2020.

In September 2020, Mark Meisel developed a 5-minute video tour to reach visitors who could not travel to the facility. Joanna Long (AMRIS) and Mark co-hosted an online only "Quantum Spin Coherence Workshop" as part of the MagLab 2020 Users Committee Meeting, during which they debuted their respective facilities' tour videos and facilitated a workshop for 160 graduate students, postdocs, and professionals located within Florida and around the world. Lecturers at this Users Workshop provided instruction on software, hardware and data handling in materials research, with applications of interest to a broad group of MagLab users and collaborators.

Throughout 2020, members of the High B/T Facility used their time to become more actively involved in the inclusion, diversity, and equity discussions about changing the culture in and beyond the workplace. Specifically, Mark Meisel engaged in AIP TEAM-UP Project with the UF

Physics IDEA committee and in the APS IDEA network through the MagLab Diversity Committee. Connectivity to research teams at Howard University were initiated and will continue.

# Facility Operations Schedule

On March 23, 2020, the University of Florida closed its campus and limited activities to essential personnel only. All of the High B/T Facility operations were closed at that time, and a reasonable time was allowed for staff to come to campus to safely stop laboratory operations. In late May 2020, a partial return to campus was permitted (Figure 2.22), but sufficient supplies of liquid helium were not available until mid-July 2020, when Bay 2 was restarted immediately. Bay 3 started a month later after an extended revision to remove legacy connections to the low temperature regions, as it was the first full opening of the instrument since Lucia Steinke started in October 2019. As stated previously, the Fast-Turnaround instrument was run up to the shut-done and then it was decided to close it for its relocation and revitalization when it will be reopened in the Physics Building in 2021. Finally, the cancellation of the APS March 2020 Meeting in Denver



Figure 2.22: July 2021 view of the corridor between the Bay 3 (left) and Bay 2 (right) shielded rooms in the Microkelvin Laboratory. The dilution refrigerator and vacuum plumbing are seen before they pass through an opening to the pumps and containers in the lower floor. As part of the "disinfect/sanitize" protocols, a freshness was restored to the facility.

severely limited our opportunities to engage with new and continuing users. From March to December 2020, no external users were allowed to come to our facility, nor could we host any speakers with potential interest who could give seminars in our department and visit the facilities.

#### 5. ICR Facility

During 2020, the Fourier Transform Ion Cyclotron Resonance (ICR) Mass Spectrometry program continued instrument and technique development as well as pursuing novel applications of FT-ICR mass spectrometry. These methods are made available to external users through the NSF National High-Field FT-ICR Mass Spectrometry Facility. The facility features eight staff scientists who support instrumentation, software, biological, petrochemical, and environmental applications, as well as a machinist, technician, and several rotating postdocs who are available to collaborate and/or assist with projects.



Figure 2.23: Picture of the 21T FT-ICR mass spectrometer.

#### Unique Aspects of Instrumentation Capabilities

The lon Cyclotron Resonance facility provides sample analysis that requires the ultrahigh resolution  $(m/\Delta m_{50\%} > 1,000,000 \text{ or more at } m/z 500$ , where  $\Delta m_{50\%}$  is the full mass spectral peak width at half-maximum peak height) and parts-per-billion mass accuracy only achievable by FT-ICR MS coupled to high magnetic fields. The facility's four FT-ICR mass spectrometers feature high magnetic fields (as high as 21T) and are compatible with multiple ionization and fragmentation techniques (Table 2.7).

| Field (T), Bore (mm) | Homogeneity | Ionization<br>Techniques |
|----------------------|-------------|--------------------------|
| 21, 123              | < 1ppm      | esi, appi, maldi         |
| 14.5, 104            | lppm        | esi, appi, maldi         |
| 9.4, 220             | lppm        | ESI, APPI                |

#### Table 2.7: ICR systems at the Magnet Lab in Tallahassee

#### Facility Developments and Enhancements

In 2015, the ICR facility commissioned the first 21T Fourier transform ion cyclotron resonance mass spectrometer. The 21T magnet is the highest field superconducting magnet ever used for FT-ICR and features high spatial homogeneity, high temporal stability, and negligible liquid helium consumption (Figure 2.23) (J. Am. Soc. Mass Spectrom., 26, 1626-1632 (2015)).

Mass resolving power of 150,000 (m/ $\Delta$ m50%) is achieved for bovine serum albumin (66kDa) for a 0.38 second detection period (see Figure 2.24), and greater than 2,000,000 resolving power is achieved for a 12 second detection period. Externally calibrated broadband mass measurement accuracy is typically less than 150ppb rms, with resolving power greater than 300,000 at m/z 400 for a 0.76 second detection period and 2,400,000 at m/z 400 for a 6.1 second detection period. Combined analysis of electron transfer and collisional dissociation spectra results in 68% sequence coverage for carbonic anhydrase. The instrument is part of the NSF High-Field FT-ICR User Facility and is available free of charge to qualified users, with optimized experimental conditions for complex mixture analysis, including ultrahigh resolution ion isolation via SWIFT (*Anal. Chem.*, 92, 3213-3219 (2020), MALDI imaging (*Anal. Chem.* 92, 3133-3142 (2020), and complex mixture analysis (*Anal. Chem.*, 90, 2041-2047 (2018). The instrument includes a commercial dual linear quadrupole trap front end that features high sensitivity, precise control of trapped ion number, and collisional and electron transfer dissociation. A third linear quadrupole trap offers high ion capacity and ejection efficiency, and rf quadrupole ion injection optics deliver ions to a novel dynamically harmonized ICR cell. FT-ICR mass spectrometry has become the method of choice for detailed chemical characterization of natural complex mixtures. The high mass-resolving power, mass accuracy, and dynamic range of FT-ICR enable resolution and confident elemental formula assignment for tens of thousands of unique components in complex organic

mixtures. An actively-shielded 14.5T, 104mm bore system offers high mass measurement accuracy (<300 parts-per-billion rms error), scan rate, and mass resolving power. The spectrometer features electrospray, atmospheric pressure photoionization (APPI), atmospheric pressure chemical ionization sources (APCI); linear quadrupole trap for external ion storage, mass selection, and collisional dissociation (CAD); and automatic gain control (AGC) for accurate and precise

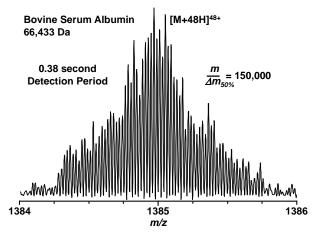


Figure 2.24: Single-scan electrospray FT-ICR mass spectrum of the isolated 48+ charge state of bovine serum albumin following a 12s detection period. Mass resolving power is approximately 2,000,000, and the signal-to-noise ratio of the most abundant peak is greater than 500:1.

control of charge delivered to the ICR cell. The combination of AGC and high magnetic field make sub-ppm mass accuracy routine without the need for an internal calibrant. Mass resolving power > 200,000 at m/z 400 is achieved at one scan per second.

The 9.4T, passively-shielded, 220mm bore system offers a unique combination of mass resolving power (m/ $\Delta$ m = 8,000,000 at mass 9,000 Da) and dynamic range (>10,000:1), as well as high mass range, mass accuracy, dual-electrospray source for accurate internal mass calibration, efficient tandem mass spectrometry (as high as MS<sup>8</sup>), and long ion storage period (*J. Am. Soc. Mass Spectrom.*, 31, 1783-1802 (2020); *Anal. Chem.*, 92, 12193-12200(2020). to the instrument is ideal for direct infusion analysis of compositionally complex organic mixtures such as dissolved organic matter (Proc. Natl. Acad. Sci. USA, 115, 549-554 (2018); Glob. Chang. Biol., 26, 1374-1389 (2020); Water Res., 169, 115201 (2020); Env. Sci. Technol., 54, 16249-16259 (2020); Geochim. Cosmochim. Acta., 273, 163-176 (2020; Pure Appl. Chem. 92, 1447-1467 (2020), biofuels (Ind. Crop. Prods., 150, 112311 (2020); Sustain. Energy Fuels, 4, 2404-2410 (2020); Energy Fuels, 34, 16181-16186

(2020), emerging contaminants (Nat. Rev. Earth Environ., 1, 237-250 (2020); Env. Sci. Technol., 54, 8830-8836 (2020); Env. Sci. Technol., 54, 9374-9386 (2020); and petroleum fractions (Energy Fuels, 34, 3013-3030 (2020); (Energy Fuels, 34, 8308-8315 (2020), because those mixtures are replete with mass "splits" that are readily separated and identified by FT-ICR MS (Energy Fuels, 34, 13903-13915 (2020)). The magnet is passively shielded to allow proper function of all equipment and safety for users. The system features external mass selection prior to ion injection for further increase in dynamic range and rapid (~100ms time scale) MS/MS (Anal. Chem., 75, 3256-3262 (2003)), with ultrahigh resolution ion isolation via stored waveform inverse Fourier transform (SWIFT) followed by

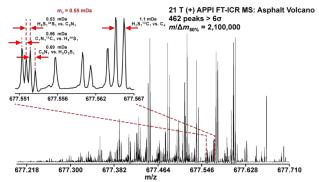


Figure 2.25: Mass scale expanded segment of 21T (+) APPI FT-ICR mass spectrum of an asphalt volcano sample after ion trap isolation. Inset illustrates the need for ultrahigh mass-resolving power to resolve ions with a mass difference on the order of the mass of an electron ( $m_e = 0.55mDa$ ).

ICR

| Histone H2B Type 2E                                      |
|----------------------------------------------------------|
| PEPAKSAPAPKKGSKKAVTKAQKKD                                |
| GIKIKIRIKIRISIR KIESIYISITIYIV YIK V L K Q VH P          |
| DTGLISSKAMGIMNSFVNDLIFERIAG                              |
| LE A S R L AHLYNKERSTLITSRELIQT AV RL                    |
| LLL PEREL AKHA V SEEGTKA V T KYT S S K                   |
| PEPAKSAPAPKKGSKKAVTKAQKKD ==                             |
| G GKKRKRSRKESYSIYVYKVLKQVHP                              |
| U IG K K R K R S R K E S Y S I Y V Y K V L K Q V HIP     |
| EASRLAHYNKRSTITSREIQTALVRL                               |
| L LIPIG ELLIA KIHIAIVISIEIG TIKIA V T K Y T S S K        |
| PEPAKSAPAPKKGSKKAVTKAOKKD                                |
| GIKIKIRIKIRISIR KIEISIYISIIYIV YIK V L K QUH P           |
| D T GII SISK A M GIIMNSIFUNDIIF ER ILALG                 |
| D T GII SISIK A M GIIMNSIFIVIN TR V L K QIVIH P          |
| ULLLIPIGLELL ALKHALVISLEIGITIKA V TIKLYLT S S K          |
| ∆ETD Coverage = 10%<br>∆CID Coverage = 44%               |
| Ubiquitin 60s Ribosomal Protein L40                      |
| MQ 1]FVK TLLTGKT I TL EVE PSDT 1EN                       |
| - VIKIAIKLIQDIKLEGI P PLOQQQRLIIFAGKQ L                  |
| EDLGRTLLSDYN I Q KLEST LHL VIIR L R G                    |
| M]G C                                                    |
| N M QLILFLVLKLTILTLG KLTILLTLLELVELP SLDLTLILELN         |
| UK ALK ILQLDIKIELGLIPPDQQRLIFAGKQL                       |
| O = ELDLG RLT L S DLY N I QLK ELS T L H L V L R L R G    |
| H G C                                                    |
| M QUIFIVIRITE TERRITITELEVEREDETER                       |
| Vikiaikiiloikieisiile eloioikieisii ifaiskuu             |
| E contractor adversaria adversaria adversaria adversaria |
| O AETD Coverage = 9%                                     |

#### ∆CID Coverage = 35%

Figure 2.26: Sequence coverage maps for both histone H2B type 2-E (Q16778) and ubiquitin 60s ribosomal protein L40 (P62987) constructed from data acquired using either ETD, CID, or chimeric modes. These sequence coverage maps illustrate the complementarity of CID vs ETD and reveal that this complementarity is preserved during chimeric ion loading. Improvements in sequence coverage using chimeric ion loading over either ETD or CID are reported.

infrared multiphoton (IRMPD) dissociation (Energy Fuels, 34, 3013-3030 (2020).

# Major Research Activities and Discoveries/Research Highlights

Complex mixture analysis - The high massresolving power, mass accuracy, and dynamic range of FT-ICR enable resolution and confident elemental formula assignment for tens of thousands of unique components in complex organic mixtures. Here, we present complex mixture characterization on the newlv developed MagLab 21T FT-ICR mass spectrometer. Combined with absorption-mode data processing, mass resolving power increases as much as a factor of 2 higher than conventional magnitude-mode display, an improvement otherwise requiring a more expensive increase in magnetic field strength. The mass spectrum shown in Figure 2.25 represents the most peaks resolved and identified in a single spectrum of any kind, and represents the highest broadband resolving power for any petroleum mass spectrum, and emphasizes the need for ultrahigh resolving power achievable only by 21T FT-ICR MS sufficient to separate isobaric overlaps prevalent in complex seep samples (Figure 2.25, Anal. Chem., 90, 2041-2047 (2018)).

Biological applications of FT-ICR MS include top-down (Proteomics, 19, 1800361 (2019)) proteomic analyses of rare proteoforms involved in cancer (Clin. Chem. Lab. Med., 59, 653-661 (2020)), sequence determination of monoclonal antibodies (J. Am. Soc. Mass Spectrom., 31, 1783-1802 (2020)), construction of proteoform families by accurate intact mass (J. Proteome Res., 20, 317-325 (2020)), development of novel ion manipulation strategies for top-down MS (Anal.

Chem., 92, 12193-12200 (2020)), and rapid and accurate diagnosis of hemoglobinopathies from 1µL of blood (*Clinical Chem.*, 65, 986-994 (2019)). High quality data from intact proteins provides a truly molecular-level understanding of phenotype, but requires ultrahigh mass resolving power, mass accuracy, sensitivity, and spectral acquisition rate. The 21T Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometer provides all these capabilities. In 2020, the ICR facility utilized 21T FT-ICR to analyze product ions derived from the application of multiple dissociation techniques and/or multiple precursor ions within a single transient acquisition. This ion loading technique, which we call, "chimeric ion loading", saves valuable acquisition time, decreases sample consumption, and improves top-down protein sequence coverage (Figure 2.26). In an analysis of breast cancer cell lysate, we performed collision-induced dissociation (CID) and electron-transfer dissociation (ETD) on each precursor on timescale compatible with

chromatography, and improved sequence coverage mean dramatically (CID-only 15% VS chimeric 33%). This approach can also be utilized to multiplex the acquisition of product ion spectra of multiple charge states from a single protein precursor or multiple ETD/proton-transfer reactions (PTR) reaction periods. The analytical utility of chimeric ion loading is demonstrated for top-down proteomics, but it is also likely to be impactful for tandem mass spectrometry applications in other areas (Anal. Chem., 92, 12193-12200 (2020).

ICR

The Consortium for Top-Down Proteomics

(www.topdownproteomics.org) launched a study to assess the current state of top-down mass spectrometry (TD MS) and middledown mass spectrometry (MD MS) for characterizing monoclonal antibody (mAb) primary structures, including their modifications. To

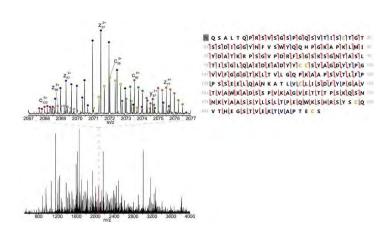


Figure 2.27: (Left) Example of an MD MS application to mAb analysis: sequencing of a light chain of recombinant human mAb with a 21T ESI FT-ICR MS employing ETD/PTR MS/MS (group 8). The inset shows an expanded view of a tandem mass spectrum with isotopic envelopes of product ions assigned and color coded for facile visualization. (Right) Total sequence coverage of 85% achieved for the analysis of the disulfide bond-reduced light chain of recombinant human mAb with a 21T ESI FT-ICR MS (group 8), based on middle-down MS/MS (combination of results from two tandem mass spectra). Included are product ions identified from CID/PTR MS/MS (10 transients averaged, b/y-ions, cleavage sites shown in blue) and of ETD/PTR MS/MS (10 transients averaged, c/z-ions, cleavage sites shown in red).

meet the needs of the rapidly growing therapeutic antibody market, it is important to develop analytical strategies to characterize the heterogeneity of a therapeutic product's primary structure accurately and reproducibly. The major objective of the study was to determine whether current TD/MD MS technologies and protocols can add value to the more commonly employed bottom-up (BU) approaches with regard to confirming protein integrity, sequencing variable domains, avoiding artifacts, and revealing modifications and their locations. The total sequence coverage obtained for the ETD/PTR MS/MS data collected off the 21T FT-ICR MS system in the ICR facility depicted in Figure 2.27 was the highest achieved from a single experiment in the study. (*J. Am. Soc. Mass Spectrom.*, 31, 1783-1802 (2020).

The, 9.4T and 14.5T instruments are primed for immediate impact in environmental and petrochemical analysis, where previously intractably complex mixtures are common. The field of "petroleomics" has been developed largely due to the unique ability of high-field FT-ICR mass spectrometry to resolve and identify all of the components in complex environmental and petrochemical samples (*Waste Manage.*, 106, 88-98 (2020), *Environ. Sci. Technol.*, 54, 9968-9979 (2020); *Energy Fuels*, 34, 4721-4726 (2020), *Environ. Sci. Technol.*, 54, 2500-2509 (2020); *J. Geophys. Res-Biogeo.*, 125, e2020JG005804 (2020), *Energy Fuels*, 34, 12449-12456 (2020).

Stored waveform inverse Fourier transform (SWIFT) is a versatile method to generate complex isolation/ejection waveforms for precursor isolation prior to tandem mass spectrometry experiments. In 2020, the ICR facility reports ultrahigh resolving power ion isolation by SWIFT on a 21T Fourier transform ion cyclotron resonance (FTICR) mass spectrometer.

Individual histone proteoforms are isolated (0.6m/z isolation window) with near 100% efficiency using a 52ms SWIFT isolation, followed by incell fragmentation by ultraviolet photodissociation (UVPD). Ion isolation resolving power of 175 000 (m/ $\Delta$ m) is demonstrated by isolation of individual peaks at a spacing of 0.0034 Da at m/z 597 from a complex mixture of Canadian bitumen. An

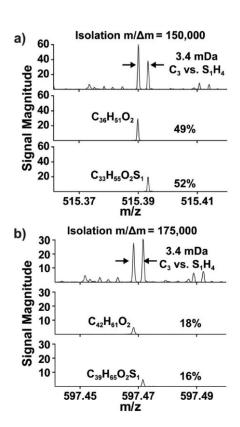


Figure 2.28: Ultrahigh ion isolation resolving power of ions that differ in mass by 3.4mDa from (-) ESI of Athabasca Canadian bitumen. (A) 16MB SWIFT was used to isolate two ions that require an isolation resolving power of 150,000 at m/z 515, with ~50% isolation efficiency. (B) 32MB SWIFT was used to isolate two ions that require an isolation resolving power of 175,000 at m/z 597, with ~17% isolation efficiency.

individual m/z ion, which corresponds to a single elemental composition, from a complex mixture is isolated and fragmented by infrared multiphoton dissociation (IRMPD). (Figure 2.28, Anal. Chem., 92, 3213-3219 (2020).

Dissolved Organic Matter (DOM) consists of soluble materials organic derived from the partial decomposition of organic materials (Water. Res., 169, 115201 (2020); Front. Earth Sci., 8 (2020); Chemosphere, 243, 125399(2020); Geochim. Cosmochem. Acta., 273, 163-176 (2020); Environ. Sci. Technol. 54, 16249-16259 (2020); Global Biogeochem. Cy., 34, e2019GB006495 (2020); Environ. Res. 181, 108915 (2020); Limnol. Oceanogr., 65, 1764-1780 (2020); Global Biogeochem. Cy., 26, 1374-1389 (2020); Front. Microbiol., 11, (2020); Mar. Environ. Res., 162, 105130 (2020); J. Geophys. Res.-Biogeosci., 125, e2020JG005804 (2020). Specifically, streams transport large amounts of terrestrially derived carbon to the ocean, especially during large rainstorms. We collected water samples daily over a 6-day storm from small drainage areas of varying landcover to see how the concentration and type of carbon changed over the course of a storm. Our results show that the amount and type of carbon in the stream changed dramatically during the storm and originated from different areas of the landscape. The flow of water through the soil also changed during the storm and was related to the type and amount of carbon entering the stream. Storm events not only impact carbon entering the stream but also may impact its transfer to coastal marine ecosystems. Climate in the study region is projected to become warmer and wetter in the coming decades. These shifts in climate could lead to more carbon export during storms, especially during winter because of more precipitation falling as rain rather than

snow. Ultrahigh resolution mass spectrometry showed that stream water DOM exported from the upland forest contained the greatest molecular diversity of the three landscape types and had the largest changes in composition over the storm suggesting that the wetland-dominated subcatchments were less compositionally diverse with regard to soil DOM pools active during the storm. A PCA of C concentration and DOM composition showed differences in water entering the stream from different landscape types and at different time points during the storm. Furthermore, the upland forest stream had the greatest percent relative abundance of CHON, CHOS, and CHONS containing molecular formulae, HUPs formulae, and HCO3<sup>-</sup>, while Fish Creek fell between the wetland sites and upland forest along Axis 1. (J. Geophys. Res. Biogeosci., 125, e2020JG005804 (2020)).

Of the estimated 5 million barrels of crude oil released into the Gulf of Mexico from the 2010 Deepwater Horizon oil spill, a fraction washed ashore onto sandy beaches from Louisiana to the Florida panhandle. In 2020, several studies investigated the quantity of DOC and quality of DOM compounds that are produced when thin oil films were subjected to sunlight over time as well as their potential toxicity. There is a general paucity of laboratory studies surrounding the characterization, transformation, and toxicity of DOMHC produced from the photodissolution of

petroleum. Identifying the optical and molecular composition of DOMHC and how it changes over time can lead to important inferences about how it influences bioavailability, dissolution, and toxicity in the environment. (*Nat. Rev. Earth Environ.*, 1, 237-250 (2020); *Earth Planet. Sci. Lett.*, 545, (2020); *Env. Sci. Technol.*, 54, 8830-8836 (2020); *Env. Sci. Technol.*, 54, 9968-9979 (2020); *Environ. Sci. Process Impacts*, 22, 2313-2321 (2020).

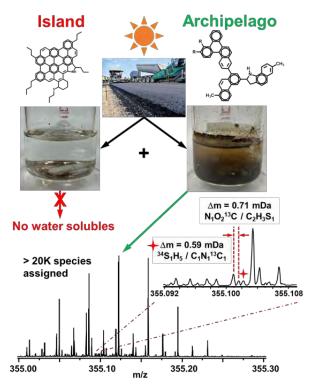


Figure 2.29: A recent MagLab study revealed the potential of asphalt cement (used in road paving) to generate water soluble species after photoirradiation (Energy Fuels, 34, 14493-14504 (2020) An internally developed extrography separation method (Energy Fuels, 34, 3013-3030 (2020); Energy Fuels, 32, 314-328 (2018)) allows for the isolation of structurally defined fractions (island, single- (top, left) and archipelago, multicore (top, right)) from asphaltenes, which comprises up to 20wt% asphalt cement (top, center). The separation photoirradiation and subsequent enables the determination of the potential of each structural motif to generate water soluble contaminants. Photoirradiation of each asphaltene structural motifs reveals that single aromatic core molecules (island) do not generate appreciable amounts of DOC, whereas the multi-core (archipelago) molecules generate large amounts of DOC (tea-stained water, right). Subsequent FT-ICR mass spectral analysis of the water characterizes the tens-ofthousands water soluble species generated by the photoirradiation of the archipelago asphaltenes. Analysis of the starting materials (top right) and photoproducts (bottom) is possible only by FT-ICR MS.

Dissolved Organic Carbon (DOC) contributions from the built environment. **Asphaltenes** are high-boiling and recalcitrant compounds that are generally minor components of crude oil (~0.1-15.0wt %) but dominate the composition of heavily weathered spilled petroleum. These solid residues exhibit a high structural complexity, comprised of polycyclic aromatic hydrocarbons (PAHs) that are a mixture of single-core (island) and multicore (archipelago) structural motifs. The mass fraction of each motif is sample-dependent. Thus, knowledge of a potential structural dependence (single-versus multicore) on the production of water-soluble species from asphaltene samples is key to understanding the contribution of photochemically generated dissolved organic matter from oil spills. In this work, asphaltene samples with enriched mass fractions of either island (single-core) or archipelago (multicore) structural motifs are photo-oxidized on artificial seawater with a solar simulator. Molecular characterization of oil- and waterphotoproducts, conducted soluble bv Fourier transform ion cyclotron resonance mass spectrometry, reveals that island motifs exhibit very limited production of watersoluble species, and their oil-soluble products reflect the molecular composition of the starting material. Conversely, archipelago motifs yield a water-soluble compositional continuum of  $O_x$ ,  $S_xO_y$ , and  $N_xO_y$  containing hydrocarbons species that exhibit the typical molecular fingerprint of DOM. The lower carbon number and aromaticity of the archipelago-derived asphaltene photoproducts suggest the occurrence of photofragmentation (or photolysis) reactions. To investigate the possibility of the opposite reaction (photopolymerization), the photo-oxidation of small PAHs isolated from a low-boiling petroleum distillation cut was also performed. vielded water-soluble It compounds with carbon number and

aromaticity up to 2-fold higher than the starting material, strongly suggesting that polymerization (addition reactions) occurs. Collectively, the results indicate that the presence of archipelago motifs and the occurrence of cracking/polymerization reactions are central in the production of dissolved organic matter from fossil fuels (Figure 2.29) (Energy Fuels, 34, 3013-3030 (2020); Energy Fuels, 34, 14493-14504 (2020).

#### Facility Plans and Directions

The ICR facility will continue to improve mass spectrometer performance and expand user access to the world's first 21T FT-ICR mass spectrometer. Current development projects include triple frequency detection in a dynamically harmonized cell for three-fold improvement in mass resolving power or measurement speed, proton transfer reactions and parallel ion parking for increased sensitivity and lower detection limit for large proteins and their fragments, and interface of the MagLab ICR systems with a newer commercial front-end.

#### Outreach to Generate New Proposals-Progress on STEM and Building User Community

The ICR program had 14 new principal investigators in 2020. The ICR program also enhanced its undergraduate research and outreach program for one undergraduate scientist from Florida A&M University, who was able to participate in research virtually due to COVID restrictions. The ICR program in 2020 supported the attendance of research faculty; postdoctoral associates; and graduate, undergraduate, and high school students at numerous virtual national conferences.

#### Facility Operations Schedule

The ICR facility usually operates year-round, but this year, due to COVID restrictions, it shifted from on-site users to users sending samples for data acquisition by internal ICR support staff and was able to maintain an active user program with minimal downtime. In addition, the lab-wide power outage December 16 -20, 2020 required all ICR instruments to be shut down with no instrument usage during that time.

# 6. NMR Facility

The NMR/MRI User Program at the MagLab in Tallahassee (FSU) is partnered with the AMRIS User Program in Gainesville (UF). Major research areas in Tallahassee include solid-state NMR (ssNMR) of biosolids and materials, magnetic-resonance imaging (MRI) of animals, and solution NMR of biomolecules. There are fourteen NMR platforms on site, including several flagship instruments such as (i) the 36T Series Connected Hybrid (SCH) platform, which operates at 1.5GHz for <sup>1</sup>H NMR; (ii) the 14.1T (600MHz) dynamic nuclear polarization (DNP) NMR platform, which provides unprecedented signal enhancements, especially for high surface area samples; (iii) one 19.6T (830MHz) and two 18.8T (800MHz) platforms, which are configured for biosolids and materials ssNMR, as well as methods development and staging of experiments for the SCH; and (iv) the 21.1T (900MHz) platform, which is currently the highest-field MRI/S instrument in existence. These platforms are coupled with some of the best NMR probes in the world, which are designed and constructed by our NMR Technology Group. Annually, the NMR/MRI user program, which is run by our NMR Instrument Managers, serves ca. 250-300 users from around the world, including Pls, students, postdocs, and technicians. The Covid pandemic (along with console installations and issues with powering the SCH) resulted in a relatively minor decrease in the number of user hours (ca. 15-20% overall); while no external users were permitted on site, we continued to support them remotely in 2020. Remarkably, a record number of peer-reviewed publications came out of the NMR/MRI User Program in 2020 (81 – up from 54 in 2019).

#### Unique Aspects of Instrumentation Capabilities

SCH. The SCH was in its second year of user operation in 2020; unfortunately, instrument time was limited by both the pandemic and subsequent failure of the helium-liquefier turbine and a local substation transformer. Fortunately, the SCH is scheduled to come back online in July 2021, with biosolids ssNMR projects to be given high priority. Nonetheless, the 13 publications that came out in 2020 reveal the true power of the SCH, proving it to be incredibly useful for the study of half-integer quadrupolar nuclei (*i.e.*, nuclear spins of 3/2, 5/2, 7/2, and 9/2, which constitute 73% of NMR-active nuclides in the Periodic Table) in a wide range of materials. Applications in this area will ramp up in 2021 for materials like metal-organic frameworks (MOFs), catalysts, and biosolids such as metalloproteins, including those with challenging low-g nuclei such as <sup>67</sup>Zn. We took advantage of the pause in SCH operations to improve both the hardware and algorithms used for field regulation to reduce short- and long-term field fluctuations. We also continued the development of new fast magic-angle spinning (FMAS) probes for <sup>1</sup>H indirect detection (ID) experiments at lower fields, in part, as staging for similar probe development on the SCH. We plan to have these capabilities ready to go when the SCH is back online, opening new possibilities for ultra-high field (UHF), high-resolution <sup>1</sup>H, <sup>13</sup>C, and <sup>15</sup>N ssNMR of biosolids (vide infra).

DNP. The DNP platform, a joint effort between NMR, AMRIS, and EMR that opened for users in 2018, has yielded 18 publications over the past two years, with more forthcoming in 2021 (four published so far). Due to the expertise and diligence of Drs. Fred Mentink-Vigier and Thierry Dubroca, the DNP had a slight increase in user hours in 2020, and several new Pls/research groups were recruited. New DNP probes were developed by Dr. Faith Scott under the supervision of Mr. Peter Gor'kov, and will be ready for use in 2021 (*vide infra*). The unique DNP platform is comprised of DNP MAS NMR and Overhauser DNP instruments (two separate 600MHz magnets), which receive microwave irradiation via a quasi-optical table (built in-house) that splits the gyrotron microwave beam. The DNP can be operated continuously (24/7) for up to three weeks at a time, unlike any other DNP platform in the world. Finally, a benchtop EPR spectrometer and tabletop MAS spinner for screening of samples were also installed.

# Facility Developments and Enhancements

Probes. The probes designed by the *NMR* Technology Group are a major factor in setting the MagLab apart from other facilities around the world, keeping our user program on the cutting edge. This team, led by Dr. Bill Brey and Mr. Peter Gor'kov, designs, manufactures, and implements probes of very high quality. They provide versatile tuning configurations for multinuclear ssNMR, low-*E* coils for lossy biosolids samples, and some of the best rf circuits and coils for detection of weak NMR signals. In 2020, three probes were developed, including two for the SCH (3.2mm HX, middle- $\gamma$ , vx = <sup>15</sup>N-<sup>71</sup>Ga; 3.2mm HX, low- $\gamma$ , vx = <sup>103</sup>Rh-<sup>15</sup>N) and one for the 800 (1.3mm HX(Y), in testing). In addition, several probes built in 2019 are routinely used across multiple platforms, including an 800MHz 0.75mm HXY MAS probe for indirect <sup>1</sup>H detection (spinning up to 100kHz) and an SCH 5.0mm HX static probe for biosolids and materials. An 800MHz 3.2mm broadband HX MAS probe is under construction, as well as a 3.2mm HXY MAS probe for the 600MHz DNP platform, and 1.3 and 1.9mm HXY DNP probes are in the design phase. We also continued the sponsored development of high-temperature superconducting (HTS) probes for solutions NMR applications at AMRIS and elsewhere. Probes currently in development have several times the Q factors of those of the previous generation and promise to have much higher sensitivity.

Platform upgrades. Aside from the construction of new probes, there are several major developments that were completed in 2020 and/or started in 2020 and extended into 2021. The 800#2 console was upgraded to a Bruker NEO, and the 900 console is in the process of being upgraded with a NEO console as well, along with a significant upgrade in the gradient and shim system (450 V/300 A) and shimming capabilities for *in vivo* MRI/S. With multiple channels and transceiver capabilities, this will offer enhanced capabilities in a new super-wide configuration to augment the existing microimaging and SSNMR applications. Once user operations have resumed, spectroscopy on the SCH will benefit from the work of Prof. Jeff Schiano (Penn State) and his students to improve field regulation. Careful measurements and analysis of the gain and phase responses of the field regulation system have enabled them to develop algorithms to better

compensate for fluctuations in cooling water temperature. In addition, Drs. Bill Brey and Ilya Litvak have worked to reduce long-term drift by improving the stability of the low-noise electronics in the field regulation system.

# Major Research Activities and Discoveries/ Research Highlights

Several major publications stemmed from studies of half-integer quadrupolar nuclei on the SCH platform, not only due to the scaling of signal proportional to  $B_0^2$ , but also because central transition ( $+\frac{1}{2} \leftrightarrow -\frac{1}{2}$ ) pattern breadths scale as  $B_0^{-1}$ , which provides unparalleled resolution. For instance, <sup>17</sup>O (l = 5/2) ssNMR was used for the identification and assignment of a "wire" of water molecules involved in hydrogen

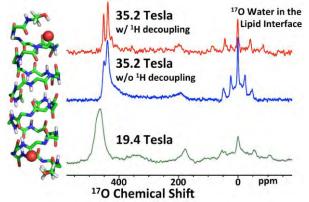
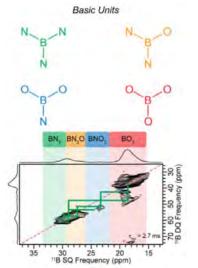


Figure 2.30:  $^{17}$ O SSNMR spectra of Leu<sub>10</sub> gramicidin-A acquired at 35.2T (without and without <sup>1</sup>H decoupling) have much higher resolution than those acquired at 19.4T.

bonding with carbonyl groups in gramicidin-A (Figure 2.30), shedding new insight on their dynamics in the central channel of the protein [Paulino, J. et al. PNAS 2020, 117, 11908, DOI]. <sup>17</sup>O multiple-quantum MAS (MQMAS) ssNMR was able to resolve 12 magnetically non-equivalent oxygen sites in a-Mg formate MOFs (with and without solvent), allowing for detailed structural characterization that is impossible at lower fields [Martins, V. et al. J. Am. Chem. Soc. 2020, 142, 14877, DOI]. 2D <sup>17</sup>O double-quantum (DQ)-single-quantum (SQ) experiments were used to probe connectivities and proximities between oxygen sites in γ-Al<sub>2</sub>O<sub>3</sub>, one of the most widely used

catalytic support materials, in order to gain an understanding of the relationship between its structure and function [Wang, Q. et al. Nat. Comm. 2020, 11, 3620, DOI]. <sup>67</sup>Zn (I = 5/2) ssNMR was used to characterize short -range structural disorder in zeolitic imidazolate framework (ZIF) glasses, revealing reduction of tetrahedral symmetry of the Zn sites at the atomic level upon progression from a crystalline phase to a glass [Madsen, R. S. K. et al. Science 2020, 367, 1473, DOI]. Finally, 1D <sup>11</sup>B (I = 3/2) MAS NMR, along with 2D <sup>1</sup>H-<sup>11</sup>B and <sup>11</sup>B-<sup>11</sup>B DQ-SQ correlation experiments, allowed for



an in depth study of structure and connectivity of boron species in h-BN nanotubes used as an oxidative catalyst (spent h-BNNT), boronsubstituted MCM-22 zeolite (B-MWW), and silicasupported boron oxide (B/SiO<sub>2</sub>) [Dorn, R. W. et al. ACS Catal. 2020, 10, 13852, DOI] (Figure 2.31).

The existence of a spin diffusion barrier (i.e., slower nuclear spin polarization diffusion around bis-nitroxides) was demonstrated for the first time under MAS-DNP conditions, using the MAS DNP NMR platform during 2020. This was in large part due to control of the microwave beam on a ms timescale [Stern, Q. Et al. Science Adv. 2021, 7, eabf5735, DOI]. On our 500, 600, 800, 830, and 900MHz platforms, numerous studies of biosolids and materials, along with methods development papers, were published. For Figure 2.31: Basic boron-centered units in spent h- instance, high-resolution multinuclear (<sup>1</sup>H, <sup>31</sup>P, BNNT and its 2D<sup>11</sup>B dipolar DQ-SQ NMR spectra (vrot 6.7Li, <sup>27</sup>Al, <sup>71</sup>Ga) ssNMR experiments conducted = 18kHz), which reveals connectivities between units. on energy materials have contributed to improved fundamental understanding of the

local bonding environments that govern ion transport [Wu, N. et al. J. Am. Chem. Soc. 2020, 142, 2497, DOI] and electron mobility [Huana, W. et al. PNAS 2020, 117, 18231, DOI], leading to insights into performance improvement of technologically important materials for rechargeable batteries, thin film transistors, and dielectrics.

#### Facility Plans and Directions

Dr. Tim Cross, the long-time director and original designer of the NMR Facility, retired in 2020; Dr. Robert Schurko, a faculty member in the Department of Chemistry and Biochemistry and an expert in ssNMR of materials and NMR methods development, took over as director in May 2020. In 2020, we also conducted interviews for three positions, including an RF/MRI engineer and two Research Faculty (to support SCH and MRI user activities). We have identified a candidate for the RF/MRI engineer position (commencing June 2021); however, other searches are ongoing, as travel restrictions have made on-site interviews impossible for most candidates.

Several new initiatives were kicked off in 2020 and are actively being pursued via external funding opportunities, which augment core funding from the NSF Renewal. These include (i) the development of a 400MHz DNP NMR platform that utilizes a 5 W klystron as a µwave source (NSF-MRI, with EMR, under review); (ii) collaborations with C.M. Physics on development of ultrawideline NMR techniques at 30+ T (as well as future UHF DNP operations; core funding, in progress); (iii) a proposal for ultra-low temperature closed He loop DNP operations at 600MHz (core funding, with EMR, in progress); (iv) conversion of an 800MHz solutions NMR spectrometer to solids capability and repositioning of solution NMR operations at 750MHz in the Department of Chemistry and Biochemistry at FSU (core funding, in progress); (v) a proposal for an 800MHz DNP system for biosolids NMR (NSF R1 midscale, with AMRIS/U. Florida, under review); and (vi) a proposal for the development of multifilament HTSs for UHF NMR magnets (NIH RO1, with Applied Superconductivity, under review). We also submitted a pre-proposal for a 1.2GHz ssNMR platform in Tallahassee (NSF R1 midscale, unsuccessful – but we will try in the R2 competition next year) and continued to plan for UHF microimaging and small-animal MRI operations on the SCH platform.

#### Outreach to Generate New Proposals-Progress on STEM and Building User Community

User recruitment was for the most part conducted virtually during 2020, via lectures and posters at national and international online conferences, as well as the usual email solicitations and a limited number of sponsorships. In 2020, we started to conduct inventories of all of the spectrometers, probes, and related hardware - we are still in the process of translating this to an overhauled web site and redesigning our pages in the ELEVATE information booklet as well. As a result of this work, we have up-to-date descriptions of all spectrometers and probes available to our users, along with active projects, and interesting items about ongoing research at the MagLab. Schurko reinitiated online group meetings and has invited several high-profile speakers (and potential collaborators); these activities continue in 2021. In 2021, we plan on resuming workshops on topics like RF circuits, DNP, and NMR on the SCH. Finally, in late 2020, the online *Fields* magazine featured a *Wizard of Oz*-themed story on ssNMR of MOFs conducted by members of our NMR user program [https://bit.ly/3brqXli]; not only was there positive feedback from the general public, but this article attracted several prominent members of the MOF/crystal engineering community to initiate development of projects at the MagLab.

STEM outreach was challenging due to the pandemic, but most of our team participated in the MagLab Open House in February 2020, and many have moved to virtual activities (e.g., Drs. Faith Scott and Rob Schurko provided virtual tours for the Women in Math, Science & Engineering (WIMSE) Program; Dr. Ilya Litvak organized an online science fair for elementary schoolchildren; Drs. Faith Scott and Sam Grant participated in MagLab's 2020 Summer Exploration Series; Drs. Schepkin and Grant presented an MRI of Veggies guessing game [https://bit.ly/3fgJnwE] and DNA extraction from fruit [https://bit.ly/3fjV5GH], respectively, at the Virtual Open House; and finally, Grant presented work from the 900 UWB magnet as part of the lab-wide tour of the MagLab for the ScienceWriters 2020 Conference, as well as providing a webinar based on his research involving non-proton MRI generated using the 900 platform [https://bit.ly/3fhWgGP]). We plan to ramp up interactions with local schools and organizations and provide more virtual tours and STEM events over the coming year. We hope to offer a workshop at an upcoming User Advisory Committee or External Advisory Committee meeting.

#### Facility Operations Schedule

In pre-pandemic years, our fleet of high-field NMR spectrometers, including 800#1, 800#2, 830, 900, 600#1, and 600#2, operate 24/7 close to 365 days per year; user hours decreased slightly in 2020 due to the COVID pandemic, and remote operations continued almost unabated, thanks to the efforts of Drs. Zhehong Gan, Ivan Hung, Riqiang Fu, and Sungsool Wi. Likewise, Dr. Grant conducted MRI experiments on the 900 (first *ex vivo* and then *in vivo*) continuously throughout the COVID-related shutdown. For NMR experimentation, the SCH is normally allocated 30 weeks of magnet time annually, with *ca*. 20 hours/week at full field. The 600 DNP runs *ca*. 250+ days per year (with downtimes for maintenance). MAS-DNP experiments require on-site personnel and was therefore prevented from use between March and June 2020. However, this time frame was used to carry out essential maintenance on the instrument – notably, the refurbishing of a helium compressor (from April to August 2020). The system was reopened for users in August 2020.

# 7. Pulsed Field Facility

The Pulsed Field Facility (PFF) is located in Los Alamos, New Mexico, at Los Alamos National Laboratory (LANL). The utilization of LANL and U.S. Department of Energy (DOE) assets enable us to provide world record pulsed magnetic fields to our international community of users – from undergraduate students through senior investigators. We provide our users with both robust scientific instrumentations engineered to operate in the transient pulsed magnetic field environment, and the support of scientists who are active researchers with expertise in high magnetic field-driven science. Our users also benefit from the strong complementary expertise and diagnostic capabilities of the DC Facility; often both facilities contribute to a given user's research. The two MagLab facilities are further connected by a common application process for the DC and PFF, by which experiments can be requested at either location under a single overarching scientific proposal.

|                                      | Capacitor Driven Pulsed Magnets |      |                    |                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |
|--------------------------------------|---------------------------------|------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Magnet System                        | Field                           | Bore | Duration<br>(FWHM) | Supported Research*                                                                                                                                                                                                                                                                                                                                                   |  |  |  |
| Cell 1<br>Cell 2<br>Cell 3<br>Cell 4 | 65T                             | 15mm | 20ms               | Magneto-optics (IR through UV)<br>Magnetization (susceptibility, extraction, tora<br>Magnetotransport (DC – MHz, GHz Conduction<br>Pulse Echo Ultrasound Spectroscopy<br>Fiber Bragg Grating Dilatometry<br>Polarization, Magnetocaloric<br>Temperature environments from 350mK to 30<br>For compatible techniques: Pressures up to 90<br>and in-situ sample rotation |  |  |  |
| Duplex Cell                          | 75T                             | 15mm | 5ms                | Same as above                                                                                                                                                                                                                                                                                                                                                         |  |  |  |
| Cell 5                               | 31.5T                           | 15mm | 1ms                | Magneto-optics (THz, free space)                                                                                                                                                                                                                                                                                                                                      |  |  |  |
| Single Turn                          | 300T                            | 10mm | Зµs                | IR and FIR Transmission, FBG Dilatometry,<br>Inductive Contactless Conductivity                                                                                                                                                                                                                                                                                       |  |  |  |
|                                      |                                 | G    | enerator Drive     | en Magnets                                                                                                                                                                                                                                                                                                                                                            |  |  |  |
| Magnet System                        | Field                           | Bore | Duration<br>(FWHM) | Supported Research*                                                                                                                                                                                                                                                                                                                                                   |  |  |  |
| 100T Multi-shot                      | 101T                            | 10mm | 15ms               | All techniques listed above                                                                                                                                                                                                                                                                                                                                           |  |  |  |
| 60T Controlled<br>Waveform           | 60T                             | 32mm | 100ms<br>(plateau) | Magnetothermal studies<br>(heat capacity and magnetocaloric)<br>FIR and THz optics<br>Larger Sample Volumes                                                                                                                                                                                                                                                           |  |  |  |

# Unique Aspects of Instrumentation Capabilities

Table 2.8: Pulsed field magnets available to users at the MagLab-PFF.

\*We will dedicate resources to work with users to develop and field new/novel techniques as needed in our magnet systems.

Table 2.8 lists the pulsed magnets available to users of the PFF. At the heart of the PFF's magnet activities is a fully multiplexed (recently updated from 6 to 8 output) computer controlled, 4MJ (32mF @ 16kV) capacitor bank. This capacitor bank is responsible for serving approximately 150 unique users per year with thousands of ~20 millisecond-long magnet pulses, which provide fields up to 65T. Additionally, this capacitor bank provides power to our newest short-pulse magnet, a 75T duplex magnet which is now available for users. Beyond our 65T short-pulse magnets, we provide users with access to the highest nondestructive magnetic fields in the world. The 100T multi-shot magnet is the first and only magnet in the world to successfully perform a magnetic field pulse to 100T in a nondestructive manner. The energy necessary – hundreds of megajoules – to run this highest field magnet is provided by LANL's 1.4GW AC generator, a unique pulsed power

supply. The AC rectification of the generator output enables the control of the pulsed power waveform, allowing for the optimization of the associated magnet systems – the 100T multi-shot magnet and 60T controlled waveform ("Long Pulse") magnet – and sample diagnostics. Beyond 100T, users have access to the semi-destructive 300T Single Turn magnet system (development and installation funding provided by LANL), which provides users with access to fields in excess of 100T; routinely pulsed up to 170T with a pulse duration of 6 microseconds.

#### Facility Developments and Enhancements

Inspection of the 1.4GW motor-generator's rotor in 2020 found a flaw in the conductor, which lead to the disassembly and inspection of the entire rotor with the intention to rewind it with new copper and insulation. This work was performed in the spring/summer of 2020. However, a subsequent internal flaw was found in the metal forging of the rotor, which will require a completely new rotor to be forged and wound to return the motor-generator to service. Since this finding, LANL and the PFF's management teams have been working on the necessary steps to procure a new rotor to allow for the return of our generator driven magnet operations.

While the generator is being repaired progress has continued on upgrades to the 100T outsert coils 1 and 2, where the winding and epoxy impregnation was successfully completed in 2020 by the magnet winding facility in Tallahassee. These upgraded coils, which were re-designed and wound with high-strength, nano-structured Cu-Nb conductor – about 50% stronger than the glidcop AL60 wires used in previous versions – are expected to add about 2T to the outsert field, decreasing the operating risk and increasing the lifetime of the 100T outsert magnet. The final steps of overwrapping the coils will be completed before the generator is back online. Upgrades to coils 3 and 4 for 60T Long Pulse (LP) are also progressing, with the completion of the winding and impregnation stages. A new path forward on the production of the large cross-section AL60

conductors needed for coil 7 of the 60T LP has been determined, which will lead to the production of enough conductor to wind the coil before the generator comes back online.

With the 100T and 60T LP offline, the NSF supported Magnet Surge has enabled the PFF to quickly design and construct capacitor bank driven magnets that will help fulfill some of the experimental needs of our users while the rotor is repaired. One such magnet, our 75T duplex magnet, has been providing users with fields up to 75T since February 2020 (Figure 2.32). This duplex magnet has two independent coils, each powered by a different subsystem of our 16kV, 4MJ capacitor bank – 1MJ and 3MJ to drive the inner and outer coil respectively. The modular design of the magnet reduces the voltage needed and provides more design flexibility to maximize the generated magnetic fields, while the cooling space between the inner and outer coils enables a short cooling time (~1hr) between pulses.

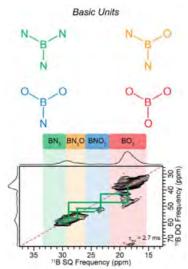


Figure 2.32: PFF postdocs prepare the duplex for a user experiment.

#### Major Research Activities and Discoveries

With the introduction of our newest capacitor bank driven magnet, the 75T duplex, our users have been able to resume high field studies beyond 65T here at the PFF. One of the first experiments to make use of this magnet was led by researchers at the University of Michigan to study the unusual high field metallic state of the Kondo Insulator YbB<sub>12</sub>. Despite being an insulator, magnetic quantum oscillations, suggestive of a Fermi surface, have been detected in this material, leading to a number of exotic theoretical predictions. Using the duplex magnet, the Kondo (insulating)

PFF

gap was closed, enabling the study of the high-field metallic state (Figure 2.33). Comparing the frequency of the quantum oscillations in both the insulating and metallic state, researchers concluded that all observed oscillations were originating from the same quasiparticle band. These results suggest a two-fluid picture in YbB<sub>12</sub> that includes charge-neutral fermions - contributing little or nothing to the charge transport - coexisting with normal (chargedfermion) electrons, providing strong constraints for existing theoretical models used to describe this material. For more detail see: Z. Xiang, L. Chen, K.-W. Chen, C. Tinsman, Y. Sato, T. Asaba, H. Lu, Y. Kasahara, M. Jamie, F. Balakirev, F. Iga, Y. Matsuda, J. Singleton, and L. Li "Unusual high-field metal in Kondo insulator", Nature **Physics** a (2021)doi.org/10.1038/s41567-021-01216-0.

#### **Research Science Highlights**

Smart non-linear transport helps users expand frontiers of superconductors

M. Leroux, F. F. Balakirev, M. Miura, K. Agatsuma, L. Civale, and B. Maiorov, *Phys. Rev. Appl.* 11, 054055 (2019).

Using a new 'smart' technique developed by PFF scientists for measuring non-linear transport in pulsed magnetic fields, critical currents in cuprates, iron- and new nickel-based superconductors have been studied up to 65T. This new technique has attracted many users both here in the USA, as well as Europe and Japan. Non-linear transport can be used to study many systems such as topological materials and charged density waves. In superconductors, measurements of non-linear electrical transport can reveal important information about their current-carrying properties. However, during these measurements, sudden

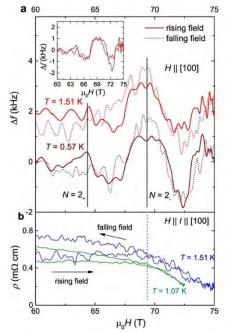


Figure 2.33: a) RF measurements of YbB<sub>12</sub> obtained in the duplex magnet. The lowest pair of Landau levels (N =  $\pm$ 2) are shown. The insert shows a small amplitude difference of the N =  $\pm$ 2 levels between T=0.57K and 1.51K suggesting a non-diverging quasiparticle mass. b) Magnetoresistance measurements show A downward kink at ~ 68T and coincides with the N=-2 sublevel. This slope change may indicate a crossover to an unknown high-field state.

changes in sample voltage near the superconducting transition can destroy the sample. Thus, until now transport experiments of superconductors in pulsed field have been limited to very low currents. To solve this problem, a new technique was developed using fast programmable gate arrays (FPGAs) that varies the current in response to changing sample voltage in less than 10ns, allowing measurements of several non-destructive current-voltage curves in a single 65T magnetic field pulse (~ 50ms). These measurements ultimately unveiled novel dynamic vortex responses as a consequence of fast-changing pulsed magnetic fields (Figure 2.34).

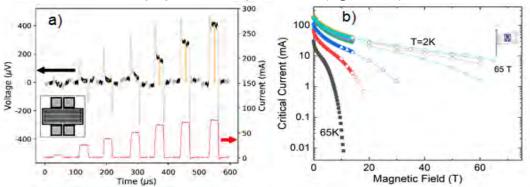


Figure 2.34: (a) Fast programmable gate arrays (FPGA) were used to produce current-voltage (I-V) curves at peak field of 30T during a magnet pulse by using short pulses of current. (b) Critical current vs. magnetic field at different temperature for a superconducting YGdBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> thin film.

Observation of cyclotron resonance and measurement of the hole mass in optimally doped La $_{\rm x}Sr_{\rm x}CuO_4$ 

K. W. Post, A. Legros, D. G Rickel, J. Singleton, R. D. McDonald, X. He, I. Bozovic, X. Xu, X. Shi, N. P. Armitage, and S. A. Crooker, *Phys. Rev. B* 103, 134515 (2021).

Cyclotron resonance (CR) studies complement existing experimental methods for measuring the band structure of metals, such as angle-resolved photoemission, quantum oscillation studies, and heat capacity, and help to disentangle the important role of electronic correlations in high temperature superconducting cuprates (HTSCs). Unfortunately, direct detection of CR in these materials has proven challenging due to the relatively heavy carrier masses, short scattering times, and the high magnetic fields needed (many tens of tesla) to detect CR in the superconducting low temperature state. By combining pulse magnetic fields and THz time-domain spectroscopy

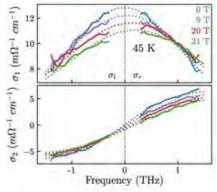


Figure 2.35: Optical conductivity from LSCO up to 31T at 45K. A clear cyclotron shift is observed, along with broadening and an amplitude reduction. The dashed lines are fit to a cyclotronactive two-fluid model.

researchers and users of the PFF were able to study the cyclotron resonance (CR) of holes in the normal state of high-quality thin films of optimally doped La<sub>2-x</sub>Sr<sub>x</sub>CuO<sub>4</sub> (x = 0.16) (Figure 2.35). Since quantum oscillations have never been detected in La<sub>2-x</sub>Sr<sub>x</sub>CuO<sub>4</sub>, even to fields up to 80T and temperatures down to 4K, this is the first measurement of a cyclotron mass in this family of cuprate superconductors. These results open the door to studies aimed at characterizing the degree to which electron-electron interactions influence carrier masses in cuprate superconductors.

# Facility Plans and Directions

#### New 30kV, 1.2MJ capacitor bank

Funding from the Magnet Surge has also enabled the PFF to upgrade its power infrastructure with the planned commissioning of a new 30kV, 1.2MJ capacitor bank in 2022. The new capacitor bank will be integrated with the existing 16kV, 4MJ bank allowing for the development of higher field capacitor bank-driven duplex magnets. Preliminary designs for an 85T duplex magnet are complete, with expected final designs in 2021. In addition to providing users with fields above 75T, the development of a higher field duplex magnet will help the PFF establish the technology and

in-house experimental technique development that is necessary for realizing higher field 100T inserts.

#### Generator subsystem activities

During the generator downtime, the PFF's power delivery team is reviewing all motor-generator subsystems and developing a plan for future maintenance and upgrades that will ensure reliable operation of the entire system once the rotor is returned. Importantly work has also begun on the final steps of a multi-year project to replace the drive and exciter (Figure 2.36), two major components of the motor-generator system which had reached their end of life.



Figure 2.36: The new exciter being unpacked before installation.

#### Development of 60T Mid-pulse magnet

Efforts are under way for the development of a 60T Mid-Pulse (MP) magnet to fulfill some of the experimental needs formerly met by the 60T LP. Although shorter in duration than the 60T LP, the 60T MP will provide users with an approximately 3x longer pulse duration (300msec pulse length, FWHM ~ 70msec, Figure 2.37) than what is available with the 65T magnets. This magnet is currently in the prototype and testing phase.

# Outreach to Generate New Proposals-Progress on STEM and Building User Community

Despite the reduction in in-person outreach events, PFF staff took part in a number of outreach activities throughout the year, including the fourth annual Los Alamos National Laboratory Summer Physics Camp for Young Women, a free camp that introduces young women from Northern New Mexico communities to STEM disciplines via hand-on experiments and lectures. During this camp, which was held via video conference, PFF scientist Vivien Zapf spent several hours with students sharing about the MagLab, giving a

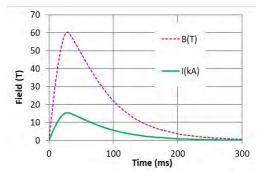


Figure 2.37: Proposed field vs time profile for the newly designed 60T mid-pulse magnet.

lecture on electricity and magnetism, and helping the students building different electrical and magnetic devices. Due to the shift to online outreach, staff scientist and PFF user program director Laurel Winter spoke about her career path and the PFF as part of the MagLab Summer Exploration Series hosted by the MagLab-Center for Integrated Research and Learning (CIRL), an online science enrichment program for middle and high school students around the country.

#### Facility Operations Schedule

Jointly with the DC Facility, the PFF solicits proposals through a common call three times a year to streamline the application process and ensure availability of resources (both staff scientists and magnets). Hours of operation for the capacitor bank driven pulsed magnets are Monday through Friday, 8:00am to 7:00pm, with extended after-hours until 11:00pm upon request. Maintenance is scheduled each Monday from 8:00am to 10:00am, or on an as needed basis. Generally, no more than three pulsed magnets (including the duplex) are scheduled for a user experiment in given week to enable rapid turnaround and continuation of an experiment following a magnet failure. Due to the COVD-19 pandemic user operations were suspended from Mid-March through June; thereafter user operations resumed in a reduced capacity of two pulsed magnets in operation a week. These were run entirely virtually, with users participating remotely in the planning, while the experiments were run by on-site user support staff. Users are anticipated to remain offsite until at least the middle of 2021.



# 3.1. EDUCATION AND OUTREACH

Despite the unique challenges brought on by a world-changing pandemic, the Center for Integrating Research and Learning (CIRL) successfully continued our efforts to build the STEM workforce through programs, evaluation, and research. Because this year has been different from previous years, the structure of our chapter will be slightly different. Our K-12 educational outreach programs (field-trips, classroom visits) were not affected until the last two months of the school year so we will discuss those efforts first. Then we will discuss the programs that we created and/or altered to address the needs of students and postdocs and the constraints of the pandemic. Finally, our evaluation and research efforts provided much needed insights into the impact, and potential, of virtual education and outreach programs.

The MagLab's work towards building the STEM workforce would not be possible without the dedication of CIRL staff whose leadership and expertise allows us to provide high-quality, research-based programs in education, evaluation and research. CIRL staff had several noteworthy accomplishments in 2020, including:

- Carlos R. Villa (K-12 Education Director) continued his term as the regional chair for the Florida Association of Science Teaching, leading science education efforts across the state and nationally. He also continues to serve on the board of the local Big Bend/Leon Association of Science Teachers.
- Kari Roberts (CIRL Evaluator) continued her terms on both the FSU ORCID committee and Postdoctoral Affairs committee, wherein she utilizes data gathered for MagLab programs to inform decisions at the institutional level.
- Dr. Roxanne Hughes (Director of CIRL) was elected as vice chair to the American Physical Society's Forum on Outreach and Engaging the Public, wherein she will use CIRL's research

to inform national efforts for physics educational outreach.

#### K-12 Programs for Students

CIRL provides three different of educational forms outreach to K-12 classrooms: (1) educational kits that teachers can borrow and use to supplement their teaching; (2) CIRL Staff and MagLab scientists' visits to local classrooms; and (3) field trips to the MagLab. These programs are facilitated by our K-12 Education Director, Carlos. Classroom outreach aims to both teach students about the research being done at the MagLab and build excitement about STEM topics through engagement



Figure 3.1: Video demonstrations for the classroom kits feature MagLab educators showing how the materials are packed, and how they can be used in the classroom.

in hands-on science activities. Each activity includes an overview of the MagLab and the types of research conducted there, and an introduction to a specific topic followed by an open-ended inquiry activity. Each visit concludes with a review of the phenomena demonstrated during the activity, and a question-and-answer session.

# 1. Loaner Kits for Classrooms

To increase access to our K-12 outreach efforts, CIRL created duplicate sets of the materials needed for our outreach activities. These kits are available at no cost upon request and are mailed to the requesting teacher anywhere in the US. Each set of materials is supplemented with a printed version of our Pre- and Post- visit activities, as well as directions for accessing an online video that models the use of the materials (Figure 3.1). This allows teachers to borrow and use the same materials Carlos uses during our extremely popular outreach activities, and significantly broadens our outreach capacity. During the 2019-2020 school year, 12 teachers requested kits, of which 50% were at Title I schools. The most popular requested activity was *Build an Electromagnet*, making up 42% of all the loaner kit requests.

# 2. Classroom Outreach

Tallahassee, FL

Classroom educational outreach is recorded based on the school year as opposed to the calendar year. Teachers can request on-site field trips for their students, or they can request that Carlos come to their classroom to conduct a MagLab lesson. During the 2019-2020 school year<sup>1</sup>, Carlos provided outreach to 4,904 students. Of these students, 62.3% were enrolled at Title I schools<sup>2</sup>. During this school year, almost two-thirds of our outreach occurred on site through field trips and tours of the Tallahassee facilities. The most requested activities in 2019-2020 were *Build an Electromagnet* for the fifth year in a row, followed by *Electricity, Static, and Currents,* and *Nature of Science<sup>3</sup>*. Most participating classrooms came from elementary schools (34%), followed by middle schools (24%), and high school classes (11%). The remaining 31% was made up of mixed grade classes. Participating schools came from 16 different school districts in Florida and Georgia. Gainesville, FL

The High B/T Facility and the Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) Facility at the University of Florida also provided classroom outreach throughout the 2019-2020 year, conducted and facilitated by Amy Howe. Over 400 students participated in hands-on materials with UF Staff, all from Title I schools. For the 2019-20 school year only two activities were requested: *Magnet Exploration* (33%) and *Build an Electromagnet* (67%). Approximately 75% of these lessons were presented to elementary students, and the remaining 25% of the presentations made to high school students. In addition to classroom visits, the UF staff also participated in science fairs, science nights, and career panels, including Talk Science with Her at First Magnitude brewery in Gainesville, held in conjunction with the United Nations International Day of Women and Girls in Science.

Los Alamos, NM

As with elsewhere, the 2020 pandemic prevented staff at the Pulsed Field Facility (PFF) from going local into classrooms and partaking in local community events. Despite this shut down, staff scientist Vivien Zapf was still able to give a virtual electricity and magnetism demonstration to a group of 20 girls as part of a local Northern New Mexico Summer Physics Camp for Young Women. The switch to virtual events allowed PFF staff to participate in programs that reached students across the nation. For example, Dr. Zapf took part in a career panel for women in STEM held

<sup>&</sup>lt;sup>1</sup> The 2019-2020 school year was shortened due to the closure of in-person schooling as a precautionary measure in the early stages of the COVID pandemic. This caused the pause of the MagLab's in-person classroom outreach and field trip programs until conditions allow for safe visitations. The date of the last in-person outreach program offered in 2020 was on March 5<sup>th</sup>.

<sup>&</sup>lt;sup>2</sup> A Title I school is a school receiving federal funds for low-income students determined by the number of students enrolled in the free and reduced lunch program.

<sup>&</sup>lt;sup>3</sup>For more information on the activities listed and all of CIRL's outreach activities please visit the outreach website: <u>https://nationalmaglab.org/education/teachers/classroom-outreach-2</u>.

virtually by the University of California. And staff scientist and PFF education representative were able to participate in the MagLab Summer Exploration series hosted by CIRL, where she spoke about her career path and the PFF for middle and high school students.

#### 3. Fieldtrips

One of our goals for 2019-2020 was to increase visits of school groups to the MagLab. Despite the disruptions resulting from COVID, 59.3% of all educational outreach included field trip visits to the MagLab. Figure 3.3 shows the percentage of classroom and on-site outreach over the past six years. Figure 3.2 shows Carlos engaging a school group in a hands-on demonstration of electromagnetism, an example of a typical field trip activity. Students then participate in a scientist-led tour. Introducing them to potential role models and teaching them about the research being conducted at the MagLab. This form of outreach continues to be a way to introduce new audiences to the MagLab with 79.1% of fieldtrip students indicating that their fieldtrip was their first time at the MagLab.

#### 4. Communicating Outreach: MagLab Educators Club

The MagLab Educators Club is CIRL's primary method of distributing announcements



Figure 3.2: CIRL Director of K-12 Programs discusses electromagnets with a group of students during a MagLab field trip.

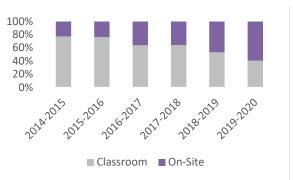


Figure 3.3: Percentage of classroom and on-site outreach over past six years.

about our outreach programs and opportunities to the local and international community of education professionals. In addition, this year the Educator's Club members were sent information and resources that provided online content to assist recipients in virtual teaching, and invitations to join in the virtual workshops that were offered. The mailing list was also operated through an email automation software for the first time, which allowed CIRL to create visually stunning emails and helped to track their effectiveness. Currently the Educator's Club has over 500 members and averages more than 1,000 reads (including email forwards to students and parents) demonstrating the high level of interest in MagLab programs.

# K-12 Outreach Response to COVID

# 1. Initial COVID Response Spring 2020: Virtual Presentations

When schools shut down across the country in March 2020, CIRL was able to respond immediately to help teachers, students and parents with online activities that could supplement their science learning. Carlos held three workshops for parents and teachers to assist them in doing science with their children in March and April. In the virtual *Encouraging a Sense of Wonder: Science for Young Learners*, Carlos showed parents questioning techniques to inspire their young children to look at the world around them through a scientist's eyes. Examples were given on how toys can be used to model physics and how they can help their children create investigations using common items around the home. A second session, entitled *SciGirls STEM* was offered to educate parents on the gender gap in STEM careers and provide activities and mindsets that can improve

girls' interest and sense of belonging in STEM. This session was modeled after the national SciGirls program, for which Carlos is a certified SciGirls instructor. The third presentation, A STEP UP Workshop, was part of STEP UP, a national initiative to increase the participation of girls in physics. Carlos is a STEP UP Ambassador, and as such, collaborates with a national community of physics teachers to deliver high school physics lessons to empower teachers, create cultural change, and inspire young women to pursue physics in college. During this presentation Carlos guided participating teachers through two lessons that could be used in their classrooms to help students reflect on the careers available to physicists and the ways in which girls can feel empowered to pursue these fields.

# 2. Summer 2020

Summer Exploration Series. Almost immediately after the call to shift to remote learning, CIRL began working on a safe program option to replace our in-person summer camps. The result was the MagLab Summer Exploration Series (SES) - an interactive virtual STEM program for middle and high school students. This 10-week program highlighted different research areas of the MagLab with live and asynchronous options for participants. All live activities were conducted via Zoom, which provided a platform for students to actively participate in sessions from any location. To accommodate all schedules, sessions were recorded and linked on the MagLab website. Since traditional summer camps can play a crucial role in maintaining youth's interest in STEM, the Summer Exploration Series was designed with the same goals as our summer camps: to maintain interest in STEM and engage youth in activities that connected them with STEM professionals and authentic STEM challenges. Each week focused on a specific research topic. Mondays were devoted to an introduction of the topic and the weekly challenge, along with SES hosts Carlos and Roxanne Hughes and a scientist or engineer who works in an area related to the week's topic. On Tuesdays, participants were given links to MagLab tutorials and videos to help them with their challenge. Many of these websites were educational content on Magnet Academy that connected with the topic of the week. On Wednesdays, Ask Me Anything interviews were conducted with a MagLab scientist or engineer. Participants were invited to ask the scientist or engineer questions about anything at all, ranging from their favorite part of their job, to their snack of choice. On Thursdays, participants viewed a prerecorded career interview. Finally, on Fridays, the hosts would showcase the challenges submitted by participants that week. Table 3.1 presents the full list of topics and presenters. At the conclusion of the program, students were mailed prizes for their participation in the challenges.

| Dates  | Торіс                        | MagLab Guests                                                                                          |
|--------|------------------------------|--------------------------------------------------------------------------------------------------------|
| Week 1 | MagLab Overview              | Alfie Brown (Safety), Tim Murphy (DC Field)                                                            |
| Week 2 | Introductory Physics         | Rachel Richardson (CMS Student), Shalinee Chikara<br>(DC Field)                                        |
| Week 3 | Electromagnetism             | Tim Murphy (DC Field), Dave Graf (DC Field), Laurel<br>Winter (Pulse Field)                            |
| Week 4 | Magnet Science & Technology  | Todd Adkins (MS&T), Kikelomo ljagbemi (MS&T<br>Student), Tom Painter (MS&T)                            |
| Week 5 | Engineering at the MagLab    | Bryon Dalton (Magnet Operations), Morgan Oliff<br>(Machine Shop), Thierry DuBroca (EMR)                |
| Week 6 | Superconductors & Cryogenics | Ernesto Bosque (ASC), Daniel Davis (ASC), Wei Guo<br>(Cryogenics) Jamel Ali (Condensed Matter)         |
| Week 7 | Materials Science            | Alyssa Henderson (Materials), Abiola Oloye (ASC<br>Student), Jun Lu (MS&T), Elizabeth Green (DC Field) |

 Table 3.1: Summer Exploration Series Topic and MagLab Staff Participation

| Dates   | Торіс                                  | MagLab Guests                                                                      |
|---------|----------------------------------------|------------------------------------------------------------------------------------|
| Week 8  | Biomedical & Pharmaceutical            | Faith Scott (NMR), Huan Chen (ICR), Sam Grant (NMR)                                |
| Week 9  | Biology & Chemistry                    | Martha Chacon (ICR), David Hike (NMR Student),<br>Ryan Baumbach (Condensed Matter) |
| Week 10 | Environmental & Earth/Space<br>Science | Pete Morton (Geochemistry), Sydney Niles (ICR), Munir<br>Humayun (Geochemistry)    |

Magnet Academy. The Magnet Academy is the outreach portion of the MagLab's website. Magnet Academy provides lesson plans, science demonstrations, and interactive activities for teachers, students, and parents. This page became a vital part of the Summer Exploration Series, with many of Tuesday's links connecting to tutorials, videos, or articles in Magnet Academy. Additionally, teachers used many of the videos during distance learning to demonstrate scientific principles. Table 3.2 shows the increase in page views for Magnet Academy over the previous year. Overall traffic increased dramatically in 2020, up more than 50% from 2019. The Try This at Home and Watch and Play sections each had a significant increase of traffic, 68% and 74% respectively. The highest increase was for the Follow the Links section, which saw an increase in views of 130%.

 Table 3.2: Pageviews for Magnet Academy

| MagLab Magnet<br>Academy Section | 2019 Pageviews | 2020 Pageviews | Change   |
|----------------------------------|----------------|----------------|----------|
| Magnet Academy                   | 662,868        | 1,000,436      | +50.92%  |
| Watch & Play                     | 380,179        | 662,502        | +74.26%  |
| Learn the Basics                 | 36,234         | 37,011         | +2.14%   |
| Explore History                  | 169,935        | 172,126        | +1.29%   |
| Try This at Home                 | 45,332         | 76,479         | +68.70%  |
| Plan a Lesson                    | 18,225         | 26,314         | +44.38%  |
| Follow the Links                 | 3,446          | 7,949          | +130.67% |

SciGirls STEM Adventures. One of our longest running middle school programs is our SciGirls summer camps. In 2020, CIRL worked with our partner WFSU to create a television program to bring the message of SciGirls to our local Tallahassee community. Thanks to a generous donation from

ATKINS Engineering, we were able to produce five 30-minute programs that highlighted local STEM education organizations, starting with the MagLab. Each episode included footage of the STEM organization, an interview with a female scientist role model, an interview with a SciGirls alumna that is now working in a STEM career, and a hands-on activity which was pre-recorded and conducted by a recent SciGirls alumna. Figure 3.4 shows a screenshot of Nia Terry a Tallahassee High School student interviewing (SciGirls 2019) Maati McKinney currently attending Spelman College in Atlanta (SciGirls 2011).



Figure 3.4: SciGirls alums Nia Terry (left) and Maati McKinney (right) discuss Maati's experience as a mathematics major at Spellman College.

# 3. Fall 2020

Middle School Mentorship. One of CIRL's premier educational and mentoring programs is our Middle School Mentorship program wherein local Tallahassee students are paired with a MagLab scientist to work on a research project for a full semester. In the Fall of 2020, CIRL transitioned the highly competitive MagLab Middle School Mentorship Program to an online format to enable students to have a science experience while maintaining social distancing protocols. The

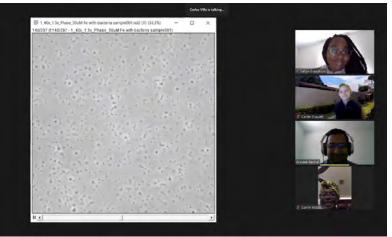


Figure 3.5: Middle School Mentorship students analyze motility of salmonella data durina an experiment done through Zoom.

program included 17 students from 12 middle schools in Leon and Gadsden counties (FL), while 11 MagLab staff participated as mentors in this program. Mentors were able to translate the mentorship experience into the virtual space using two approaches: 1) working as a group to develop an experiment that the mentor would run, followed by students analyzing the resulting data with input from their mentor; and 2) working together online with materials that were sent to the students' homes as their mentors guided them through video conferencing. All of these mentors were incredibly creative and flexible as we worked through a unique form of mentoring.

Carlos facilitated weekly Zoom meetings wherein students met with their mentors every Friday morning for the entire fall semester. The program culminated in a virtual poster presentation session attended by the students' family, teachers, principals, and mentors. A full list of 2020 participants and their projects can be found on our website and in Table 3.3 below. A screenshot of two students working with their mentors can be seen in Figure 3.5.

| Students & School                                                                                                   | Research Area                                                                          | Mentors                                             |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------|
| Selena Humayun (Swift Creek Middle)<br>Khamari Williams (Florida A&M University School)                             | Building an efficient DC Motor                                                         | Elizabeth Green                                     |
| Alisa Gubanova (Florida State University School)<br>Jonjon She (Deerlake Middle)                                    | Optimization of Electromagnets<br>using different materials                            | Daniel Davis                                        |
| Blake Rehbein (Tallahassee School of Math and<br>Science)<br>Kayla Washington (Gadsden Elementary<br>Magnet School) | Coding Physics                                                                         | Dmitry Semenov                                      |
| Anthony Jimenez (Fort Braden School)<br>Toshmon Stevens II (Raa Middle)                                             | Everyday Materials:<br>Microstructural Analysis                                        | Abiola Oloye                                        |
| Carter Brazzell (School of Arts and Sciences)<br>Corrin Hobbs (Florida A&M University School)                       | Comparing the Motility of<br>Salmonella typhimurium Before<br>and After Ingesting Iron | Jamel Ali, Prateek<br>Benhal, & Saliya<br>Grandison |
| Sagar Bhat <i>(Fairview Middle)</i><br>Nishi Bhanderi (Maclay)<br>Liliana Vizcarrondo (Montford Middle)             | Quantum Computing                                                                      | Paul Eugenio                                        |
| Samitha Balireddy (Fairview Middle)<br>Nicole Beam (Swift Creek Middle)                                             | Exploration of Ultra-Low-Noise DC<br>Power Supply                                      | Guangxin Ni &<br>Christina Schiffert                |
| Sofia Evers (Maclay)<br>Viswa Janapati (Fairview Middle)                                                            | Classification of Unknown<br>Materials using the Experimental<br>Method                | Robert Walsh                                        |

Table 3.3: Middle School Mentorship 2020

Note: Italics denote Title I schools

High School Externship, In 2020, CIRL formalized the High School Externship program to facilitate an increased number of extern opportunities for local high school students. Several high schools in the Tallahassee area offer externship programs where students receive coaching on working in a professional setting through a course at their school, and are placed with a professional in their community to gain real-world experience in a field in which they are interested. CIRL partnered with these local high schools to provide placements for students looking for an externship opportunity in science and engineering. Local high school students contacted Kari to express their interest in securing an externship placement at the MagLab. She helped each interested student identify a potential mentor, then coached the students on how to contact and make connection with potential mentors. Twelve students are currently participating in this program. During the school year, CIRL has helped mentors develop projects for the students that align with their interest and ability levels, provided guidance to the mentors on mentoring in a virtual environment, and connected students to additional resources as needed. Externship students will continue working with their mentor through the spring semester of 2021 and will present a final poster describing the work they have done with their mentor over the course of the school year. A full list of students and mentors are presented in Table 3.4.

| Table 3.4. High School Externs | 111p 2020-2021                |                      |
|--------------------------------|-------------------------------|----------------------|
| Student                        | School                        | Mentors              |
| Nicholas Bosque                | Lincoln High School           | Dmitry Semenov       |
| Spencer Gibbs                  | Maclay School                 | Kaya Wei             |
| Aaron Hoak                     | Lawton Chiles High School     | Jun Lu               |
| Antariksha Krishnan            | Lawton Chiles High School     | Rama                 |
| Annette Lu                     | Maclay School                 | Ilya Litvak          |
| Alexus Manners                 | Lincoln High School           | Martha Chacon Patino |
| Katie Matthews                 | Maclay School                 | Jamel Ali            |
| McKenna Parker                 | Lincoln High School           | Martha Chacon Patino |
| Vamsi Posinasetty              | James S. Rickards High School | Kari Roberts         |
| Timi Sobanjo                   | Lawton Chiles High School     | Jamel Ali            |
| Azaria Varnado                 | Lawton Chiles High School     | Bianca Trociewicz    |
| Audrey Wright                  | Lawton Chiles High School     | Tom Painter          |
|                                |                               |                      |

Table 3.4: High School Externship 2020-2021

Note: Note: Schools in italics are Title I schools

Although we were able to hold three virtual K-12 programs in 2020, we made the decision to cancel the following programs: Research Experience for Undergraduates, Research Experience for Teachers. In discussions with our scientist mentors and local administrators we felt that these research experience programs were most impactful when participants can come and work side-by-side with scientists at the MagLab. Many of our scientist mentors did not believe that they could transition to virtual programming in time for the summer. To honor their time and research priorities, we believed that canceling the summer in-person programs was the safest option for everyone. Despite the cancellation of summer camps and the REU and RET programs, the diversity of participants in the remaining virtual programs was worth of highlighting and can be found in Table 3.5.

| Table 3.5: Demographics for Programs held in 2 | 020 |
|------------------------------------------------|-----|
|------------------------------------------------|-----|

|                                         | Total                        | %<br>Women | % African<br>American | %<br>Hispanic | % American<br>Indian/Native<br>Hawaiian |
|-----------------------------------------|------------------------------|------------|-----------------------|---------------|-----------------------------------------|
| Middle School Mentorship<br>(Fall 2020) | 17 middle school<br>students | 47.1%      | 23.5%                 | 17.6%         | 0%                                      |
| Externship (2021-2022<br>academic year) | 12 high school<br>students   | 58.3%      | 16.7%                 | 8.3%          | 8.3%                                    |

|                                            | Total            | %<br>Women | % African<br>American | %<br>Hispanic | % American<br>Indian/Native<br>Hawaiian |
|--------------------------------------------|------------------|------------|-----------------------|---------------|-----------------------------------------|
| Summer Exploration Series<br>(Summer 2020) | 86 K-12 students | 39.0%      | 16.9%                 | 7.2%          | 4.8%                                    |

# Graduate Students and Postdocs

Prior to March 2020 CIRL provided traditional, in-person support through professional development and mentoring for MagLab graduate students and postdocs, including one in-person workshop for these early career scientists. Kari tailored the Inclusive Graduate Education Network (IGEN) training that she participated in at the National Postdoc Association meeting for MagLab mentees and mentors. CIRL's workshop, *Optimizing Mentoring Relationships by Aligning Expectations*, covered key issues for mentors and mentees, such as how to set expectations and goals for a mentoring relationship. It also provided a space for mentees and their mentors to develop tools and strategies for maximizing their relationship to accomplish their goals while at the lab. The workshop was positively received, and both mentees and mentors expressed interest in seeing more of the curriculum. Roxanne Hughes and Kari have been working with representatives from the Center for the Improvement of Mentored Experiences in Research (CIMER) who are leading an NSF funded effort to update the IGEN curriculum for national labs. Throughout 2020, they worked with representatives from Argonne National Lab and NASA Jet Propulsion Lab to adapt the IGEN mentoring curriculum and piloted the updated curriculum with a small group of MagLab faculty in November 2020.

#### Scientist Outreach

In 2020, 54 scientists and staff reported conducting outreach to communicate information about the MagLab to the community. Together, these scientists reached 1,942 people in 2020, the majority (54.4%) of which were K12 students. Of the 54 scientists who conducted outreach in 2020, 32 conducted long-term outreach working with K12 or undergraduate students. These scientists mentored a total of 57 individuals this year. Of these individuals, 40 (70.2%) were matched with their mentor through a CIRL program.

One of our most noteworthy examples of this was Julia Smith, DC Field, who partnered with the Leon County Public Library to host a monthly science night at the Leon County main library branch. Two science nights were hosted inperson in January and February 2020. Figure 3.6



Figure 3.6: Julia Smith asks two young STEM learners questions during MagLab Science Night at the Library in January 2020.

shows one of these science nights. At these sessions, community members participated in a handson science activity led by Julia Smith. For the 2020-2021 school year, Julia Smith has translated these science nights into virtual outreach programs for families and students. Julia Smith presents an activity via a live Zoom session, and attending students are encouraged to try the activity on their own. Any student who completes the activity and sends Julia Smith a photo, video, or description of their results receives a prize.

# Evaluation and Research

# 1. Evaluation

Evaluation for MagLab educational programs is conducted by Kari Roberts, using the latest guidance and best practices for evaluation as outlined by experts in evaluation and the social sciences, and the National Science Foundation. All education programs at the lab are evaluated, and results are shared with program managers every year to allow for data-driven decision-making in planning programs for future years. Primary metrics for each program are determined based on the program's goals and mission and measured using appropriate methodology. Evaluation methodology for each program conducted in 2020 is described briefly below in Table 3.6.

 Table 3.6: Evaluation Description for MagLab Education and Outreach Programs

 Program
 Form of Evaluation

| Program                                                    | Form of Evaluation                                                                                                                                                                                                                                |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Classroom outreach                                         | Post-survey to teachers after outreach conducted (formative evaluation), post-survey to students who come to the lab for outreach.                                                                                                                |
| Summer Exploration<br>Series                               | Weekly surveys to participants, post-program survey, and web platform<br>metrics which measure student's attendance in SES events, engagement at<br>SES events, participant satisfaction, and participant knowledge of new topics<br>and careers. |
| Middle School<br>Mentorship                                | Pre-/Post-survey measuring STEM Identity, STEM Self-Efficacy, perceptions of scientists and science careers.                                                                                                                                      |
| Graduate<br>Student/Postdoc<br>Professional<br>Development | Survey to current postdocs in conjunction with the lab's climate survey to determine professional development needs and assess mentoring and regular tracking of graduate students and postdocs to determine career trajectories.                 |
| Winter Theory School                                       | Post-survey assessing participants perceived value of the Winter Theory<br>School and how they will apply what they learned in the program.                                                                                                       |
| Open House                                                 | Post-experience surveys and brief interviews given to attendees of the annual Open House to assess perceived benefits of the annual Open House and provide feedback for future years.                                                             |

The pivot to online programming in 2020 posed new challenges for program evaluation of informal science education (ISE) programs. ISE summer programs across the country, including those in CIRL, were required to rapidly shift focuses and formats. Program evaluation design traditionally shifts with programs as they change, and rapid changes in programs required an equally rapid shift in program evaluation methodology. Thanks to the structure of CIRL and the center's history of commitment to data-driven decision making and program design, we were able to maintain the established rigor in program evaluation design at a time when other centers were not. The program that marked the most significant change to its pre-COVID counterpart was the Summer Exploration Series (SES). Kari worked in tandem with the SES program director and Roxanne Hughes to develop an appropriate evaluation methodology as the program took shape and evolved.

The primary goals of the SES evaluation plan were to:

- 1. Assess whether the program goals had been met.
- 2. Measure the attendance and engagement for each activity in the program.
- 3. Measure student perceptions of each activity in the program.
- 4. Provide data-driven suggestions for improving the program should CIRL choose to run the program again in future years.

In order to accomplish these goals, the evaluation plan leveraged several data sources, each of which is presented in Table 3.7.

Table 3.7: Summer Exploration Series Evaluation Tools and Metrics

|                                 | riselles Evaluation roois and Metrics                                                                                   |                                                          |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Tool                            | Frequency and Timing                                                                                                    | Associated Metrics                                       |
| Program Registration Form       | Students completed this form one time at the beginning of their participation.                                          | Demographics                                             |
| End of Week Survey              | Students completed this survey once per week, at the end of each week of the 10-week program.                           | Student Satisfaction,<br>Attendance, Student<br>Learning |
| End of Program Survey           | Students completed this survey once at the end of the program. This survey was combined with the Week 10 weekly survey. | Student Satisfaction                                     |
| YouTube Metrics                 | Metrics were pulled by the manager of the MagLab<br>YouTube channel once per week, for the previous<br>week's metrics.  | Attendance and<br>Engagement                             |
| Zoom Attendance<br>Reports      | Attendance reports were downloaded after each session and reviewed by the evaluator once per week                       | Attendance                                               |
| Zoom Chat Transcripts           | Chat transcripts were downloaded after each session<br>and reviewed by the evaluator once per week                      | Engagement                                               |
| Weekly Challenge<br>Submissions | Program Manager uploaded the submissions each week and reviewed by the evaluator once per week                          | Attendance                                               |
|                                 |                                                                                                                         |                                                          |

Operational definitions for attendance and engagement were developed prior to the start of the program. Calculation of these metrics leveraged YouTube metrics, Zoom reports (attendance and chat), and the weekly challenge submissions. Table 3.8 reports which data collection methods were used to measure attendance and engagement for each element of the SES program.

#### Table 3.8: Evaluation Data Collection

| Program<br>Element              | Operational<br>Definition of Attendance                                                                       | Data<br>Source for<br>Attendance | Operational<br>Definition of Engagement                                                                       | Data<br>Source for<br>Engagement |
|---------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------|
| MWF Live<br>Sessions            | Attendance count at live session                                                                              | Zoom<br>attendance<br>summary    | Number of relevant<br>questions asked by<br>students                                                          | Zoom chat<br>transcript          |
| Tuesday<br>Links<br>Exploration | Count of students who<br>self-reported that they<br>completed the Tuesday<br>activity on the weekly<br>survey | YouTube<br>metrics               | Audience Retention/<br>average percent of video<br>watched in each week<br>(Monday to Sunday of<br>each week) | YouTube<br>metrics               |
| Thursday<br>Career<br>Videos    | Unique viewers of the<br>videos in each week<br>(Monday to Sunday of<br>the week)                             | YouTube<br>metrics               | Audience Retention/<br>average percent of video<br>watched in each week<br>(Monday to Sunday of<br>each week) | YouTube<br>metrics               |
| Weekly<br>Challenge             | Count of challenge<br>submissions for each<br>week                                                            | Challenge<br>submissions         | None                                                                                                          | None                             |

The final evaluation plan resulted in the collection of rich quantitative and qualitative evaluation data which provided valuable feedback on all elements of the program (both during and after the program concluded), as well as insights into the success of the program overall. At the conclusion of the program, CIRL was able to use the results of the evaluation to make data-driven decisions on how this program should be modified in the future. Additionally, the unique experience of evaluating a program in a purely virtual setting yielded valuable insights on how traditional evaluation methodology can be adapted to provide feedback to informal educators who continue to navigate an uncertain future with virtual programming. CIRL plans to disseminate the lessons learned from the evaluation of the SES plan to a national audience via publications and conference presentations in 2021.

# 2. Educational Research

A cornerstone of CIRL's programs is that they are developed based on research conducted by CIRL staff. Our research not only informs our MagLab programs but adds to scholarship for K-16 informal STEM education and mentoring programs nationally. In 2020, Roxanne Hughes continued to lead CIRL's research efforts focusing on the impact of informal STEM education programs on participants' STEM identity. In 2020, CIRL staff had two publications that added to the STEM identity dialogue.

- Hughes, R., Schellinger, J., Billington, B., Britsch, B., & Santiago, A. (2020). A Summary of Effective Gender Equitable Teaching Practices in Informal STEM Education Spaces. Journal of STEM Outreach, 3(1). https://www.jstemoutreach.org/article/18529-a-summary-of-effective-gender-equitable-teaching-practices-in-informal-stem-education-spaces
- Hughes, R., Schellinger, J., & Roberts, K. (2020). The Role of Recognition in Disciplinary Identity for Girls. Journal of Research on Science Teaching. DOI:10.1002/tea.21665

In 2020, Roxanne Hughes became a co-PI on an NSF Quantum Convergence grant. She is working along with Tim Murphy and Amy McKenna as well as the lead PIs at Morgan State University to develop a quantum literacy curriculum for K-12, undergraduates, and vocational students to broaden participation of underrepresented racial minorities in the quantum workforce. She was selected to be a part of this effort because her STEM identity research informs the development of programs that help marginalized students to thrive, not just survive, in STEM.

#### Public Outreach

Public outreach is run by the MagLab's Public Affairs team who continued to build broad trust and appreciation for science across all audiences throughout 2020. Public Affairs promotes the MagLab's work through news media coverage, events (both in-person and virtual), videos, interactive content, social media, and our print magazine (*fields*).

In 2020, the MagLab posted 14 news stories and was included in more than 250 media articles reaching more than 506 million readers in Forbes, Business Insider, Scientific American and other local and national news outlets.

# 1. Website & Social Media

In 2020, the MagLab website received 1.59 million total pageviews, a 12% increase from 2019. The website also saw growth in key analytics for engagement, including a 17% increase in number of sessions, and a 13% increase in unique pageviews. The average time spent on page also increased by 18 seconds, an important indicator of engagement with page content.

Sections of the site, by percentage of all pageviews (Jan-Dec 2020):

| Education                      | 65.00 |
|--------------------------------|-------|
| User Facilities                | 7.50  |
| Homepage                       | 6.00  |
| About                          | 4.98  |
| News/Events                    | 3.00  |
| Research                       | 2.45  |
| Magnet Development             | 2.20  |
| Staff                          | 2.00  |
| Personnel/Publication Database | 1.95  |
| User Resources                 | 1.00  |

Throughout 2020, sections of the website with more education-based content experienced substantial growth as COVID impacted schools and changed where people accessed

information. In particular, the Education section's pageviews increased 44.8% compared to 2019, a result of CIRL's efforts to move previously in-person content online coupled with a sudden increased demand for online learning. Meanwhile, the About section saw a 2% increase compared to 2019, for an overall increase of 137% since 2015. We also recorded our highest amount of weekly traffic ever in the one-week period of April 26-May 2 with nearly 50,000 page views. Similarly, April 2020 yielded our highest ever monthly traffic with over 182,000 page views, 24% higher than the same period in 2019.

To meet our audiences changing needs due to the expanded COVID pandemic, the MagLab's Public Affairs team also provided new and innovative online content in 2020 including downloadable Zoom backgrounds, virtual puzzles, SciBall trading cards, Combatting COVID feature stories, and a feature about what happens when scientists are out of the lab. Collectively, this new content has more than 5,100 pageviews.

The MagLab's social media accounts continued to grow and reach new and diverse audiences as well. Facebook followers grew 6.5% in 2020 and posts on the lab's Facebook account reached diverse audiences by age and gender (Figure 3.7). Likewise, the more than 550 tweets on the MagLab's Twitter account reached over 1 million people in 2020 with nearly 400 new followers added.

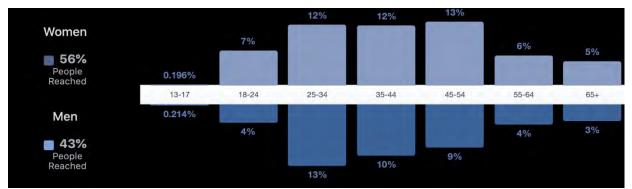


Figure 3.7: Breakdown of audience reached through Facebook posts (which is different from followers or fans).

The lab's LinkedIn account also gained over 460 followers and our LinkedIn posts in 2020 reached more than 105,000 people across diverse career levels and categories (Figure 3.8).

Followers on Instagram and Pinterest also continued to grow. The lab's Pinterest account skews younger with more than 50% aged 18-34, with a nearly 54% female audience.

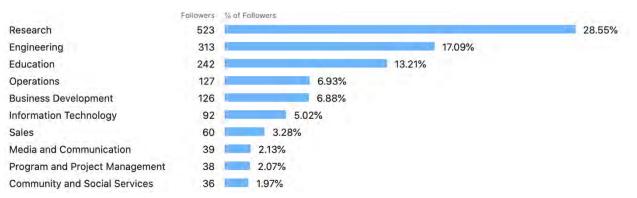


Figure 3.8: LinkedIn followers by career category 2020.

MagLab videos received more than 33 million impressions on YouTube in 2020 and were viewed 2.2 million times (Figure 3.9). The lab's YouTube channel added 28,500 subscribers and

nearly 73,000 hours of MagLab videos were watched in 2020. As COVID shuttered schools in Spring 2020, demand for MagLab videos grew substantially. From March 1<sup>st</sup>-June 1<sup>st</sup> we had:

- 7.2 Million impressions
  - 14% higher than the same period in 2019
  - 24% higher than the first quarter of 2020
- 507,000 views
  - 13% higher than same period last year
  - 40% higher than first quarter of 2020
- 17.5K hours of watch time
  - 9% higher than same period last year
  - 41% higher than first quarter of 2020

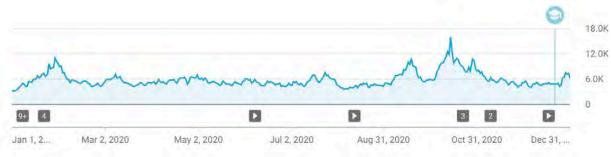


Figure 3.9 YouTube views throughout 2020.

Other peaks in views coincide with the release of new videos and schools restarting in the fall. Nearly 15% of the MagLab's YouTube watchers are female and audiences come from all ages and around the world (Figure 3.10). Outside of the United States, the MagLab's YouTube audience is mostly from India, The Philippines, Indonesia, Pakistan, Bangladesh, United Kingdom, Canada, Malaysia, Turkey, and Sri Lanka.

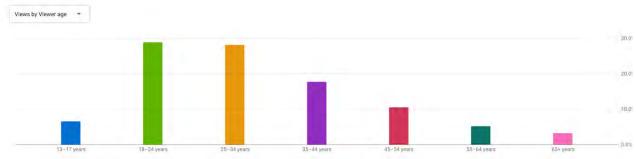


Figure 3.10 YouTube viewers by age, 2020.



The most popular videos on the MagLab's YouTube channel continue to be the See-Thru Science video series which shows viewers what electricity and magnetism might look like if they weren't invisible. In 2020, the lab released 28 new videos including an Elvis parody music video called "Stuck on You" which earned 41,000 impressions and about 2,000 views.

# 2. Events

Before Florida was impacted by COVID, The MagLab was fortunate to host an in-person Open House event in celebration of the lab's 25<sup>th</sup> anniversary in February 2020, prior to being impacted by COVID. With a special "time" theme, more than 10,000 visitors enjoyed classic MagLab demos and dozens of new experiences including the ability to turn back time with a laminar flow demo, timed radar races, ancient geological samples, how everything from your body's circadian rhythm to atomic clocks tick, and some special Dr. Who demos. Visitors of all ages were also invited to a Travel-Through-Time Scavenger Hunt, and to predict the future in a Time Vault that



Figure 3.11 Pictures from 2020 Open House on February 22.

will be opened at the MagLab's 50th Open House in 2045 (Figure 3.11).

As the continuing COVID pandemic changed the nature of "events," the MagLab partnered with local organizations to offer special events in the online space including a TechTopic talk hosted by the Leon County Research and Development Authority on thermo-electric materials and several Museum Mixology virtual lectures hosted by the Tallahassee Museum on topics ranging from asphaltenes to Earth's ancient crust.

#### 3. Fields Magazine

Stories of high field science from across the globe continued to be featured in fields magazine in 2020 (Figure 3.12). While the COVID pandemic changed the lab's print distribution plans, two new issues were released in 2020 and the fields website earned more than 10,500 pageviews. These issues featured environmental stories on PFAS and asphaltene work at the MagLab as well as features on magnetic fields for recycling in Europe and a look at the worldwide work on metal organic frameworks.



Figure 3.12 Covers of two issues of fields release in 2020.

# 3.2. CONFERENCES AND WORKSHOP

Each year, the National MagLab hosts or sponsors a variety of workshops and conferences related to high magnetic field research (Table 3.9). While the COVID pandemic altered some of the MagLab's offerings, we are proud to have pivoted many of our meetings to still offer them in the virtual space.

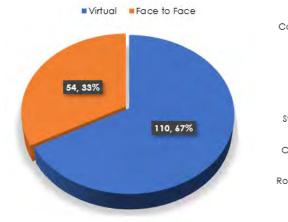
| Event                   | Date                 | Location           | Description                                                                                                                                                                                                                                                                        | Attendees | In Person/<br>Virtual |
|-------------------------|----------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------|
| Theory Winter<br>School | Jan 6 to<br>10, 2020 | Tallahassee,<br>FL | The National MagLab held its<br>8th Theory Winter School<br>focused on Quantum Matter<br>Without Quasiparticles. This<br>development shed new light<br>on open questions of<br>quantum criticality,<br>unconventional<br>superconductivity, and new<br>types of topological phases | 80        | In person             |

| Event                                                 | Date                        | Location           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Attendees                                                             | In Person/<br>Virtual |
|-------------------------------------------------------|-----------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------|
|                                                       |                             |                    | of matter. The tentative topics<br>of the school include electron<br>transport without qua-<br>siparticles, Sachdev-Ye-Kitaev<br>models, novel phases in<br>twisted bilayer graphene,<br>fraction topological phases,<br>deconfined quantum<br>criticality, and many-body<br>localization.                                                                                                                                                                                                                                                                                                                       |                                                                       |                       |
| Convergence<br>Research in<br>High Magnetic<br>Fields | Jan 9 &<br>10, 2020         | Tallahassee,<br>FL | A scientific symposium and<br>festschrift celebration to<br>honor Greg Boebinger and his<br>contributions to convergence<br>research in high magnetic<br>fields in celebration of his<br>60 <sup>th</sup> birthday.                                                                                                                                                                                                                                                                                                                                                                                              | 119                                                                   | In person             |
| User Workshop                                         | Sept 14<br>& 15,<br>2020    | N/A                | A two-day workshop on the<br>topic of quantum spin<br>coherence featuring talks<br>from across the MagLab's<br>user community.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 160                                                                   | Virtual               |
| User Committee<br>Meeting                             | Sept 16<br>to 18,<br>2020   | N/A                | An annual meeting of users<br>who represent the<br>laboratory's broad<br>multidisciplinary user<br>community and advises lab<br>leadership on all issues<br>affecting users of our<br>facilities.                                                                                                                                                                                                                                                                                                                                                                                                                | 120                                                                   | Virtual               |
| Applied Super-<br>conductivity<br>Conference          | Oct 24<br>to Nov<br>7, 2020 | N/A                | An important meeting for the<br>electronics, large scale, and<br>materials fields within the ap-<br>plied superconductivity<br>community. The conference<br>featured 1357 presentations<br>(486 contributed/ invited<br>talks, 856 posters/ invited<br>posters, and nine plenary<br>talks) during the five days of<br>the conference. More than<br>500 manuscripts were sub-<br>mitted for peer review in the<br>Special Issue of the IEEE<br>TRANSACTIONS ON APPLIED<br>SUPERCONDUCTIVITY; An<br>exhibition took place during<br>the conference with the<br>participation of 63 companies<br>from 15 countries. | 1,630 from<br>39<br>countries<br>(370 of<br>whom<br>were<br>students) | Virtual               |

#### 3.3. BROADENING OUTREACH

In addition to the Diversity and Education sections of this report which speak to the MagLab's work to broaden participation through education and outreach, MagLab staff regularly take advantage of conferences and workshops to share information about the lab's user program with diverse researchers from around the globe. Each talk, presentation, poster or abstract opportunity provides the chance for scientists to learn more about the lab's research capabilities and broaden our user program to new scientists from across disciplines and career level – from graduate students and postdocs to tenure track faculty.

In 2020, MagLab staff gave 164 lectures, talks and presentations to organizations around the country and the world (Figure 3.13). Because of the global impacts of COVID, many national and international meetings were cancelled or pivoted to the virtual space. As such, more than 67% (110) of the 2020 MagLab presentations were conducted virtually (Figure 3.14), but the MagLab is proud to have continued the important work to broaden participation through outreach and presentations at prominent meetings and conferences including the 259th



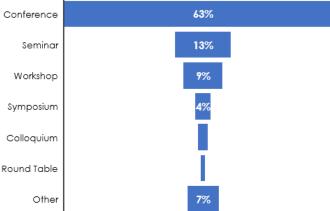


Figure 3.13 Breakdown of 2020 Presentations given virtually or in-person.

Figure 3.14 2020 Presentation types.

ACS National Meeting and Expo, the 61st Experimental NMR Conference, ASC 2020, the 2020 Gulf of Mexico Oil Spill and Ecosystem Science Conference, ASMS 2020, Biomedical Engineering Society Virtual Annual Meeting, 51st Lunar and Planetary Science Conference, Conference for Undergraduate Women in Physics (CuWiP) and Low Temperature/High Field Superconductor Workshop.

# 4. In-house Research

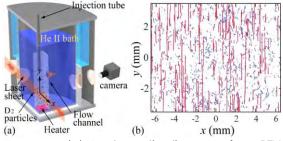
#### 1. CRYOGENICS

The Cryogenics Laboratory located at the National High Magnetic Field Laboratory is a fully developed facility for conducting low temperature experimental research and development. A number of specialized experimental equipment are available in the lab, which include the Cryogenic Helium Experimental Facility (CHEF) for horizontal single and two-phase heat transfer and flow research, the Liquid Helium Flow Visualization Facility (LHFVF) for high Reynolds number superfluid helium (He II) pipe flow visualization research, the Laser Induced Fluorescence Imaging Facility (LIFIF) for high precision molecular tagging velocimetry measurement in both gaseous and liquid helium, and the Cryogenic Magnetic Levitation Facility (CMLF) for studying cryogenic fluid hydrodynamics in controlled gravity environment. The laboratory supports in-house development projects as well as contracted scientific work directed by Prof. Guo in the Mechanical Engineering department at the FAMU/FSU College of Engineering. Currently, the three major research foci of the cryogenics lab include: 1) fundamental turbulence and heat transfer research in cryogenic helium; 2) guench spot detection for accelerator cavities; 3) catastrophic loss of vacuum in liquid helium cooled pipes. These research activities are supported by external funding agencies including the National Science Foundation, the Department of Energy, the Army Research Office, and our industrial partners.

#### Turbulence research with He II

Many flows in nature have extremely high Reynolds (Re) or Rayleigh (Ra) numbers, such as those generated by flying aircraft and atmospheric convection. Better understanding of these flows can have profound positive impacts on everyday life, such as improving the design of energy efficient applications and our understanding of climate change. To achieve large Re values in a laboratory, the common route is to increase the characteristic length of the flow, which normally requires the construction of expensive and energy consuming large-scale flow facilities and wind

tunnels. An alternative method is to use a fluid material with very small kinematic viscosity. At the cryogenics lab, we adopt helium-4 as the working fluid. Helium-4 has extremely small kinematic viscosity (3 orders of magnitudes smaller than that for air) which enables the generation of highly turbulent flows in compact table-top equipment. Furthermore, when helium-4 is cooled below about 2.17K, it undergoes a phase transition into a superfluid phase (He II), which consists of two miscible fluid components: a viscous normal component and an inviscid superfluid fluid component. Turbulence in He II is a cutting-edge research area that is important both in fundamental science and in practical applications



Cryogenics

Figure 4.1: (a) A schematic diagram of our PTV counterflow setup. (b) Representative tracks obtained at 1.85K and 38mW/cm<sup>2</sup> for particles trapped on vortices (blue) and entrained by the normal fluid (red).

of He II as a coolant. In order to make quantitative flow field measurements, we have developed two powerful flow visualization techniques. One is the molecular-line tagging velocimetry technique, which is developed based on tracking thin lines of He II excimer tracers created via femtosecond-laser field ionization of helium atoms. A particle tracking velocimetry (PTV) method in He II using seeded micron-sized frozen hydrogen particles has also been developed and implemented (see Figure 4.1). The application of these techniques to the study of heat-induced counterflow in He II has revealed a novel form of turbulence, the characterization of which is critical for the development of a theoretical model that could describe the complex two-fluid dynamics in various quantum fluids systems. We have also designed and fabricated sophisticated towed-grid system for studying turbulence in He II generated via mechanical forcing. This system has allowed us to examine both the vortex dynamics and the motion of the thermal component in He II, which has led to a number of publications:

- X. Wen, S. Bao, L. McDonald, J. Pierce, G.L. Greene, L. Crow, X. Tong, A. Mezzacappa, R. Glasby, W. Guo, and M.R. Fitzsimmons, "Imaging fluorescence of <sup>4</sup>He<sub>2</sub> excimers created by neutron capture in liquid helium II", Phys. Rev. Lett., 124, 134502 (2020). Selected as Editor's Suggestion.
- S. Yui, H. Kobayashi, M. Tsubota, and W. Guo, "Fully coupled dynamics of the two fluids in superfluid 4He: Anomalous anisotropic velocity fluctuations in counterflow", Phys. Rev. Lett, 124, 155301 (2020).
- H. Sanavandi, S. Bao, Y. Zhang, R. Keijzer, W. Guo†, and L. N. Cattafesta III, "A cryogenichelium pipe flow facility with unique double-line molecular tagging velocimetry capability", Rev. Sci. Instrum., 91, 053901 (2020).
- Y. Tang, S. Bao, T. Kanai, and W. Guo†, "Statistical Properties of Homogeneous and Isotropic Turbulence in He II Measured via Particle Tracking Velocimetry", Phys. Rev. Fluids, 5, 084602 (2020).

# Quench spot detection for accelerator cavities

Many modern particle accelerators utilize superconducting ratio-frequency (SRF) cavities, cooled by He II, to accelerate charged particles. There is a strong demand to reach ever higher accelerating fields in these cavities so that the particles can gain higher energies over shorter distances. The prospect of shorter accelerator beamlines is very significant due to the high costs of typical accelerators. The maximum accelerating field of SRF cavities is limited by cavity quenching caused by Joule heating from tiny resistive defects near the cavity surface (i.e., quench spots). By locating and subsequently removing the defects, the maximum accelerating field can be significantly improved. Therefore, a long-standing research effort in the accelerator field is to develop reliable methods to detect those sub-millimeter defects. Our lab is active in developing novel technologies for surface quench spot detection based on our molecular tagging flow visualization in He II. We have conducted a proof-of-concept experiment using a miniature heater to simulate a quench spot and have demonstrated hot-spot detection with an unprecedented resolution. Recently, an imaging scheme for hot spot detection in 3D space is developed. Our work has the potential to advance the state-of-the-art of accelerator cavity diagnostics. Recent papers include:

- S. Bao and W. Guo, "Quench spot detection for superconducting accelerator cavities via flow visualization in superfluid helium-4", Phys. Rev. Applied, 11, 044003 (2019).
- S. Bao, T. Kanai, Y. Zhang, L. N. Cattafesta III, W. Guo, "Stereoscopic detection of hot spots in superfluid helium-4 for accelerator-cavity diagnosis", Int. J. Heat Mass Tran., 161, 120259 (2020).

#### Loss-of-vacuum heat and mass transfer

SRF cavities in linear accelerators are operated with high vacuum inside, while being immersed in a bath of LHe (typically He II around 2K). A string of SRF cavities housed in a cryomodule essentially forms a long LHe cooled vacuum tube (i.e., the beamline tube). An accelerator can experience a catastrophic breakdown if the cavities accidently lose their vacuum to the surrounding atmosphere. To understand this vacuum break process and to aid the development of accelerator cryogenics safety protocols, our lab has launched a project to study nitrogen gas propagation in a purposely designed helium-cooled tube system and has developed a

theoretical model to interpret the gas dynamics and the heat transfer process. Recent representative publications include:

- N. Garceaua, S. Bao, and W. Guo, "Heat and mass transfer during a sudden loss of vacuum in a liquid helium cooled tube Part I: Interpretation of experimental observations", Int. J. Heat Mass Tran., 129, 1144-1150 (2019).
- S. Bao, N. Garceau, and W. Guo, "Heat and mass transfer during a sudden loss of vacuum in a liquid helium cooled tube Part II: Theoretical modeling", Int. J. Heat Mass Tran., 146, 118883 (2020).

In the reporting period, we have also conducted numerical study of merging rotating superfluids. When rotating classical fluids merge together, the viscous shear force at the interface can lead to the formation of vortical structures [28], the drifting of which assists angular momentum (AM) advection from one fluid body to another. However, for invisid quantum fluids such as He II or Bose-Einstein condensates (BECs), little is known on what flow structures may form at the interface and how the AM transfer is achieved. We conducted numerical studies of the merging dynamics of a rotating BEC with a static BEC in both 2D and 3D space. During the condensate merging, we observed the spontaneous formation of spiral soliton lines in the 2D case and corkscrew-shaped soliton sheets in the 3D cases (see Figure 4.2). These soliton structures enable fast AM transfer, even in the absence of fluid advection and vortex drifting. A close examination of the flow field around these soliton structures reveals strikingly that their sharp endpoints (2D case)

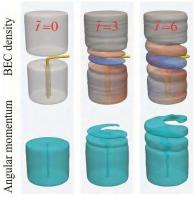


Figure 4.2: Time evolution of the density and angular momentum in the merging of a rotating BEC with an initially static BEC.

or edge lines (3D case) can induce flows like a point vortex or a vortex line but effectively with a fraction of a quantized circulation. Furthermore, we discovered that the AM transfer is achieved via a novel mechanism: the soliton structures can exert a torque that directly creates AM in the initially static BEC and annihilates AM in the rotating BEC. These discoveries not only enrich our knowledge of BEC merging dynamics but may also benefit the study of various other rotating superfluid systems, such as the merging of spinning neutron stars and the collision of revolving galactic dark matter halos that are believed to form BECs. Relevant publications include:

- T. Kanai, W. Guot, M. Tsubota, and D. Jin, "Torque and Angular Momentum Transfer in Merging Rotating Bose-Einstein Condensates", Phys. Rev. Lett., 124, 105302 (2020).
- T. Kanai, W. Guo<sup>+</sup>, and M. Tsubota, "Merging of rotating Bose-Einstein condensates", J. Low Temp. Phys., 195, 37-50 (2019).

On the education side, our research has allowed us to educate both graduate and undergraduate students, as well as postdoc researchers. Over the past a few years, we have engaged more than 10 undergraduate students (including four females) and six graduate students in our quantum fluids research. These graduate students include Jian Gao, Brian Mastracci, Andrew Wray, Toshiaki Kanai, and visiting students Alex Marakov (from University of Florida) and Emil Varga (from Charles University in Prague). The training that these students have received makes them well-prepared for their careers. Jian, Brian, and Andrew are research scientists at the Facility for Rare Isotope Beams, the Jefferson National Lab, and the Lawrence Livermore National Lab, respectively. Alex joined the quantum computing team at Northrop Grumman, and Emil is now a postdoc at University of Alberta. Toshiaki will continue to be supported in the proposed research. Among the undergraduate students, Onyewychi Ebere has been recruited as a graduate student at Florida A&M University, an HBCU.

## 2. GEOCHEMISTRY

## Overview

The facility primarily investigates natural processes, both recent and ancient, through the analysis of trace element contents and isotopic compositions.

## Introduction

The Geochemistry Program's main funding is through grants from the Geoscience directorate at NSF and NASA. On average, the program has fifteen active grants with an average budget per grant of \$100,000/year. All tenure-track faculty have their appointments in FSU's College of Arts and Sciences. This year, Geochemistry Program member Jeremy Owens was named Sloan Research Fellow. The fellowship is awarded to early career scientists who are selected based on their scientific accomplishments, creativity and potential for innovative research. Challenges related to the COVID crisis included restricted laboratory activities and a post doc detained while on a scientific expedition due to travel restrictions. We were not able to host outside users, involve undergraduate students or mentor high and middle school students.

The facility has seven mass spectrometers, which are available to outside users. Three instruments are single collector inductively coupled plasma mass spectrometers for elemental analysis, one of which is dedicated to *in-situ* trace element analyses on solid materials using laser ablation. The other two are dedicated to elemental analyses of solutions. The facility has four mass spectrometers dedicated to determination of isotopic compositions. One is a multi-collector inductively coupled plasma mass spectrometer (NEPTUNE) used for determination of isotopic abundances of metals. A second is a thermal ionization multi collector mass spectrometer, which is mainly used for Sr-isotopic compositions. The third mass spectrometer is designed for the measurement of the light stable isotope compositions (C, N O). A fourth mass spectrometer is dedicated to sulfur isotope analyses.

## Publications and Outreach

The program members have published 31 peer-reviewed publications and an even greater number of presentations at meetings and invited presentations at other institutions. Almost all of those were done virtually. The program normally involves a large number of undergraduate students as well as REU summer interns in its research. However, this past year's activity was limited.

## Science Highlights

Ocean deoxygenation related to modern climate change has become an increasingly urgent issue. There is an increased need to better constrain low but non-zero oxygen concentrations using sedimentary geochemical tracers to provide evidence for past natural variations. To date, most redox proxies are not sensitive to such variations. Our research investigates the vanadium (V) isotope variations of modern marine sediments deposited under a range of redox environments (Wu et al., 2020 *Geochim. Cosmochim. Acta*). Our results document how changes in local redox conditions impart a significant isotopic fractionation from seawater as recorded in the local sedimentary V isotopic signature. Our results highlight the direct link between authigenic marine sedimentary V isotope compositions and the overlying local redox conditions. This investigation of V isotopes. This work will help to investigate ancient climate events to better constrain ranges and rates of natural variation in oxygen contents of our oceans to potentially constrain future implications.

A second highlight concerns the work of post doc Shuying Yang published in *Science Advances* showing that recycled oceanic crust plays an important role in the chemical enrichment of volcanic rocks with implications for the history of plate tectonics on Earth. The planet is encircled by a 40,000km chain of underwater volcanoes that erupt basalt and build the

oceanic crust in all ocean basins. The chemistry of these basaltic lavas exhibits a distinct depletion in elements that readily enter melt from the mantle that form the Earth's crust. Such incompatible elements are partly stored in the continental crust over billions of years and partly recycled back into the mantle by plate tectonics. Yang et al. developed a chemical fingerprint for the recycled crust using the ratio of the abundances of germanium (Ge) and silicon (Si). Recycled crust melting beneath the ridges retains Ge preferentially to Si, and these melts extract incompatible elements from the recycled crust. Addition of melts derived from recycled crust compensates, even overcompensates, for the losses of incompatible elements in the mantle source creating chemicalenriched lavas. Yang et al. calibrated the amount of recycled crust estimated from the Ge/Si ratio to a more abundant dataset of potassium and titanium in lavas to estimate the global extent of recycled crust beneath the oceanic ridges. That number is vital to understanding how long plate tectonics has operated on Earth. The final word on the history of plate tectonics may not have been written, but the Ge/Si ratio is a new chemical proxy that allows us to finally get an empirical handle on that long-vexing question.

A third highlight is our research related to coastal shorelines and shelves that show to play major transformative roles in the supply of bioactive trace metal nutrients to the open ocean. In a series of four papers published by Morton and colleagues in late 2019 and 2020, continental shelves adjacent to the Arctic and western North Pacific margins were found to release high concentrations of redox active metals such as Fe, Mn, and Co to the ocean but trap other metals like V near the coast. Coastal currents transported these enriched plumes hundreds of km from their origin, but concentrations steadily decreased with distance as the dissolved metals were transformed to the particulate phases through geochemical and biological processes. In general, these authigenic and biogenic particles eventually settle out of the water column to the benthic sediments, but biologically produced organic ligands could interrupt this process by preserving the metals in the dissolved fraction and prevent their transformation to settling particles. Furthermore, the enriched plumes followed along isopycnal or isohaline surfaces, allowing the circulation of these metals to be traced throughout the different ocean basins in specific water masses.

#### Progress on Stem and Building the User Community

The facility is open to users of all disciplines, and we have a long-time collaboration with the USGS and the South Florida Water Management District. Due to the COVID restrictions the number of outside users, undergraduate students and 9-12 students we mentor was limited. Graduate student users are 65% female. Within the area of Geosciences, the faculty has collaborations with researchers throughout the US, Europe as well as Asia. The disciplines for which we do service analyses at a more local level range from magnet science to pharmacy and anthropology.

## 3. CMS/ UF PHYSICS/ UF CHEMISTRY

Here we present a few exciting research discoveries from both our teaching and research MagLab faculty that are not driven by our users but by our faculty themselves. The strength of our **MagLab faculty's in**-house science is crucial to the success of our user facility. Our faculty are internationally known for their front-line science, which leads to a world-class scientific environment, which drives innovation for our user program. Our international acclaim brings new users and stresses the eminence of our MagLab. There are many more examples of exciting inhouse research than shown here – these were chosen for impact and breadth, as decided by our chief scientist.

CMS

We begin with some examples of our in-house theoretical research in condensed matter sciences and note that each research topic is directly related to MagLab work, focused on our users across all three of our campuses. The broad range of this theoretical research reflects the breadth of our users, domestic and international. We start with studies of correlation and dynamics in strongly correlated quantum systems, modeling results from a wide range of experimental techniques. Next, some of our users are particularly strong in developing materials for quantum computation, and we report on the development of new analytic tools for designing pulse sequences for spin-based quantum computing. Innovative theoretical work on topological materials has been reported including bound vortices, quantum Hall states, symmetry breaking, Dirac node braiding, and coulombic effects in twisted bilayer graphene. Theoretical research has also been accomplished on the Mott transition in 1D quantum spin liquids, Cooper pairing symmetry in the two-dimensional Hubbard model, and the physical and magnetotransport properties of InAs/GaSb superlattices are explored.

## Condensed Matter Theory at FSU and UF

## 1. Correlations and Dynamics in Strongly Correlated Electron Systems

## Summary

We are pursuing the study of correlations and dynamics in strongly correlated quantum systems. Many aspects of our work have involved close collaboration with experimentalists and have utilized computational tools to predict or explain the outcomes of experiments such as neutron scattering, torque magnetometry and terahertz optics. Our work involves extensive use of resources at the research computing center (RCC) and the Planck computing cluster at FSU. Systems of interest include: 1) spin orbit coupled pyrochlore systems (see work on Yb<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> in PNAS [1] and PRB [2] with C. Broholm's group); we have recently studied the pseudo spin-1/2 spin liquid system Ce<sub>2</sub>Zr<sub>2</sub>O<sub>7</sub> (unpublished with A. Nevidomskyy and R. Moessner, led by postdoc Anish Bhardwaj), 2) S=1 chain material NiNb<sub>2</sub>O<sub>6</sub> (see PRL with P.Armitage's group [3]) with student Prakash Sharma and postdoc Kyungmin Lee (unpublished) and 3) S=1 kagome antiferromagnet Na<sub>2</sub>Ti<sub>3</sub>Cl<sub>8</sub> (see PRL [4] with collaborators T. Birol, A. Paul and C. Chung). See Figure 4.3 for representative results published in 2020.

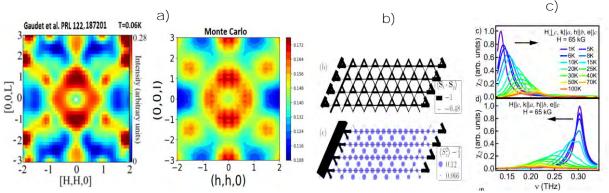


Figure 4.3: (a) Results of the comparison between neutron scattering data and theory for the spin-orbit coupled pyrochlore Yb<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> [see Ref. [1]] (b) Results from an investigation of the spin-1 kagome material Na<sub>2</sub>Ti<sub>3</sub>Cl<sub>8</sub>. A model Hamiltonian was studied with DMRG and was shown to harbor both trimerized/valence bond (top) and spin nematic phases (bottom) [see Ref. [4]] (c) Results of finite temperature Lanczos simulations showing the temperature dependent shift in the dynamical susceptibility of a ferromagnetic spin chain with onsite anisotropy.[see Ref. [3]]

#### Acknowledgements

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- [5] K. Lee, R. Melendrez, A. Pal, H. J. Changlani, Phys. Rev. B 101, 241111(R) (2020).

## 2. Efficient Two-Qubit Pulse Sequences Beyond CNOT [1]

Zeuch, D. (FSU, Physics); <u>Bonesteel, N.E.</u> (FSU, Physics) Introduction

Electron spins in neighboring quantum dots can be coherently controlled by adiabatically switching on and off, or "pulsing", the exchange interaction between them. If logical qubits are encoded using three spin-1/2 quantum dots then it is known that such exchange pulsing is sufficient for universal quantum computation [2].

Designing sequences of exchange pulses to carry out two qubit quantum gates on the six spins forming two three-spin qubits is a surprisingly difficult problem. The most efficient known two-qubit gate sequence for a controlled-NOT gate (CNOT), due to Fong and Wandzura [3], was found by a numerical brute force search that offered little insight into its derivation.

#### Results and Discussion

In [1] we have "reverse engineered" the Fong-Wandzura sequence in order to understand its structure (building on earlier work of [4]). The key steps in this reverse engineering are shown in Figure 4.4. This deconstruction of the sequence allowed us to modify it and produce entirely new sequences that can be used to carry out arbitrary controlled-rotation gates, not just CNOT gates. These gates are useful for a number of quantum algorithms, (e.g., Shor's famous factoring algorithm, and some proposed quantum simulation algorithms [5]). Our new sequences for these gates can be shown to be "optimal" in a certain sense.

#### Conclusions

We have developed new analytic tools for designing efficient pulse sequences for spin-

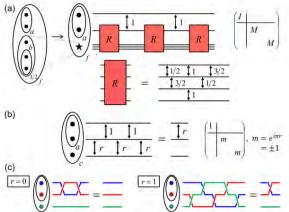


Figure 4.4: "Reverse engineering" of the Fong-Wandzura sequence. Horizontal lines represent spins, vertical double arrowed lines indicate exchange pulses labeled by duration in units of  $\pi/J$ , and time flows from left to right. (a) Fong-Wandzura CNOT sequence acting on 5 of the 6 spins associated with two 3-spin gubits with a repeating patterns of pulses grouped into the box R; (b) simpler three spin sequence where the pulse r is either the identity or a simple swap and so squares to the identity in the same way that the pulses in the box R square to the identity; (c) simple sequences of spin exchanges which determine the result of carrying out sequence (b) on three spins. We show in [1] that the simplified sequence (b) determines entirely the effect of the full twoqubit sequence in (a). By modifying the simple three spin sequences at the "bottom" of this construction and working our way back "up," we have constructed entirely new sequences for arbitrary controlled rotation gates (see [1] for details).

based quantum computing using control of the exchange interaction as a resource. As the quality

of spin qubits continues to improve, it is likely these and related sequences will become useful in the actual implementation of simple quantum algorithms in these systems in the near future. *References* 

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3. Bound fermion states in pinned vortices in the surface states of a superconducting topo-logical insulator [1]

Deng, H. (FSU, Physics); Bonesteel, N.E. (FSU, Physics); <u>Schlottmann, P</u>. (FSU, Physics) Introduction

The possibility of realizing Majorana zero modes at surfaces of strong topological insulators (TI) due to the proximity of an s-wave superconductor (S) was first proposed by Fu and Kane [2]. In this scenario, a zero mode forms within the normal core of a superconducting vortex at the TI-S interface. In addition to this zero mode, finite energy bound states also form within the core. Understanding these bound states will be important for any potential future application of Majorana zero modes to quantum computation. While these bound states have previously been studied numerically (see, e.g. [3]), here we study them essentially analytically. Our results provide us with convenient expressions for experimentally measurable quantities such as the local density of states (LDOS) and form the starting point for direct perturbative calculations of the energy shifts due to a small magnetic field.

## Method

We use the method originally employed in the classic work of Caroli, de Gennes and Matricon [3] for a vortex line in a three-dimensional superconductor [4]. The Bogoliubov-de Gennes equations are solved (i) for small distances (compared to the correlation length  $\xi$ ) from the core of the vortex, where the superconductor order parameter can be neglected, and (ii) for larger distances, still smaller than  $\xi$ , but where the order parameter needs to be taken into account. These two solutions are then matched at an intermediate radius. The matching condition determines the value of the energy of the bound state inside the vortex core.

## Results and Discussion

Using this approach, we obtain analytical expressions both for the energy spectrum and the wave functions associated with the bound states. These wave functions consist of products of a Bessel function and an exponential decay as function of the distance to the core of the vortex. The

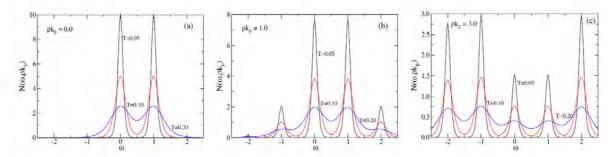


Figure 4.5: Local density of states (LDOS) of the bound states in the vortex as a function of energy  $\omega$  for three distances  $\rho$  from the center of the core: (a)  $\rho k_F = 0.0$ , (b) at  $\rho k_F = 1.0$  and (c)  $\rho k_F = 3.0$ . The three curves in each panel represent different temperatures: T = 0.05 (black), T = 0.1 (red) and T = 0.2 (blue) with all energies expressed in units of  $\Delta^2/E_{F.}$  The LDOS is in arbitrary units but the same for all three panels. (See [1] for more details).

results can then be used to determine an analytic expression of the LDOS for the bound states (see, e.g. Figure 4.5), a quantity which is, in principle, experimentally accessible via STM [5]. Our analytic results form a basis for further perturbative calculations such as determining the energy shift of the bound states with a small magnetic field.

Conclusions Our analytic results for the energy spectrum of bound states within a vortex core provides convenient analytic expressions for physically measurable quantities such as the LDOS. In a larger context, our results provide a context for exploring the question of how the gaps to these bound states can be raised – thus minimizing their effect on any future application for quantum computation – by, for example, reducing the Fermi energy so that it nears the Dirac point, although a full analysis of this effect will require going beyond the approximations used in this work.

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## 4. Quantum Hall States and Their Interfaces

Kun Yang and Li Chen (MagLab); Wei Zhu (West Lake Univ.); Donna Sheng (Calstate North Ridge) Introduction

Quantum Hall states are the very first topological states of matter. Edges and interfaces are windows that allow us to peek into their bulk topological properties. In the past year we studied the interface between the Pfaffian and anti-Pfaffian quantum Hall states that are relevant to the 5/2 fractional quantum Hall state, which is the leading candidate of a non-Abelian quantum Hall state that is of very strong current interest. We also constructed a new family of quantum Hall states at filling factor 2/5.

Methods of Theoretical Studies and Results

In Ref. [1] we used DMRG to study the Pfaffian/anti-Pfaffian interface and found a quantized dipole moment density of the interface, which is tied to the mismatch of the Hall viscosity of the two states separated by the interface. This is a general result applicable to all quantum Hall interfaces, but particularly important for the 5/2 physics as this means disorder potential couples to the dipole moment and can thus induce domains of the Pfaffian and anti-Pfaffian in the 5/2 system. This is one of the very few explanations of the experimentally observed thermal Hall conductivity. Our result thus lends considerable support to this scenario, which was purely speculative before our work.

In Ref. [2] we used conformal field theory to construct a new family of quantum Hall states at filling factor 2/5, whose topological properties share some similarity (like edge modes) with the standard Jain state, but different in a number of important ways, including shift and Hall viscosity, as well as and multibody relative angular momenta. Physically the new states can be understood as composite fermion integer quantum Hall states realized by occupying Landau levels different from the lowest two (as in the Jain state). This points to the richness of quantum Hall states that were not anticipated previously.

## Conclusions

We have performed comprehensive theoretical and numerical studies on quantum Hall states and their interfaces. We studied general interfaces, and the Pfaffian/anti-Pfaffian interface in particular. Our results shed considerable light on their topological properties, and their relevance in samples with disorder.

#### Acknowledgements

This work was supported by NSF and DOE.

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# 5. Diagnosis of explicit symmetry breaking in the tight-binding constructions for symmetry -protected topological systems

Oskar Vafek (MagLab) and Xiaoyu Wang (MagLab)

## Introduction

It has been well established that for symmetry-protected topological systems, the nontrivial topology prevents a real space representation using exponentially localized Wannier wave functions (WFs) in all directions, unless the protecting symmetry is sacrificed as an on-site transformation. This makes it challenging to determine the symmetry of various physical observables represented using such WFs. In this work, we propose a practical method for overcoming such challenges using the Kane-Mele model as a concrete example. We present a systematic procedure for diagnosing the symmetry of any observables, as well as a method for constructing symmetric operators up to arbitrary truncation accuracy.

Methods of Theoretical Studies and Results

For a set of isolated electron bands with nontrivial topology, it is possible to achieve a real space representation using exponentially localized Wannier functions (WFs) in all directions, provided that the protecting symmetry is sacrificed as a site-local transformation. As a result, under any scheme of truncation, the representation of any local and symmetric operator using these WFs inevitably breaks the protecting symmetry explicitly. This has led to debates on the validity of tight-binding implementations for symmetry-protected topological systems.

Using the Kane-Mele model and the Su-Schrieffer-Heger model as examples, we presented a quantitative discussion of the severity of the degree of symmetry breaking. We showed that the exponential localization of the WFs guarantees that the symmetry properties for an intrinsically symmetric operator are retained with exponential accuracy. More precisely, the accuracy of symmetry is bounded by the absolute accuracy of the truncation up to a nonuniversal constant. As a result, a tight-binding implementation should *not* lead to significant issues, as long as the interesting physics occurs at an energy scale larger than the exponentially small energy scale where symmetry breaking effects are important. This latter energy scale can always be made sufficiently small by increasing the real space truncation length-scale.

## Conclusions

We developed a practical method for overcoming challenges associated with using real space Wannier representation of symmetry protected topologically non-trivial systems, using Kane-Mele model as a concrete example. We also presented a systematic procedure for diagnosing the symmetry of any observables, as well as a method for constructing symmetric operators up to arbitrary truncation accuracy.

## Acknowledgements

This work was supported by NSF.

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# 6. Non-Abelian Dirac node braiding and near-degeneracy of correlated phases at odd integer filling in magic-angle twisted bilayer graphene

<u>Oskar Vafek (MagLab)</u> and Jian Kang (MagLab -> Soochow U.) Introduction

Since the discovery of correlated insulating phases and superconductivity (SC) in magic-angle twisted bilayer graphene (TBG) and other moiré systems, tremendous theoretical effort has been devoted toward understanding the properties and the mechanisms of these correlated electron

phenomena. Two entirely different insulating phases have been observed at the filling of v = 3: the (quantum) anomalous Hall (QAH) state when one of the layers of the TBG is aligned with the hexagonal boron nitride (hBN) substrate, and a gapped insulating state without the hBN alignment and without anomalous Hall conductance. The former is easy to understand; the latter is much less understood.

#### Methods of Theoretical Studies and Results

We used the density matrix renormalization aroup (DMRG) to study the correlated electron states favored by the Coulomb interaction projected onto the narrow bands of twisted bilayer graphene within a spinless onevalley model. The Hilbert space of the narrow bands is constructed from a pair of hybrid Wannier states with opposite Chern numbers, maximally localized in one direction and Bloch extended in another direction. Depending on the parameters in the Bistritzer-Macdonald model, the DMRG in this basis determines the ground state at one particle per unit cell to be either the quantum anomalous Hall (QAH) state or a state with zero Hall conductivity which is nearly a product state. Based on this form, we then apply the variational method to study their competition, thus identifying three states: the QAH, a gapless  $C_2T$ -symmetric nematic, and a gapped  $C_2T$ -symmetric stripe.

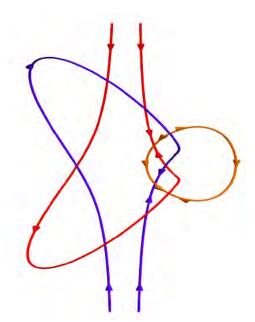


Figure 4.6: The "world lines" of the Dirac nodes as a function of the parameters of the  $C_2T$ -symmetric model with matching colors for the nodes. The arrows of the colored curves represent the topological charges of the corresponding nodes.

In the chiral limit, the energies of the two  $C_2T$ -symmetric states are found to be significantly above the energy of the QAH. However, all three states are nearly degenerate at the realistic parameters of the Bistritzer-Macdonald model. The single-particle spectrum of the nematic contains either a quadratic node or two close Dirac nodes near G. Motivated by the Landau level degeneracy found in this state, we propose it to be the state observed at the charge neutrality point once spin and valley degeneracies are restored.

The optimal period for the  $C_2T$  stripe state is found to be two-unit cells. In addition, using the fact that the topological charge of the nodes in the  $C_2T$ -nematic phase is no longer described simply by their winding numbers once the translation symmetry is broken, but rather by certain elements of a non-Abelian group that was recently pointed out, we identified the mechanism of the gap opening within the  $C_2T$  stripe state. Although the nodes at the Fermi energy are locally stable, they can be annihilated after braiding with other nodes connecting them to adjacent (folded) bands. Therefore, if the translation symmetry is broken, the gap at one particle per unit cell can open even if the system preserves the  $C_2T$  and valley U(1) symmetries, and the gap to remote bands remains open (Figure 4.6).

#### Conclusions

While the Dirac nodes in the  $C_2T$ -nematic phase have been assumed to be generally protected by  $C_2T$  and valley U(1) symmetries, we found that these nodes can be lifted by only breaking the moiré translation symmetry, without breaking the  $C_2T$  and valley U(1) symmetries, and without closing the gap to the remote bands. Our calculation shows that a gapped  $C_2T$  period-2 stripe state is nearly degenerate with the QAH and  $C_2T$ -nematic states, and thus is a candidate state for the ground state at the filling of v = 3 without the hBN alignment. We presented an analysis of the topological properties of the Dirac nodes in the  $C_2T$ -nematic state. During the transition from the  $C_2T$ -nematic state to the  $C_2T$ -symmetric period-2 stripe state, remarkably, the topological charge associated with these nodes should not be described by their (Abelian) winding number,

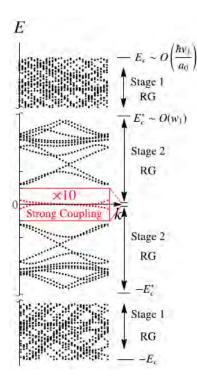


Figure 4.7: Schematic illustration of the two stage RG procedure for arriving at the strong coupling limit. but by elements of (non-Abelian) Salingaros vee group of real Clifford algebra C0,3. Since it is a non-Abelian group, the topological charge of these nodes depends on how they are braided with other nodes away from the CNP. Therefore, a gap at CNP can be opened even without breaking the  $C_2T$  and valley U(1) symmetries.

Acknowledgements This work was supported by NSF.

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## 7. Renormalization Group Study of Hidden Symmetry in Twisted Bilayer Graphene with Coulomb Interactions

<u>Oskar Vafek (MagLab)</u> and Jian Kang (MagLab -> Soochow U.) Introduction

Magic angle twisted bilayer graphene has attracted a lot of attention since it was shown to host correlated phases, including superconductivity in 2018. Here, we developed a novel two stage renormalization group which connects the continuum Hamiltonian for twisted bilayer graphene at length scales shorter than the moire superlattice period to the Hamiltonian for the active narrow bands only which is valid at distances much longer than the moire period. This also allowed us to calculate exactly the exciton energy spectrum from the Coulomb interactions projected onto the renormalized narrow bands.

Methods of Theoretical Studies and Results

In Ref. [1] we developed a renormalization group (RG) approach to the Coulomb interactions in the twisted bilayer graphene and show that the AB region tunneling (w1) renormalizes in precisely such a way as to compensate for the growth of Fermi velocity vF making the magic angle largely insensitive to the effective dielectric constant  $\epsilon$ . Interestingly, we find that w0 does not renormalize due to Coulomb interactions. Therefore, the ratio w0/w1 shrinks, and the system flows closer to the chiral limit described by Tarnopolsky, Kruchkov, and Vishvanath in their 2019 PRL. As illustrated in Figure 4.7, the flow from a high energy (with the UV cutoff Ec),

where the Coulomb interaction and w0, w1 are perturbative, to a low energy of the narrow bands where neither is, crosses over to a regime where the effects of w0 and w1 become nonperturbative, but the Coulomb interaction is still perturbative. This happens at the energy scale  $E^*c \sim O(w1)$ , marking the beginning of the second stage of our RG; we demonstrated that the second stage seamlessly connects to the first stage even if E\*c changes. In the second stage, we numerically integrate out the two most remote bands, one above and one below the charge neutrality, rotate the remaining states to diagonalize the renormalized kinetic energy, and reexpress the interaction in terms of the rotated states, iterating the procedure until we reach the narrow bands. If the resulting narrow bands' bandwidth (or, more precisely the root mean square of the renormalized kinetic energy dispersion) is much smaller than the interaction (or more precisely, the particle-hole charge gap), as we find

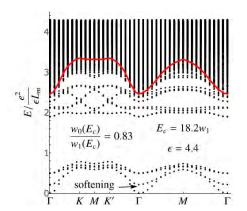


Figure 4.8: The strong coupling exciton spectrum after stage 1 and 2 RG. The red curve is the onset of the particle-hole continuum.

it is near the magic angle, the final step is treated nonperturbatively in the Coulomb interaction, i.e., by solving the interaction-only problem (strong coupling limit) and then treating the renormalized kinetic energy terms as a perturbation. In the final step, we also computed the single particle and charge neutral collective modes (shown in the Figure 4.8).

### Conclusions

The Coulomb RG induced softening of the hidden symmetry collective modes suggests that they may not be frozen out even at few tens of Kelvin. Our results offer a significant shift of perspective in that the chiral limit—previously considered unphysical—gains the status of an attractive mid-IR RG fixed point.

## Acknowledgements

This work was supported by the NSF.

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## 8. Approaching the Mott transition: theory vs. experiment

PI: <u>Vladimir Dobrosavljevic</u> (FSU/Physics- MagLab). These studies were done in collaboration with several experimental groups, also involving FSU graduate student Yuting Tan, who carried out most theory calculations, together with the PI.

Introduction

The Mott metal-insulator transition (MIT) stands out among the key unresolved phenomena in interacting electron systems. At low temperatures magnetic instabilities typically mask the Mott MIT; the antiferromagnetic ground state dominates the low-energy excitations. To circumvent this problem, we study Mott insulators that are currently under scrutiny for their quantum spin liquid ground state (QSL) as a result of large geometrical frustration. The absence of anti-ferromagnetism enables us to investigate the genuine Mott state down to  $T \rightarrow 0$ , and in doing so to test various theoretical ideas and scenarios. This program was carried out in several systems that display Mott-like physics in absence of magnetic order, where we show that most experimental features can be described, in surprising detail, within appropriate applications of Dynamical Mean-Field Theory (DMFT).

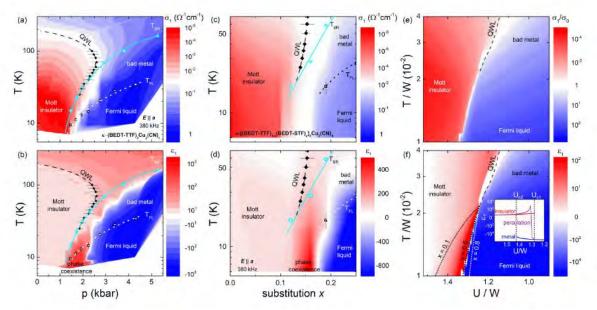
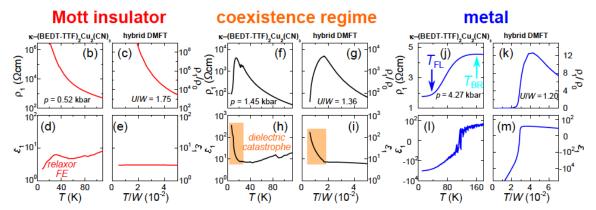


Figure 4.9: Phase diagram of kappa-(BEDT-TTF) $_2Cu_2(CN)_3$  when tuned through the Mott MIT [1] by physical pressure (a,b) or chemical substitution (c,d), compared with hybrid DMFT calculations as a function of correlation strength U=W (e,f).



Inhomogeneous Electronic states in spin-liquid Mott organics materials

Figure 4.10: The Mott-insulating state (b-e) yields thermally activated resistivity and small, positive values of the dielectric permittivity. While the permittivity indicates a reduction with cooling when metallic clusters percolate, is strongly increased upon entering the metal-insulator phase coexistence region (f-i). In contrast, the correlated metallic state (j-m) in the heavy quasiparticle regime exhibits Fermi-liquid properties with a quadratic temperature dependence of the resistivity at low temperatures, accompanied by large negative values of the dielectric permittivity [2].

Coulomb repulsion among conduction electrons in solids hinders their motion and leads to a rise in resistivity. A regime of electronic phase separation is expected at the first-order phase transition between a correlated metal and a paramagnetic Mott insulator, but remains unexplored experimentally as well as theoretically nearby T=0. We approach this issue [1,2] by assessing the complex permittivity via dielectric spectroscopy, which provides vivid mapping (Figure 4.9) of the Mott transition and deep insight into its microscopic nature. Our experiments utilizing both physical pressure and chemical substitution consistently reveal a strong enhancement of the quasi-static dielectric constant  $\varepsilon_1$  when correlations are tuned through the critical value. All experimental trends are captured by dynamical mean-field theory of the single-band Hubbard model supplemented by percolation theory (Figure 4.10). Our findings suggest a similar "dielectric catastrophe" in many other correlated materials and explain previous observations that were assigned to multiferroicity or ferroelectricity.

Mott Quantum Criticality in two-dimensional electron systems in semiconductors

The possibility of the strong electron-electron interaction driven insulating phase from the metallic phase in two-dimensions has been suggested for clean systems without intentional disorder, but its rigorous demonstration is still lacking. Here, we examine [1] the finite-temperature transport behavior of a few layered-MoS<sub>2</sub> material in the vicinity of the density-driven metal-insulator transition (MIT), revealing previously overlooked universal features characteristic of strongly correlated electron systems. Our scaling analysis, based on the Wigner-Mott theoretical viewpoint supplemented with DMFT, conclusively demonstrates that the transition is driven by strong electron-electron interactions and not disorder, in striking resemblance to what is seen in other Mott systems. Our results provide compelling evidence that transition-metal dichalcogenides provide an ideal testing ground for the study of strong correlation physics, which should open an exciting avenue for future research, making a parallel with recent advances in twisted bilayer graphene. Very similar results were also found [2] in a strongly interacting two-dimensional electron MITs, with features displaying all features expected from the DMFT standpoint.

Acknowledgements

Work in Florida (V. Dobrosavljevic an Yuting Tan) was supported by the NSF Grant No. 1822258, and the National High Magnetic Field Laboratory through the NSF Cooperative Agreement No.

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## 9. Pairing in the two-dimensional Hubbard model from weak to strong coupling

The Hubbard model is the simplest model that is believed to exhibit superconductivity arising from purely repulsive interactions and has been extensively applied to explore a variety of unconventional superconducting systems. A collaborative team including UF Physics members performs intensive extensions of the model to further probe the evolution of the leading superconducting instabilities of the single-orbital Hubbard model on a two-dimensional square lattice as a function of onsite Coulomb repulsion U and band filling by calculating the irreducible particle-particle scattering vertex obtained from dynamical cluster approximation(DCA) calculations. These results are compared to both perturbative Kohn-Luttinger (KL) theory as well as the widely used random phase approximation (RPA) spin-fluctuation pairing scheme [1]. While there is general agreement that the leading Cooper pairing instability of the Hubbard model close to half-filling is the  $d_{x^2-y^2}$  state, and work on the t-J model valid in this regime corresponding to very large U suggests the same, rather less is known consensually about the rest of the Hubbard model pairing phase diagram, including fillings far from n=1 and intermediate to strong U. These regimes are not simply of academic interest but may well represent reasonable descriptions of a variety of unconventional superconductors, including cuprates, organic Bechgaard salts, heavy fermion materials, iron-based superconductors, and ultracold fermionic gases. References

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## 10. Structural, morphological and magnetotransport properties of composite semiconducting and semimetallic InAs/GaSb superlattices

Arsenide and antimonide-based semiconductor heterostructures have attracted attention for many years as technological cornerstones for emerging, high-performance nanoscale devices. In particular, extensive research efforts have been dedicated to type-II broken-gap InAs/GaSb heterostructures where the superlattice (SL) periodicity can modify the band structure, resulting in either a semiconducting (energy gap,  $E_G>0$ ) or semimetallic ( $E_G<0$ ) material system. In this work, an InAs/GaSb double-period superlattice structure was grown by solid-source molecular beam epitaxy using valved cracker sources for both arsenic and antimony. The structural, morphological, and magnetotransport characteristics were investigated by high-resolution X-ray diffraction, transmission electron microscopy, and transport measurements as a function of temperature and magnetic field [1]. Specifically, in-plane magnetotransport was performed over a variable temperature range down to 390mK and in magnetic fields up to 9 T, and numerical analysis reveals the presence of at least two carrier populations, (see Figure 4.11). The higher-mobility carriers exhibit Shubnikov-de Haas oscillations, testifying to the crystalline quality of the heterostructure and interfaces.

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## Condensed Matter at UF

1. Inelastic neutron scattering study of the anisotropic S=1 spin chain [Ni(HF<sub>2</sub>)(3-Clpyridine)<sub>4</sub>]BF<sub>4</sub>

Spin chains have played a foundational role in understanding many-body physics in the quantum regime, and important example is the isotropic S=1 an antiferromagnetic system that does not have an analytical solution and possesses a nondegenerate gapped ground state known as the Haldane phase. Real systems have anisotropy which complicates the simple description, and an interesting case is the material [Ni(HF<sub>2</sub>)(3-Clpyridine)<sub>4</sub>]BF<sub>4</sub>, which is known as NBCT. Motivated to clarify the nature of the high magnetic field and low temperature response of this system, an intriguing discovery was made at ultralow magnetic fields. Specifically, using the High B/T Facility Fast-Turnaround Instrument, NBCT was shown to be close to a quantum phase boundary as inferred from isothermal magnetization studies, down to 50mK, that placed an upper limit for a possible critical magnetic field (which could indicate the existence of a gap) of  $35 \pm 10$ mT [1]. These results were included in a request for neutron beam time so inelastic scatting experiments could be performed down to 70mK [2]. The experimental data were combined with DMRG numerical studies, see Figure 4.12, to characterize the anisotropic crystalline distortions that provide the basis of an unusual magnetic phase diagram [2].

This is an example of UF Physics, leveraging MagLab HBT at UF and MagLab EMR in Tallahassee results [1] to

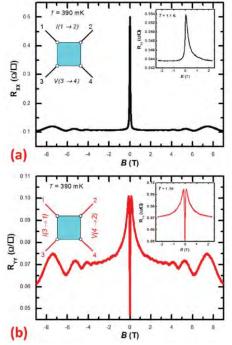


Figure 4.11: (a) In-plane longitudinal resistivity (component R<sub>XX</sub> of the magnetoresistance matrix) vs. B, up to B = 9T and at T = 390mK. The right inset shows  $R_{XX}$  at T = 1.1K, where a large negative magnetoresistance is observed for |B| < 0.3T. For B > 2.5T, Shubnikov-de Haas oscillations appear. (b) In-plane longitudinal resistivity in the direction orthogonal to panel (a) (component  $R_{YY}$ ) vs. B, up to B = 9T and at T = 390mK. The right inset shows  $R_{YY}$ at T = 1.1K, and the abrupt magnetoresistance is reduced at T =1.1K (inset) compared to T = 390 mK (main panel). For B > 1.7T, Shubnikov-de Haas oscillations again appear, testifying of a carrier population with high mobility. [1]

gain access to inelastic neutron scattering beam time at Oak Ridge National Laboratory. References

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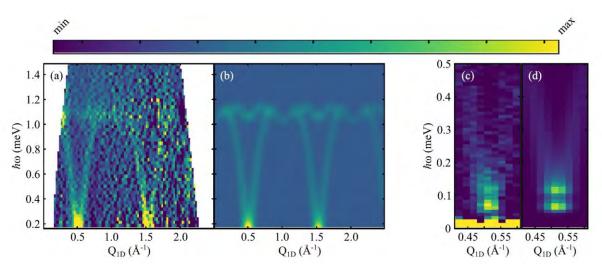


Figure 4.12: a) The WSe<sub>2</sub> monolayer-on-fiber assembly used for optical absorption studies in 60T. b) Discrete jumps in the absorption indicate emptying and spontaneous filling of specific valley LLs. c) Schematic depicting spontaneous valley polarization, driven by electron interactions.

## 2. Pressure-induced suppression of ferromagnetism in CePd<sub>2</sub>P<sub>2</sub>

When a ferromagnetic transition is suppressed by a clean control parameter such as pressure, typically, the second-order phase transition changes to first order to a critical value of the control parameter and the transition abruptly drops toward 0K. As the system approaches the critical point in a second-order phase transition, fluctuations in the order parameter extend to larger and larger length scales, while the order parameter varies smoothly between the ordered and disordered phases. An example is the correlated electron material CePd<sub>2</sub>P<sub>2</sub> that orders ferromagnetically at 29K. Prior work by Lai et al. [1] found evidence for a ferromagnetic quantum critical point induced by chemical compression via substitution of Ni for Pd. However, disorder effects due to the chemical substitution interfere with a simple analysis of the possible critical behavior. A collaboration between MagLab sites in Tallahassee and Gainesville allowed for a "multimessenger" study of the temperature—pressure—magnetic-field phase diagram of single crystals of CePd<sub>2</sub>P<sub>2</sub> to 25 GPa using a combination of resistivity, magnetic susceptibility, and x-ray diffraction measurements [2]. This investigation of parameter space showed the ferromagnetism appears to be destroyed near 12 GPa, as shown in Figure 4.13, without any change in the crystal structure [2].

This is an example of UF Physics, MagLab – Tallahassee, MagLab High B/T Facility, and a MagLab Collaborative Grant Program. *References* 

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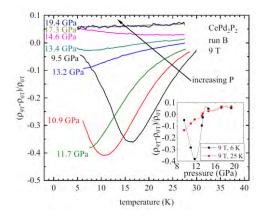


Figure 4.13: Magnetoresistance as a function of temperature for CePd<sub>2</sub>P<sub>2</sub> at varying pressures. At low pressure, magnetoresistance is negative and possesses a clear valley near the transition temperature for a given pressure. Above about 12 GPa, however, this feature vanishes, and as pressure increases further, magnetoresistance shifts from negative to positive above about 13.4 GPa. The inset shows magnetoresistance as a function of pressure at 6K and 25K, critical which is above the temperature, the magnetoresistance starts negative and gradually increases, becoming positive at higher pressures. The 6 K data shows a deep minimum at 11.7 GPa, near the critical pressure where the magnetic order appears to vanish. [2]

## Condensed Matter at LANL

1. Spontaneous Valley Polarization of Interacting Carriers in a Monolayer Semiconductor Li, J., Goryca, M., Stier, A., <u>Crooker, S. A.</u> (MagLab-LANL); Wilson, N. P., Xu, X. (University of Washington)

Electron-electron (e-e) interactions underpin many interesting phenomena in 2D layers of mobile charges, including the fractional quantum Hall effect, spin textures (skyrmions), and quantum Hall ferromagnetism. These phenomena arise from the Coulomb repulsion between charges, which in turn typically enhances the susceptibility of spin or related pseudospin (e.g., valley, layer, subband) degrees of freedom, and can even cause instabilities and spontaneous transitions to broken symmetry phases. Such interactions have been studied in 2D electron and hole gases (2DEGs, 2DHGs) in conventional Si, GaAs, and AlAs semiconductors (and also in graphene), usually deep in the quantum regime at high magnetic fields B where only a few Landau levels (LLs) are occupied. Studies in tilted B have proven indispensable in these materials, because they provide

a means to tune orbital (cyclotron) (Zeeman) and spin energies independently, thereby allowing to align LLs with different quantum numbers, so that e-e interactions can manifest most clearly. In the newer family monolayer of transition-metal dichalcogenide (TMD) semiconductors such as MoS<sub>2</sub> and WSe<sub>2</sub>, recent advances in material quality have enabled highmobility 2DEGs and 2DHGs. Owing to large carrier masses and reduced dielectric screening, e-e interactions are anticipated to be strong, even carrier densities. at high Of particular interest, band extrema lie at the inequivalent K and K' points (valleys) of the Brillouin zone, providing exciting opportunities to study both spin and valley degrees of freedom in doped monolayer systems. However, because spins in TMD monolayers are locked out-of-

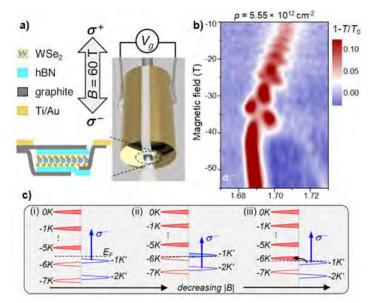


Figure 4.14: a) The WSe<sub>2</sub> monolayer-on-fiber assembly used for optical absorption studies in 60T. b) Discrete jumps in the absorption indicate emptying and spontaneous filling of specific valley LLs. c) Schematic depicting spontaneous valley polarization, driven by electron interactions.

plane by strong spin-orbit coupling, tilted-B methods cannot align LLs with different valley-spin index. To date this has limited studies of predicted valley-spin instabilities and phase transitions arising from e-e interactions.

We report magnetoabsorption spectroscopy of gated WSe<sub>2</sub> monolayers in high magnetic fields up to 60T. When doped with a 2D Fermi sea of mobile holes, well-resolved sequences of optical transitions are observed in both circular polarizations, which unambiguously reveal the number of filled LLs in each of the K and K' valleys. This reveals the interaction-enhanced valley Zeeman energy, which is found to be highly tunable with hole density. We exploit this tunability to align the LLs in K and K' and find that the 2D hole gas becomes unstable against small changes in LL filling and can spontaneously valley polarize. These results cannot be understood within a single-particle picture, highlighting the importance of exchange interactions in determining the ground state of 2D carriers in monolayer semiconductors (Figure 4.14).

#### Acknowledgements

The NHMFL is supported by NSF through NSF/DMR-1644779 and the State of Florida. *References* 

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## 2. Thermal and magnetoelastic properties of a-RuCl<sub>3</sub> in the field-induced low-temperature states

Schönemannn, R. Weickert, F. <u>Jaime, M.</u> (LANL, MPA-MAGLAB); Imajo, S. Kindo, K. (U. Tokyo, ISSP); Yan, J. Mandrus, D.G. Nagler, S.E. (ORNL); Takano, Y. (UF, Physics); Brosha, E.L. (LANL, MPA-11); Rosa, P.F.S. (LANL, MPA-CMMS)

## Introduction

The proposal that Mott insulators with a strong spin-orbit coupling and the correct geometry provide a promising platform for the realization of the sought after Kitaev quantum spin liquid (QSL) [1, 2] has led to a significant ongoing research effort into the layered antiferromagnet (AFM) a-RuCl<sub>3</sub>. Results from thermal Hall effect [3], neutron scattering [4] and other experimental probes indicate evidence for a field-induced (proximate) QSL phase in a narrow field range 7-10 T above the suppression of the AFM order. In this work we investigate the temperature-field phase diagram of a-RuCl<sub>3</sub> via magnetocaloric effect and fiber Bragg grating (FBG) dilatometry measurements. *Experimental* 

Thermal expansion and magnetostriction measurements on a-RuCl<sub>3</sub> were obtained with an optical FBG method, allowing detection of relative changes in the in-plane sample dimensions  $\Delta L/L_0$  with a resolution of 10<sup>-8</sup>, in a superconducting magnet system with fields up to 14T. Magnetocaloric measurements were done in a MagLab's 65T short pulse magnet. An AuGe thin film thermometer was directly deposited on the sample surface ensuring excellent thermal coupling to the sample and high sensitivity at low temperatures.

Results and Discussion

The zero-field coefficient of thermal expansion vs temperature shows a sharp transition into the AFM ordered state around 7K in accordance with the reported (H,T) phase diagram. We also observe a Schottky-like anomaly in applied fields H > 7T originating from a spin gap that evolves with  $H^3$  – resembling the expected field dependence of the Majorana fermion gap in the pure Kitaev model.

Magnetostriction measurements  $\Delta L/L_0$  vs H carried out within the AFM state display two distinct features around 6T and 7T (Figure 4.15 (a)) originating from a transition between differently stacked AFM layers (6T) and the transition to the proposed (proximate) Kitaev QSL phase at 7T.

The same transitions are evident in the magnetocaloric measurements under quasi-adiabatic and quasi-isothermal conditions. Remarkably the magnetocaloric reveals a crossover from a reversible behavior at higher temperatures to a dominantly irreversible behavior at temperatures below 1K evidenced by pronounced sample heating at the transition temperatures during the field up- and down-sweep (Figure 4.15 (b)). This indicates the presence of irreversible processes at the phase boundary between the AFM and the proposed (proximate) QSL state possibly induced by AFM domain movement and/or a first order phase transition, which would lead to a breakdown of quantum critical behavior at low temperatures.

Our measurements do not show evidence for a phase transition between the (proximate) QSL and a polarized paramagnetic phase above 7T. Therefore, our results place strong constraints on any theory put together to explain quantum critical behavior and the phenomenology of a QSL phase in a-RuCl<sub>3</sub> [5].

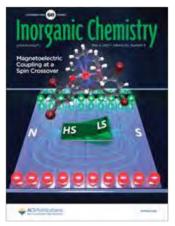
Acknowledgements

The National High Magnetic Field Laboratory is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida. This material is based upon work supported by the Department of Energy (DOE), Office of Science, National Quantum Information Science Research Centers; Los Alamos Laboratory Directed Research and Development program through project 20210064DR; the Gordon and Betty Moore Foundation's EPiQS Initiative, Grant No. GBMF9069; the DOE, Office of Science, Basic Energy Sciences, Materials Sciences and Engineering Division; the DOE Office of Science, Basic Energy Sciences, Division of Scientific User Facilities and the MagLab UCGP program.

References

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- [5] Schönemann, R., et al., Phys. Rev. B 102, 214432 (2020).

## 3. Magnetoelectric coupling at spin crossovers



V. B. Jakobsen, C. T. Kelly, <u>G. G. Morgan</u> (UC Dublin, Chemistry), J.-X. Yu, D.-T. Chen, J. Gu, J. Chen, J. Jiang, L. Zhang, Y. Yu, <u>X.-G. Zhang, H.</u> <u>P. Cheng</u> (UF, Physics), E. Dobbelaar (U. Kaiserslautern, Chemistry), E. Trzop, <u>E. Collet</u> (U. Rennes), X. Ding, F. Weickert, S. Chikara, and <u>V. S.</u> <u>Zapf</u> (MagLab-PFF) Introduction

We investigate the ability of magnetic field-induced spin crossovers (SCO) in 3d transition metals to couple to changes in the electric polarization. Magnetoelectric (ME) coupling between magnetic properties and electric polarization have been long studied primarily in (anti)ferromagnetic oxides. Here we explore a different route to ME coupling, where we use SCO in molecular materials instead of long-range order in inorganic oxides. We have found ME couplings within 10% of the record for any compound in three Mn<sup>3+</sup> molecular

compounds, as well as novel states of matter including transitions between Jahn Teller (JT) solid, liquid and gas states emerging both at low and high fields. SCO occur in certain 3d transition metals when the total electronic spin state S changes due to electrons changing orbitals. Such SCOs have dramatic effects on the lattice and electronic properties since the bond lengths of the 3d ion change by up to 10%, particularly when the SCO toggles a JT effect. SCO are common in compounds containing organic ligands with transition temperatures between ~50-400K since soft

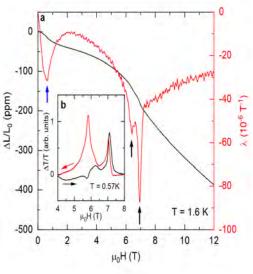


Figure 4.15: (a) Magnetostriction  $\Delta L/L_0$  (black) and magnetostriction coefficient  $\lambda$  (red) as a function of magnetic field. (b) Relative change of the sample temperature vs. magnetic field under auasi isothermal conditions.

lattices can more easily accommodate the strain that accompanies the spin state change without self-destruction.

## Experimental

Two Mn<sup>3+</sup> SCO compounds that show spin crossovers between 40 and 140K were synthesized, characterized for structural, electric and magnetic properties, and modelled with analytical and first-principles approaches.<sup>1-3</sup> In particular, low and high-field measurements of the magnetization and electric polarization at the MagLab-PFF and MagLab-Tallahassee investigated the ability of SCO to induce different electrically polar phases. High-field phase diagrams were extracted up to 45T (DC) and 65T (pulsed), and the phase diagrams comprising different structural, magnetic and electric phases were identified.

## Results and Discussion

In two Mn<sup>3+</sup> SCO compounds, spin crossovers triggered 2<sup>nd</sup> and 1<sup>st</sup> order structural phase transitions between different polar and nonpolar phases, which created effective ME couplings within 10% of the record for any material. These transitions were induced by changes in temperature and magnetic field and explored up to 65T. Since the different Mn<sup>3+</sup> low (S = 1) and high (S = 2) states carry different JT distortions, new JT phases of matter were identified in one compound<sup>4,5</sup> in which JT distortions with three degenerate choices of orientation form ordered state with solid and liquid properties, and also carry electric polarizations, thus creating different electrically polar, antipolar phases. The dynamic JT state at high temperatures is identified as a JT gas with paraelectric properties. Finally, the coupling among symmetry-breaking or non-symmetry breaking spin state, ferroelastic and ferroelectric order parameters was identified for each compound. *Conclusions* 

In conclusion, SCO can trigger structural phase transitions in molecular Mn3+ compounds with different electrically polar properties and thereby induce ME coupling. This research direction is promising for creating coupling between magnetic, electric and structural degrees of freedom. *Acknowledgements* 

The NHMFL is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida. Scientific research was funded by the Center for Molecular Magnetic Quantum Materials (M2QM), an Energy Frontier Research Center funded by the DOE, Office of Science BES DE-SC0019330; the LANL Laboratory-Directed Research and Development program; Science Foundation Ireland (SFI) 12/IP/1703; Irish Research Council GOIPG/2016/73 fellowship; and Danish travel grants for VBJ.<sup>1-3</sup>

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## 4. Scale-invariant magnetic anisotropy in RuCl<sub>3</sub>

RuCl<sub>3</sub> is a primary contender for hosting a Kitaev-like spin-liquid state. An important aspect of this correlated spin state is that, at least in the theoretical model, it is controlled by a single energy scale, the exchange interactions. Study of magnetic response in this system in a broad range of magnetic fields and temperatures below exchange interaction energy allows insight into the

stronaly correlated spin state in RuCl<sub>3</sub> and its potential relation to the physics of spin-liquids. Here report measurements of magnetic anisotropy in a broad range of magnetic fields and temperatures in single-crystal RuCl<sub>3</sub>. The observed magnetic response is scaleinvariant in the sense that in a broad range of magnetic fields and temperatures it does not show any direct dependence on an energy scale associated with exchange interactions. Such scale-invariance is characteristic of a non-interacting collection of spins-however, in the strongly coupled spin system, such scale-invariance indicates strongly correlated spin state, somewhat analogous to quantum criticality where characteristic energy scale is driven to zero by strong electronic correlations.

This work is a result of three years development of resonant of magnetotropic magnetometry where magnetic anisotropy in the sample is inferred from the frequency shift of small cantilever on which the sample is mounted. This measurement produces the magnetotropic coefficient, the angular derivative of magnetic torque. The detailed description of the technique will be published elsewhere (Figure 4.16).

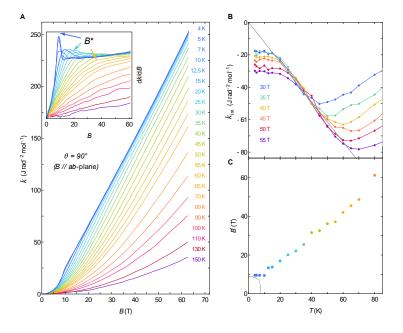


Figure 4.16: Measurements of magnetic anisotropy in RuCl<sub>3</sub>. (A) Magnetic field dependence of the magnetotropic coefficient up to 64T showing linear-in-magnetic field behavior in the entire magnetic field range (down to AFM transition) at the lowest temperature and quadratic-in-field dependence at the highest temperature. Inset: Field dependence of the slope, dk/dB. B\* indicates magnetic field of the crossover from B<sup>2</sup> to linear-in-B behavior. (B) Temperature dependence of the zero-field intercept of the extrapolated high-field behavior of the magnetotropic coefficient. The intercept is linear in temperature indicating scale-invariant behavior of magnetic anisotropy in a broad range of temperatures and magnetic fields. (C) Temperature dependence of the crossover field B\*. The linear-in-T dependence in a broad temperature range is only cut off by AFM transition at low temperatures.

K.A. Modic, R.D. McDonald, Y. Lai, J.C. Palmstrom, D. Graf, M.-K. Chan, F. Balakirev, G.S. Boebinger, J.B. Betts, M. Schmidt, D.A. Sokolov, P.J.W. Moll, B.J. Ramshaw, A. Shekhter, *Nature Physics* 17, 240 (2020), Scale-invariant magnetic anisotropy in RuCl<sub>3</sub>.

Acknowledgements

Reference

The National High Magnetic Field Laboratory is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida.

## 5. Thermodynamic evidence for a two-component superconducting order parameter in $Sr_2RuO_4$

The nature, and even the symmetry, of the superconducting order parameter in  $Sr_2RuO_4$  is not established and is a subject of active research. Although multiple theoretical and experimental investigations point to unconventional –p-wave-superconductivity in  $Sr_2RuO_4$ , recent NMR suggest otherwise because they fail to detect the expected signature of the time-reversal breaking in the superconducting state. Symmetry-resolved measurements of elastic moduli can determine the dimensionality of the order parameter, whether it is single or multi-component, and, potentially, resolve a question of time-reversal breaking. Resonant ultrasound measurements in this work address directly the dimensionality of the superconducting order parameter in Sr<sub>2</sub>RuO<sub>4</sub>. Compelling evidence is found for the multicomponent, possibly p-wave, superconducting order parameter in Sr<sub>2</sub>RuO<sub>4</sub>. Specifically, analysis of the elastic shear moduli shows a discontinuous jump in c<sub>66</sub> across the superconducting transition. Such behavior of the shear modulus in the tetragonal Sr<sub>2</sub>RuO<sub>4</sub> can only occur if the superconducting order parameter belongs to one of the two-dimensional irreducible representations of the stress in the tetragonal crystal. This is consistent with the p-wave superconductivity and it rules out several broadly discussed alternatives (Figure 4.17). *Reference* 

S. Ghosh, <u>A. Shekhter</u>, F. Jerzembeck, N. Kikugawa, D.A. Sokolov, M. Brando, A.P. Mackenzie, C.W. Hicks, B.J. Ramshaw, *Nature Physics* 17, 199 (2020), Thermodynamic evidence for a two-component superconducting order parameter in  $Sr_2RuO_4$ 

Acknowledgements

The National High Magnetic Field Laboratory is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida.

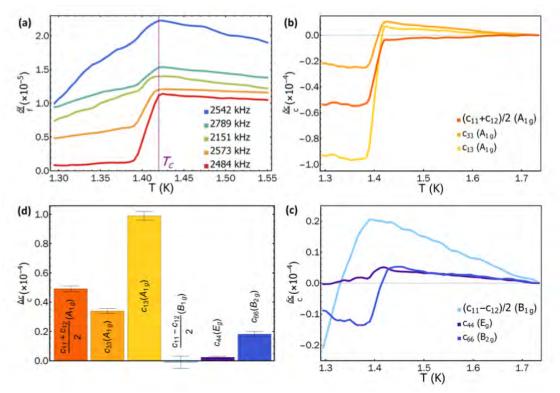


Figure 4.17: Measurements of elastic moduli in  $Sr_2RuO_4$ . (a) Temperature dependence of the frequency shift for several mechanical resonances. (b) Behavior of three compressional elastic moduli across the superconducting transition. All compressional elastic moduli must exhibit a discontinuous jump, whether the order parameter is single or multi-component, as is observed. (c) However, the discontinuous jump in the shear moduli is warranted only for multi-component order parameter. In  $Sr_2RuO_4$  the elastic modulus  $c_{66}$  exhibits the jump across the superconducting transition, ruling out single-component order parameters. (d) Elative magnitude of the jump across the superconducting transition. The jump in  $c_{66}$  is comparable in magnitude to the jump in compressional elastic moduli.

## 6. Quantum criticality at the extremities of a CDW phase in HgBa<sub>2</sub>CuO<sub>4</sub>

The physics of the anomalous metallic state in high-temperature superconductors the is believed to be driven by quantum criticality, however, the nature of such connection and the mechanism of the detailed metallic conductivity are not well understood. Analysis of Hall coefficient in a broad doping range within a context of conventional fermi liquid theory can help identify the marker of the quantum critical point expected at the critical doping. In this work, we report measurements of the Hall coefficient at low temperature and very high magnetic fields in the high-temperature superconductor HgBa<sub>2</sub>CuO<sub>4</sub> to address this question. We find the signature of the fermi surface collapse at the critical doping, consistent with some scenarios of metallic quantum criticality (Figure 4.18). Reference

M.-K. Chan, R.D. McDonald, J.B. Betts, A. Shekhter, E.D. Bauer, N. Harrison, *PNAS* 117, 9782 (2020), Quantum criticality at the extremities of a CDW phase in HgBa<sub>2</sub>CuO<sub>4+ $\delta$ </sub>.

Acknowledgements

The National High Magnetic Field Laboratory is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida.

## 7. One-component order parameter in URu<sub>2</sub>Si<sub>2</sub> uncovered by resonant ultrasound spectroscopy and machine learning

Here we address a long-standing question of the

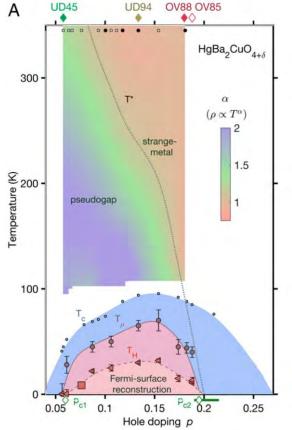


Figure 4.18: Doping-temperature phase diagram of the cuprates. The temperature  $T_H$  of the sign-change in the Hall coefficient can be used as a marker for the Fermi-surface reconstruction. Our measurement shows zero-temperature collapse of  $T_H$  at the critical doping, indicating the direct impact of the quantum criticality in cuprates on the character of the charge carriers on the Fermi surface.

symmetry of the hidden order in the heavy fermion URu<sub>2</sub>2Si<sub>2</sub> using symmetry-resolved resonant ultrasound measurements. These measurements provide a compelling evidence for the single-component order parameter in the hidden order phase of URu<sub>2</sub>2Si<sub>2</sub> (Figure 4.19). *Reference* 

S. Ghosh, M. Matty, R. Baumbach, E.D. Bauer, K.A. Modic, A. Shekhter, J.A. Mydosh, E.-A. Kim, B.J. Ramshaw, *Science Adv.* 6, eaaz4074 (2020), One-component order parameter in URu<sub>2</sub>Si<sub>2</sub> uncovered by resonant ultrasound spectroscopy and machine learning *Acknowledaements* 

The National High Magnetic Field Laboratory is supported by NSF through NSF/DMR-1157490/1644779 and the State of Florida.

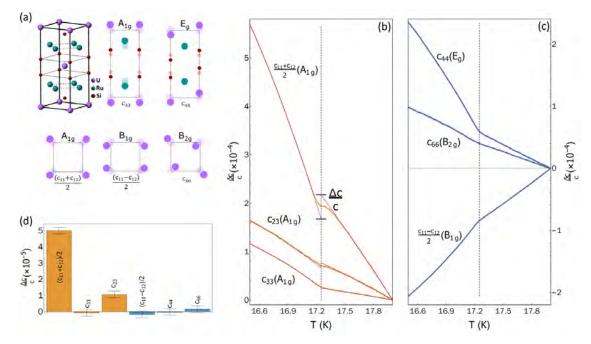


Figure 4.19: Resonant ultrasound measurements in URu<sub>2</sub>2Si<sub>2</sub> across the hidden order phase boundary. (a) Sketch of the irreducible components of the strain/stress tensor in the tetragonal lattice of in URu<sub>2</sub>2Si<sub>2</sub>. (b) Temperature dependence of the compressional elastic moduli showing discontinuous jump at the hidden order transition. (c) Temperature dependence of three shear moduli showing no jump across the hidden order boundary. (d) Relative magnitude of the jump in the six elastic moduli of in URu<sub>2</sub>2Si<sub>2</sub>.

## 8. GaN/AlGaN 2DEGs in the Quantum Regime: Magneto-transport and Photoluminescence to 60T

Crooker, S. A.; McDonald, R. D.; Doorn, J. L.; Zimmermann, I.; Lai, Y.; Winter, L. E. (MagLab-LANL) Lee, M.; Ren, Y.; Cho, Y. J.; Ramshaw, B. J., Xing, H. G.; Jena, D. (Cornell University)

The wide-bandgap semiconductor GaN is a foundational material for solid-state lighting and highpower electronics. Furthermore, the two-dimensional electron gas (2DEG) that forms naturally at GaN/AlGaN heterointerfaces is of interest for high-electron mobility transistors. 2DEG structures grown by molecular-beam epitaxy (MBE) have exhibited electron mobilities exceeding  $10^5$  cm<sup>2</sup>/Vs, galvanizing interest in quantum phenomena and novel electron correlations in GaNbased materials. Indeed, transport measurements have shown a robust integer quantum Hall effect in GaN/AlGaN heterojunctions, and an indication of a fractional quantum Hall state (filling factor v=5/3) was reported by Manfra et al. nearly two decades ago. In comparison with the more widely studied GaAs-based 2DEGs, electrons in GaN 2DEGs have significantly heavier masses (~0.24m<sub>0</sub> vs. ~0.07 m<sub>0</sub> in GaAs), and the dielectric constant is smaller ( $\epsilon$ ~9.5 in GaN vs. ~13 in GaAs), so that enhanced electron-electron interactions are expected.

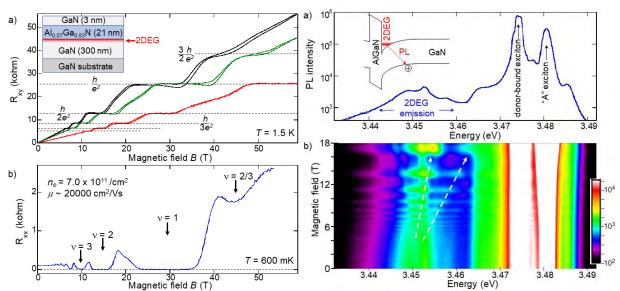
However, peak mobilities in GaN-based 2DEGs are, to date, typically achieved at large electron densities  $n_e \sim 10^{12}/\text{cm}^2$ , so that high magnetic fields B>40T are required to reach the "quantum limit" where v < 1. Such large B are (just) within reach of modern superconducting-resistive hybrid magnet technologies but are routinely exceeded by pulsed magnets. Pulsed fields can therefore enable detailed studies of high-density 2DEGs, including not only transport but also optical measurements that probe the response of the 2DEG to a photogenerated hole, which

have historically proven to be a powerful tool to measure screening and many-body effects in GaAs- and ZnO-based systems.

Using high magnetic fields up to 60T, we report magneto-transport and photoluminescence (PL) studies of a GaN/AlGaN 2DEG grown by MBE. Transport measurements demonstrate that the quantum limit can be exceeded (v < 1) and show evidence for the v=2/3 fractional quantum Hall state (see Figure 4.20). Simultaneous optical and transport measurements reveal synchronous quantum oscillations of both the PL intensity and longitudinal resistivity in the integer quantum Hall regime. PL spectra directly reveal the dispersion of occupied Landau levels in the 2DEG and therefore the electron mass. Persistent photodoping effects are also investigated. These results demonstrate the utility of high (pulsed) magnetic fields for detailed measurements of quantum phenomena in high-density 2DEGs.

## Acknowledgements

The NHMFL is supported by NSF through DMR-1644779 and the State of Florida. *References* 



[1] Crooker, S. A. et al., Applied Physics Letters 117, 262105 (2020).

Figure 4.20: Left: Transverse and longitudinal resistivity of the GaN/AlGaN 2DEG structure, to 60T. The black trace was acquired after 3 days in the dark, and the quantum limit is achieved at ~27 T. The fractional v=2/3 state is observed. Red trace was acquired after illuminating briefly with white light (note that  $n_e$  approximately doubled). Right: PL spectrum at 1.5K. The color map shows intensity oscillations of the 2DEG PL, which track the SdH oscillations of  $R_{xx}$  measured in transport.

## Condensed Matter at FSU

## 1. Interplay of Charge and Spin Orders with High-Temperature Superconductivity in La-Based Cuprates at High Magnetic Fields

In underdoped cuprates, the relationship between the pseudogap, superconductivity, and charge and spin ordering has been of key interest. Since high magnetic fields (H) are commonly used to suppress superconductivity and probe the nature of this unusual normal state, one of the central issues is to understand the interplay of superconductivity with charge and spin orders in the limit of high magnetic fields. However, the upper critical field ( $H_{c2}$ ) or the extent of superconducting (SC) phase with vortices, a type of topological excitations, has been controversial. A group led by MagLab scientist Dragana Popović performed a comprehensive series of experiments using several complementary electrical transport techniques on

underdoped La-214 cuprates, including those in which charge and spin orders appear in the form of stripes that are most pronounced for doping  $x\sim1/8$ . This study, which is of unprecedented scope, establishes a robust phase diagram for superconducting vortices in underdoped cuprates (Figure 4.21). It finds that, while the vortex phase diagram of underdoped cuprates is not very sensitive to the details of the charge orders, quantum fluctuations and disorder play a key role as temperature  $T \rightarrow 0$ . The presence of stripes, on the other hand, seems to alter the nature of the anomalous normal state, such that the high-field ground state is a metal, as opposed to an insulator [1].

In the same stripe-ordered cuprates, the group also revealed much-needed transport signatures of the elusive pair-density wave (PDW) state in the regime where superconductivity is destroyed by phase fluctuations, at fields  $H < H_{c2}$ . These findings have broad implications for cuprate physics because they do not support a scenario in which the PDW correlations are responsible for the pseudogap [2].

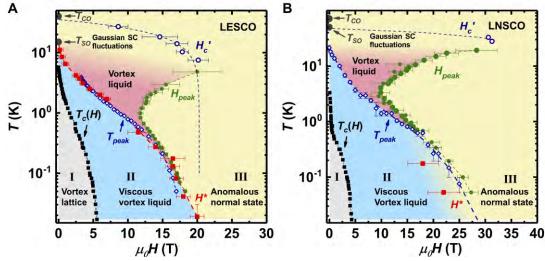


Figure 4.21: In-plane transport *T*-*H* phase diagram of striped cuprates with  $H \mid \mid c$  axis. (A) La<sub>1.7</sub>Eu<sub>0.2</sub>Sr<sub>0.1</sub>CuO<sub>4</sub> (LESCO); (B) La<sub>1.48</sub>Nd<sub>0.4</sub>Sr<sub>0.12</sub>CuO<sub>4</sub> (LNSCO). *T<sub>c</sub>*(*H*) (black squares) mark the boundary of the pinned vortex lattice, which is a superconductor with the in-plane resistivity  $\rho_{ab}=0$  for all *T*<*T<sub>c</sub>*(*H*) [region I; *T<sub>c</sub>*(*H*)>0]. *H*<sup>\*</sup>(*T*) symbols mark the boundary of the viscous vortex liquid, in which *dV/dI* (V-voltage, *I*-current) is non-Ohmic [for *H*<*H*<sup>\*</sup>(*T*)] and which freezes into a vortex glass at *T*=*T<sub>c</sub>*=0; dashed red line guides the eye. Ohmic behavior is found at *H*>*H*<sup>\*</sup>(*T*). *H*<sup>\*</sup>(*T*=0) thus corresponds to the upper critical field *H<sub>c2</sub>*. *H<sub>peak</sub>*(*T*) (green dots) represent fields above which the magnetoresistance (MR) changes from positive to negative. The region *H*<sup>\*</sup><*H*<*H<sub>peak</sub>, in which the positions of the peak in \rho\_{ab}(T). <i>H<sub>c</sub>*'(*T*) is the field above which SC fluctuations are not observed; Gaussian fluctuations of the SC amplitude and phase are expected at the highest *T* and *H*<*H<sub>c</sub>*'(*T*). The highest field region (III) corresponds to the *H*-revealed normal state. The dashed line in (A) is a fit with  $\mu_0H_c$ '[*T*] = 20.3[1-(*T*[K]/35.4)<sup>2</sup>]. In (B), SC fluctuations vanish between 33K and 48K for *H*=0, and the dashed line is a guide to the eye. Zerofield values of *T*<sub>50</sub> and *T<sub>co</sub>*, the onset temperatures of spin and charge orders, respectively, are also shown; both spin and charge stripes are known to be enhanced by *H*. Except for *T<sub>c</sub>*(*H*), lines do not represent phase boundaries, but finite-temperature crossovers.

#### Acknowledgements

This work was supported by NSF grants nos. DMR-1307075 and DMR-1707785, the National High Magnetic Field Laboratory (NHMFL) through NSF Cooperative agreement no. DMR-1157490, and the State of Florida.

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## 2. Origin of gaplike behaviors in URu<sub>2</sub>Si<sub>2</sub>: Combined study via quasiparticle scattering spectroscopy and resistivity measurements

Shengzhi Zhang (MagLab & FSU, Physics); Greta Chappell (MagLab & FSU, Physics); Naveen Pouse (UC San Diego, Physics); Ryan E. Baumbach (MagLab & FSU, Physics); M. Brian Maple (UC San Diego, Physics); Laura H. Greene (MagLab & FSU, Physics); <u>Wan Kyu Park</u> (MagLab) Introduction

Despite decades of intensive research, whether the hidden order (HO) in  $Uru_2Si_2$  is primarily associated with itinerant or localized electrons remains to be unambiguously determined. In

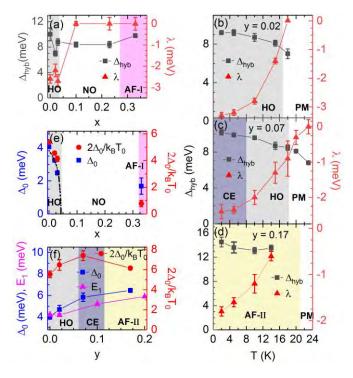


Figure 4.22: Gap values extracted from the QPS (a - d) and resistivity (e – f) data on  $URu_2Si_{2-x}P_x$  and  $URu_{2-y}Fe_ySi_2$  single crystals. Labels at the bottom denote different regions in the phase diagram (see the text). PM denotes the paramagnetic state.  $\Delta_{hyb}$  and  $\lambda$  are the hybridization gap and the renormalized f-level, respectively, obtained from the QPS data.  $\Delta_0$  is the zero-temperature gap in the bosonic excitations extracted from the temperaturedependent resistivity. All lines are a guide to the eye. (a)  $\Delta_{hyb}$  and  $\lambda$  at 2K as a function of x in URu<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub>. The hybridization gap is observed in all phases including the NO. (b) – (d)  $\Delta_{hyb}$  and  $\lambda$  as a function of temperature for different y in URu<sub>2-y</sub>Fe<sub>y</sub>Si<sub>2</sub>. The hybridization gap opens well above the ordering temperature. (e)  $\Delta_0$  and its mean-field ratio as a function of x in URu<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub>. T<sub>0</sub> is the ordering temperature. The NO data are fit well to the Fermi liquid expression without the bosonic excitation term. (f)  $\Delta_0$  and its mean-field ratio as a function of y in URu<sub>2-y</sub>Fe<sub>y</sub>Si<sub>2</sub>.  $\Delta_0$  and  $E_1$ , the gap detected in inelastic neutron scattering [6], show similar dependence on y. The mean field ratio is quite different between AF-I and AF-II, suggesting that these two antiferromagnetic orders are of different nature.

addition, gap values extracted from different measurements are somewhat discrepant, presumably because different gaplike behaviors may reflect different aspects of the HO problem. Experiments and Data Analysis

To address these outstanding questions, we performed a combined study via auasiparticle scattering spectroscopy (QPS) and electrical resistivity measurements [1] on the polished (001) surface of Uru<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub> [2] and Uru<sub>2-y</sub>Fe<sub>y</sub>Si<sub>2</sub> [3] single crystals, whose ground state spans a wide range of the phase space: HO, no order (NO), and an antiferromagnetic phase (AF-I) for the P substitution; HO, coexisting (CE) region, and another antiferromagnetic phase (AF-II) for the Fe substitution. The QPS and dc resistance data were analyzed using the models proposed by Maltseva et al. [4] and Jobiliong et al. [5], respectively, the latter assuming gapped bosonic excitations as the major scattering source in the ordered state.

#### Results and Discussion

A hybridization gap is observed in all five phases including the NO region [Figures 4.22 (a) - (d)], with minimal change upon crossing the phase boundary. This indicates that the opening of a hybridization gap itself is not associated with the ordering and thus localized electrons must be the maior player. The temperature dependence of the resistivity including the jump at the transition temperature is well reproduced by the Jobiliong et al. model. The extracted gap [Figure 4.22 (e) & (f)] reveals that the two antiferromagnetic phases (AF-I & AF-II) are of different nature. In URu<sub>2-y</sub>Fe<sub>y</sub>Si<sub>2</sub>, it

matches with the  $E_1$  gap detected by inelastic neutron scattering [6].

Conclusions

The orderings in URu<sub>2</sub>Si<sub>2</sub> are likely due to localized electrons and the gaplike behaviors in many physical properties can be explained by considering the gapped bosonic excitations in such ordered states. Our results suggest that the multitude of f electrons in URu<sub>2</sub>Si<sub>2</sub> may play intriguing roles leading to intertwined orders (HO and AF), whose analogs can be found in other correlated systems.

## Acknowledgements

This work was supported by the NSF/DMR-1704712. The work at the NHMFL was partly supported by the NSF/DMR-1644779 and the State of Florida and partly by the FSU startup funds under Award No. 0000028452. The work at UCSD was supported by the DOE-BES-DMSE under Award No. DEFG02-04-ER46105 and by the NSF/DMR-1206553.

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## 3. Influence of hydrostatic pressure on hidden order, the Kondo lattice, and magnetism in $URu_2Si_{2-x}P_x$

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## Introduction

URu<sub>2</sub>Si<sub>2</sub> is well known as a strongly correlated electron Kondo lattice that hosts (i) the enigmatic hidden order (HO)  $T_0 \approx 17.4 \text{K}$  and state near (ii) superconductivity (SC) below  $T_c = 1.5K$ [1]. However, even after substantial efforts, the HO state and its relationship to more common ordered states such as magnetism remain unclear. Earlier works where the ground state is tuned using pressure, chemical substitution, and applied magnetic fields have provided insights, but are often difficult to understand because they simultaneously tune multiple connected factors. To avoid this complexity, the chemical substitution series URu<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub> was recently

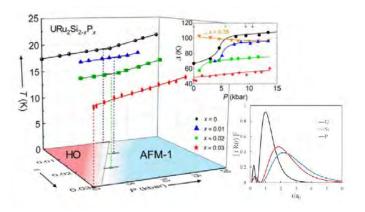


Figure 4.23: Temperature-concentration-pressure (T-x-P) phase diagram for URu<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub> showing the phase boundaries for the low x hidden order and antiferromagnetic phases. (top inset) The energy gap parameter  $\Delta$ , extracted from fits to the low temperature electrical resistivity data. (bottom inset) The radial probability distribution for U, Si, and P expressed in atomic units determined using a tight binding Hartree-Fock approximation.

investigated [2], where it was proposed that the primary tuning parameter is a combination of s/p-site electron doping and lattice compression. In the current study, we investigate the influence of applied pressure in this series [3]. These results provide new insights to the quasi-universal phase diagram that results from electron-like substitution (Si $\rightarrow$ P and Ru $\rightarrow$ Co/lr) and may also point the way towards stabilizing HO in related uranium based Kondo lattice compounds that exhibit magnetism in their natural form.

## Experimental

Electrical resistivity p(T) measurements were performed on single crystal specimens of URu<sub>2</sub>Si<sub>2-x</sub>P<sub>x</sub> with the current applied along the crystalline ab-plane in a Quantum Design Physical Property Measurement System (PPMS) at temperatures *T*= 1.8K - 300K. Applied pressures up to 20.5 kbar were achieved using a double-wall beryllium copper clamped piston cylinder cell and a quasi-hydrostatic pressure environment was provided with Daphne 7575 oil.

## Results and Discussion

Within the chemical substitution series  $URu_2Si_{2-x}P_x$ , there is an evolution in the ground-state behavior from hidden ordered (HO) for  $x \le 0.03$ , to Kondo lattice behavior with no ordering (NO) for  $0.03 \le x \le 0.26$ , to antiferromagnetism (AFM-2) for  $0.26 \le x \le 0.5$  [2]. To better understand what factors, control this behavior, temperature-dependent electrical resistivity measurements were performed. Specimens in the HO x region show similarities to the parent compound, where (i) HO transforms into antiferromagnetism (AFM-1) at a critical pressure ( $P_c$ ) and (ii)  $P_c$  decreases with increasing x and collapses towards P = 0 near  $x \approx 0.03$  (Figure 4.23 left). At larger x, no pressure induced phase transitions are observed in the NO x region, and the AFM-2 state is only weakly suppressed by P. Measurements further reveal that AFM-1 and AFM-2 are distinct from each other. Calculations of the wave functions using the tight-binding Hartree-Fock approximation were performed and show (i) that the radial probability distributions for the phosphorus ions are more tightly bound than those for the silicon and (ii) that the energy difference between the orbitals decreases with increasing x (Figure 4.23 bottom inset).

## Conclusions

Based on our measurements and calculations, we conclude that the cumulative effect of  $Si \rightarrow P$  substitution is to (i) decrease the hybridization strength, which correlates with the weakening of HO and (ii) at large x, additional effects such as electrical charge tuning also play an important role in determining the ground-state behavior.

## Acknowledgements

This work was performed at the National High Magnetic Field Laboratory, which is supported by NSF Cooperative Agreement No. DMR-1644779 and the State of Florida. Synthesis of crystalline materials and their characterization was supported by the Center for Actinide Science and

Technology (CAST), an Energy Frontier Research Center (EFRC) funded by the DOE, Office of Science, Basic Energy Sciences (BES), under Award No. DE-SC0016568.

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## 4. Superconductivity in a uranium containing high entropy alloy

Nelson, W. N. (MagLab, FSU Physics), Chemey, A. T. (FSU Chemistry), Hertz, M. (FSU Chemistry), Choi, E (MagLab), Graf, D. (MagLab), Latturner (FSU Chemistry), Albrecht-Schmitt, T. E. (FSU Chemistry), Wei, K. (MagLab), <u>Baumbach, R. E.</u> (MagLab, FSU Physics)

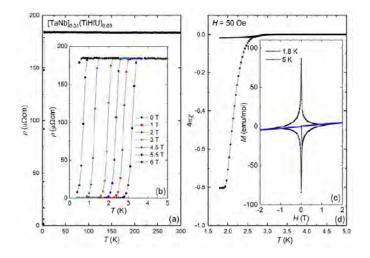


Figure 4.24: Summary of electrical transport  $\rho$  (T) and magnetization data  $4\pi\chi$  and *M* for [TaNb]<sub>0.31</sub>(TiUHf)<sub>0.69</sub>. (a.b)  $\rho$  (T) showing the transition to the zero resistance state near  $T_c = 3.1$  K and its suppression with increasing magnetic field *H*. (c,d)  $4\pi\chi$  vs T collected for H = 50 Oe and *M* vs *H* at 1.8K.

## Introduction

High entropy alloys (HEA) are multicomponent mixtures of randomly combined elements where, instead of producing disordered mixtures of lower order crystalline compounds (binaries, ternaries, etc.), solid solutions with simple structures (e.g., body center cubic) are formed [1–5]. Many attractive behaviors are observed in HEAs, including fracture resilience at cryogenic temperatures, excellent mechanical properties at elevated temperatures, high strength, and high resistance to radiation damage. An emerging class of HEAs are those hosting 4d and 5d transition metals that exhibit phonon mediated superconductivity with large upper critical fields [5]. Importantly, many HEAs are functional in multiple distinct ways, making them attractive as candidates for a variety of applications, e.g., as next generation wires for superconductivity in an f-electron containing HEA, [TaNb]<sub>0.31</sub>(TiUHf)<sub>0.69</sub>, which is also the first to include an actinide ion [6].

## Experimental

Polycrystalline specimens were produced using the arc furnace method. Powder x-ray diffraction and energy dispersive spectroscopy measurements were used to determine the structure and chemical composition. Temperature and magnetic field dependent magnetization, electrical resistivity, thermopower, thermal conductivity, and heat capacity measurements were performed using a Quantum Design Magnetic Properties Measurement System and Physical Properties measurement system for temperatures 1.8K < T < 300K and H < 9T.

## Results and Discussion

Similar to the Zr analogues  $[TaNb]_{1-x}(TiZrHf)_x$  [5],  $[TaNb]_{0.31}(TiUHf)_{0.69}$  [6] crystallizes in a bodycentered cubic lattice with the lattice constant a = 3.41(1) Å and exhibits phonon mediated superconductivity with a transition temperatures  $T_c \approx 3.2$  K and upper critical fields  $H_{c2} \approx 6.4$  T (Figure 4.24). Like other HEA superconductors, this occurs in a highly disordered environment, which likely provides pinning centers for superconducting vortices. Bulk electrical transport, magnetization, heat capacity, thermopower, and thermal conductivity measurements reveal other similarities to the Zr-analogues, where it is seen that the f-electrons are delocalized and that the chemical disorder results in a large and nearly temperature independent electrical resistivity and a small thermal conductivity.  $[TaNb]_{0.31}(TiUHf)_{0.69}$  thus emerges as a representative of what likely is a much larger family of actinide materials that may be of importance for both technological (e.g., development of durable waste forms) and basic science (reservoir for superconductivity) reasons. *Conclusions* 

These measurements indicate that [TaNb]<sub>0.31</sub>(TiUHf)<sub>0.69</sub> is a disordered type II superconductor that is described by the BCS theory within the weak electron-phonon coupling regime, similar to what was earlier reported for the Zr-containing analogues. This is consistent with the conclusion that the uranium f-electrons are delocalized and do not (i) carry a well-defined magnetic moment or (ii) result in strong electronic correlations.

## Acknowledgements

Synthesis and material characterization were supported by CAST, an EFRC funded by the DOE under Award DE-SC0016568. Kaya Wei acknowledges support from the Jack E. Crow NHMFL postdoctoral fellowship. This work was performed at the NHMFL which is supported by NSF Cooperative Agreement DMR-1644779 and the State of Florida.

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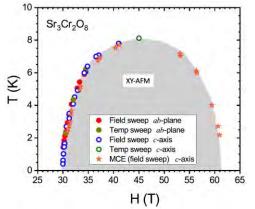


Figure 4.25: (H, T) phase diagram from dilatometry and sound velocity data in DC magnetic fields along the ab-plane and along the c-axis, and magnetocaloric effect data in pulsed magnetic fields.

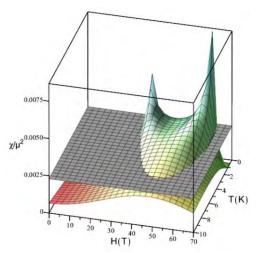


Figure 4.26: Calculated temperature and magnetic-field dependence of the magnetic susceptibility in  $Sr_3Cr_2O_8$  per spin. The intersection with the gray plane represents the critical (H<sub>c</sub>, T<sub>c</sub>) line and qualitatively agrees with Figure 4.25.

# 5.Enhanced spin correlations in the Bose-Einstein condensate compound Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub>

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#### Introduction

Enhanced spin correlations are key to understand phase transitions and specific types of order, among myriads, in magnetic systems. They help us classify critical phenomena that are oblivious to microscopic details, allowing predictions for bigger and perhaps more consequential systems. By studying the thermal and sound propagation properties of spin states in  $Sr_3Cr_2O_8$  and their coupling to the crystal lattice, some of the strongest spin correlations in any members of the quantum magnetism family of compounds are found, in the absence of any indication of frustration or reduced dimensionality. [1]

## Experimental, Results and Discussion

High-quality single-crystal samples of the spin-dimer system Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub> were grown using the floating-zone technique. Spin-lattice effects in this material were studied by means of ultrasound and dilatometry techniques in dc-field 35 T and 45 T magnets at MagLab, Tallahassee, FL; and by magnetocaloriceffect experiments in pulsed 60 T magnets at ISSP, University of Tokyo, Japan.

Combined experimental (Figure 4.25) and modeling (Figure 4.26) studies allowed us to probe and explain the spin-correlated regime in the proximity of the fieldinduced XY-type antiferromagnetic (XY-AFM) order also referred to as a Bose-Einstein condensate of magnons. We found that the XY-AFM state is

presented by a dome phase diagram, whereas paramagnetic, spin gapped dimer, spincorrelated, and spin-saturated states take place around the dome (not detailed here). The reported minimalistic quasi-one-dimensional phenomenology is consistent with a "passive" crystal lattice that acts as a silent witness to the mechanisms driven by magnetic correlations. *Acknowledgements* 

Work at the NHMFL was supported by NSF through NSF/DMR-1644779, the State of Florida, and the DOE Office of Basic Energy Science Project No. "Science at 100 T".

The research was partially supported by the DFG (Grant No. SFB 1143), the Würzburg-Dresden Cluster of Excellence on Complexity and Topology in Quantum Matter (EXC 2147, Project No. 390858490), by the BMBF via DAAD (Project No. 57457940), and Dresden High Magnetic field

Laboratory (HLD) at Helmholtz-Zentrum Dresden-Rossendorf (HZDR), member of the European Magnetic Field Laboratory (EMFL).

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## 6. Experimental protection of quantum coherence by using a phase-tunable image drive

S. Bertaina (CNRS-Marseille, France), H. Vezin (CNRS-Lille, France), H. de Raedt (U. of Groningen, The Netherlands), I. Chiorescu (FSU- MagLab)

## Introduction

A method to increase the coherence time of a qubit up to its relaxation time has been introduced and verified experimentally on several diluted quantum spins. The work has been published in [1]. *Experimental* 

Data taken at CNRS-Lille, France, using a conventional pulse ESR spectrometer Bruker E680 equipped with an incoherent electron double resonance (ELDOR) bridge and a coherent arbitrary waveform generator (AWG) bridge. Numerical analysis involved the use of the QuTip package.

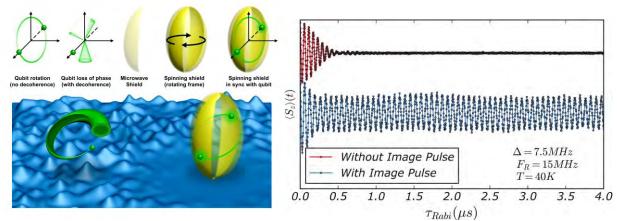


Figure 4.27: (left) Artist representation (by J. Kevin – MagLab) of the principle introduced in this work. The qubit phase information is shown by the green ball in a circular motion. The fast dephasing in the absence of the commensurate microwave shield is due to the interaction with various decoherence sources (shown as rough waters). However, when the shield is applied, the decoherence sources (shown by calm waters underneath) are no longer disturbing the qubit phase information. The top figures indicate the qubit and shield rotation in the rotating frame (Bloch sphere); the commensurate aspect of the motion is shown by the green ball glowing every time the shield and qubit meet. (right) Measurement performed on a Gd spin system, with (blue) and without (red) the Floquet microwave shield (from [1]).

## Results and Discussion

The principle of the method is given in Figure 4.27 (left) and verified on diamond P1 defects (S = 1/2), Mn<sup>2+</sup> impurities in MgO (S = 5/2) and Gd<sup>3+</sup> impurities in CaWO<sub>4</sub> (S = 7/2). A typical result is shown in Figure 4.27 (right), from [1], whereby "image pulse" is the microwave shield introduced in Figure 4.27 (see [1] for details).

In Figure 4.27 (left) the top figures show the motion of a qubit (green ball) without and with a specially designed Floquet microwave shield (in yellow). The motions of the qubit and shield are commensurate, shown by the green ball glowing each time the two meet. Without a shield, the qubit phase information is lost in a disc-like pattern due to decoherence sources ("rough waters" underneath, on left) while with the shield on, the decoherence sources are managed and the coherence is preserved up to qubit's energy relaxation time.

The example shown in Figure 4.27 (right) details the quantum Rabi oscillations of a Gd3+ spin with (blue) and without (red) the microwave shield in place. The maximum coherence times presented in [1] extend to 15 microseconds, which is the maximum allowed by the Bruker setup. *Conclusions* 

We have introduced a universal method allowing to protect the qubit coherence; the method is demonstrated on several quantum spin systems.

### Acknowledgements

Work supported by the CNRS infrastructure RENARD (award IR-RPE CNRS 3443). Partial support by the NSF DMR-1644779 and the State of Florida is acknowledged.

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## 7. Site-specific spectroscopic measurement of spin and charge in (LuFeO<sub>3</sub>)<sub>m</sub>/(LuFe<sub>2</sub>O<sub>4</sub>)<sub>1</sub> multiferroic superlattices

Fan, S. (U. of Tenn., Knoxville, Physics); Das, H. (Tokyo Inst. Of Tech.); Rébola, A. (Instituto de Fisica Rosario-CONICET); Smith, K.A. (U. of Tenn., Knoxville, Chemistry); Mundy, J. and Brooks, C. (Harvard); Holtz, M.E., Muller, D.A., and Fennie, C.J. (Cornell); Ramesh, R. (UC, Berkeley); Schlom, D.G. (Cornell); McGill, S.A. (MagLab); <u>Musfeldt, J.L</u>. (U. of Tenn., Knoxville, Physics & Chemistry) Introduction

We develop a method for extracting interface spectra (+ magnetization) in multiferroic superlattices and employ this approach to reveal precisely how enhanced Lu layer distortion increases the Curie temperature.

## Experimental

We performed magnetic circular dichroism measurements (MCD) in the 25 T Split-Florida Helix magnet. Access to the unique Split-Florida Helix magnet at the National High Magnetic Field Laboratory was crucial to this work because MCD is sensitive to field direction. The high coercivity of these superlattices also requires a large ±25 T field to close the magnetic hysteresis loop. *Results and Discussion* 

Figure 4.28 summarizes the magnetic circular dichroic responses of all superlattices [1]. Three Ferelated excitations are assigned in the dichroic spectra based upon their energies and intensities. Constant energy cuts of the dichroic spectra reveal optical hysteresis loops. We extract the interface response by subtracting the spectra of the end members in proper proportion. In addition to the dramatic intensity change above 2 eV, analysis of the interface spectra at different characteristic energies reveals that increased Lu-layer distortion selectively enhances the spin-up charge transfer. Because the dichroic signal is proportional to magnetization, this implies that enhanced magnetization in the LuFe<sub>2</sub>O<sub>4</sub> layers boosts the Curie temperature in these multiferroic superlattices.

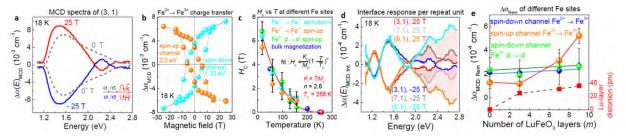


Figure 4.28: (a) MCD of the (3,1) superlattice at  $\pm 25T$  and  $\pm 0T$ . (b) Optical hysteresis for the spin-up and spindown channel Fe<sup>2+</sup>  $\rightarrow$  Fe<sup>3+</sup> charge transfer excitations. (c) Coercivity vs. 7 for different Fe-related excitations. (d) Interface MCD spectra for (3,1), (7,1), and (9,1) superlattices. (e) Remnant field vs. *m* for different Ferelated excitations.

## Conclusions

Understanding the inner workings of multiferroic interface materials is in its infancy, and the spectroscopic decomposition method that we report is a powerful means to learn about how they track with site-specific understanding directly at the interface. Analogous opportunities exist to exploit interface materials to enhance spintronics and photonics. As a result, there is broad utility in revealing interface dynamics well beyond the multiferroics community. *Acknowledgements* 

Research at the U. of Tenn. was supported by the DOE, Office of Basic Energy Sciences, Mater. Sci. Div. under Award DE-FG02-01ER45885 (J.L.M.). Work at the NHMFL was supported by the NSF through DMR-1644779, DMR-1229217 (S.M.), and the State of Florida. Film growth and electron microscopy characterization was supported by the DOE, Office of Basic Energy Sciences, Div. of Mater. Sci. and Eng., under Award No. DE-SC0002334. The Electron Microscopy Facilities at the Cornell Center for Materials were supported through the NSF MRSEC program (DMR-1719875). Research at the Tokyo Institute of Technology was supported by the Grant-in-Aid for Scientific Research 19K05246 from the Japan Society for the Promotion of Science (JSPS) and TSUBAME supercomputing facility. The use of the Maryland Advanced Research Computing Center (MARCC) was supported by the Platform for the Accelerated Realization, Analysis, and Discovery of Interface Materials (PARADIM): an NSF Materials Innovation Platform (DMR-1539918). Work at UC Berkeley was funded by the SRC ASCENT center under the SRC-JUMP program. *References* 

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## 8. Ring currents modulate optoelectronic properties of aromatic chromophores at 25T

Kudisch, B. (Princeton U.); Maiuri, M. and Moretti, L. (Princeton U. and Politechnico di Milano); Oviedo, M.B. (Princeton U., UC Riverside, and Universidad Nacional de Cordoba); Wang, L., Oblinsky, D.G., and Prud'homme, R.K. (Princeton U.); Wong, B.M. (UC Riverside); McGill, S.A. (MagLab); and <u>Scholes, G.D</u>. (Princeton U.)

#### Introduction

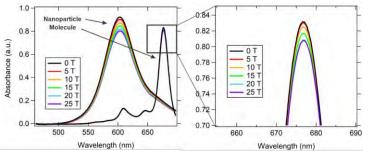
Magnetic fields are powerful, incisive scientific tools to investigate and manipulate the properties of next-generation quantum materials. Many organic systems studied so far have intrinsic magnetism which leads to straightforward Zeeman interactions in applied magnetic fields. However, we have observed magnetic-induced effects in the photo-physics of *diamagnetic* organic molecules which expands the scope of candidate materials that may be considered for multifunctional devices.

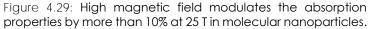
#### Experimental

We used the Ultrafast Optics instrumentation at the MagLab in conjunction with the 25 T Split-Florida Helix Magnet to measure the time-resolved, sub-picosecond, photo-excited absorbance dynamics of copper phthalocyanine nanoparticles, as well as a few other systems, in high magnetic fields.

#### Results and Discussion

Using the 25T Split-Florida Helix Magnet, we confirmed our theoretical prediction that a strong magnetic field applied on organic aromatic molecules affects their optoelectronic properties. Aromatic ring currents induced by the applied fields were shown to modulate not only the light absorbing properties of the model aromatic chromophore, but also its subsequent ultrafast





dynamics after light absorption, graphically shown in Figure 4.29 and Figure 4.30. This magnetic field sensitivity was also demonstrated to be enhanced by molecular aggregation in certain packing arrangements, analogous to a quantum molecular solenoid. [1] *Conclusions* 

Despite modern society's reliance on the interconversion of magnetic fields and circular electron currents,

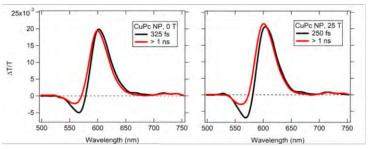


Figure 4.30: Subpicosecond intersystem crossing rate modulation at 25T.

most attempts to design magnetosensitive organic devices rely on materials already possessing intrinsic magnetism since they will obviously be affected by magnetic fields. Discovering that magnetic field-induced ring currents in "nonmagnetic" aromatic chromophores not only exist but are also controllable by both magnetic field strength and simple material properties greatly expands the scope of materials that should be considered for multifunctional magnetic technologies.

## Acknowledgements

We acknowledge financial support by the NSF, MRI program (DMR-1229217), and by Princeton University through the Innovation Fund for New Ideas in the Natural Sciences. A portion of this work was performed at the National High Magnetic Field Laboratory, which is supported by the NSF Cooperative Agreement DMR-1157490/1644779 and the State of Florida. M.M. acknowledges financial support by European Community (H2020 Marie Skłodowska Curie Actions), Project 655059. M.B.O. acknowledges financial support by the NSF - Institute for Complex Adaptive Matter (NSFICAM) and the NSF for the use of supercomputing resources through the Extreme Science and Engineering Discovery Environment, Project TG-CHE140097 and acknowledges financial support by the Agencia Nacional de Promoción Científica y Tecnológica fondo para la Investigación Científica y Tecnológica (ANPCyT-FONCyT, Grant PICT-2017-0795). B.M.W. acknowledges support from the DOE, Office of Science, Early Career Research Program under Award DE-SC0016269. B.K. acknowledges support by the NSF Graduate Research Fellowship under Grant DGE-1656466 as well as the Princeton Environmental Institute Walbridge Fund. *References* 

[1] Kudisch, B., et al., Proceedings of the National Academy of Sciences, 117, 11289-11298 (2020).

## 9. Probing Dielectric Transition and Molecular Dynamics in Metal Organic Framework [(CH)<sub>3</sub>NH<sub>2</sub>]Mg(HCOO)<sub>3</sub> Using NMR

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### Introduction

The mechanism of the electric phase transition in metal organic framework (MOF) multiferroics with the general formula [(CH)<sub>3</sub>NH<sub>2</sub>]M(HCOO)<sub>3</sub>, where M is the metal cation, is studied using multinuclear (<sup>15</sup>N, <sup>13</sup>C, <sup>25</sup>Mg) NMR technique. [1-3] Chemical shifts for M=Mg MOF near the phase transition (270K) and the correlation time of the carbon and nitrogen atom in the MOF cavity were measured and analyzed using BPP theory. The evolution of the <sup>13</sup>C, <sup>15</sup>N spectra indicate that the phase transition is prominently governed by the dynamics of the DMA<sup>+</sup> cations.

Experimental We used 17T at the condensed matter physics NMR facility and 600MHz, 830MHz Bruker high-resolution NMR instruments at the high-resolution NMR facility at MagLab to obtain the spectra, chemical shifts and spin-lattice relaxation T<sub>1</sub>. We used a Bruker Magic Angle Spinning (MAS) unit with 3.2mm rotor spinning at 14KHz.

### Results and Discussion

Figure 4.31 a shows the evolution of the <sup>13</sup>C CP/MAS NMR spectra of methyl carbons in the Mg-MOF as a function of temperature. A single resonance is observed above the transition phase temperature, implying that DMA<sup>+</sup> cations are in a disordered motional state averaging chemical shifts. the As the temperature is lowered, additional two peaks appear and gradually gain in intensities while the center peak intensity decreases. The emergence of the doublet in the low-temperature phase indicates that the DMA<sup>+</sup> cation is displaced from its center in the cavity such that the two methyl groups in the DMA<sup>+</sup> cation become chemically inequivalent. Similar behavior is exhibited by the formate carbons which also shows a single resonance above the phase transition temperature (Figure 4.31 b). The case for <sup>15</sup>N shows a single peak corresponding to the NH<sub>2</sub> group in the cavity (Figure 4.32 a). The phase

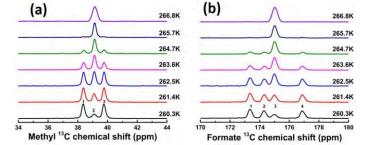


Figure 4.31: <sup>13</sup>C spectra (a) of the dimethylammonium cation and (b) of the format framework.

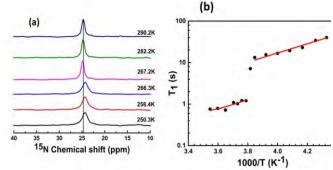


Figure 4.32: (a)  $^{15}N$  spectra in [(CH<sub>3</sub>)<sub>2</sub>NH<sub>2</sub>]Mg(HCOO)<sub>3</sub> and (b) its T-dependent T<sub>1</sub> relaxation. Red line shows fit to the BPP model.

transition was observed through the change in its chemical shift as well as linewidth. This is consistent with the theory that the nitrogen atoms are disordered over three different positions due to the weak hydrogen bonds above the phase transition resulting in motionally-narrowed line. Below the phase transition, the motion of the DMA<sup>+</sup> ion slows down as it localizes into one of the three positions in the lattice, such that the <sup>15</sup>N linewidth becomes broader. A first-order phase transition is evidenced by the temperature dependent relaxation time  $T_1$  of <sup>15</sup>N across the phase transition (Figure 4.32 b). At higher temperatures, the  $T_1$  relaxation is ten times faster than at lower temperatures. The two regions above and below the phase transitions were fitted separately using a BPP model. The activation energy and single particle correlation time were found to be 28.6 ± 8.3kJ/mol and  $1.5 \pm 6.0 \times 10^{-14}$  respectively.

Conclusion

The changes in the spectra of <sup>13</sup>C, <sup>15</sup>N indicate that the phase transition is prominently governed by the dynamics of the DMA<sup>+</sup> cations. From the fitting of 7<sub>1</sub> experimental data to BPP relaxation model, the correlation time is in reasonable agreement with the values found using other techniques. [4]

## Acknowledgements

All NMR experiments were carried out at the National High Magnetic Field Lab (NHMFL) supported by the NSF Cooperative Agreement DMR-1644779 and the State of Florida. *References* 

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## 4. MAGNETS AND MAGNET MATERIALS

A central part of the MagLab's Mission is to develop, operate, and maintain the new magnet systems that enable a world-leading high-magnetic-field user program.

For twenty-six years, the MagLab's user facilities were based on copper alloys and lowtemperature superconducting (LTS) materials. In 2020 the MagLab commissioned its first magnet using High Temperature Superconducting (HTS) materials, a 32T magnet, presently the highest field superconducting (SC) magnet worldwide. This magnet is the product of a development effort that started at a low level in 2007 when the first coil was tested using a novel form of REBCO (rare earth barium copper oxide, REBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub>) on a high strength Hastelloy substrate and electroplated copper stabilizer. It received some external funding with a Major Research Instrumentation grant in 2009. The more than \$16M needed to develop the technology and deliver the working system is an indication of the tremendous amount of development that went into characterizing the conductor, developing an insulation system, joints, terminals, winding technology, quenchprotection technology and controls system. The presently operational user magnet provides field approaching that of our workhorse resistive magnets (35T in 32mm room-temperature bore) while having lower field ripple, electronic noise, and consuming approximately 20MW less power. While eight resistive magnets share two pairs of power supplies, the 32T SC magnet is expected to eventually be running 24/7, like the other (20T) SC magnets in the milliKelvin facility, thereby providing a 60% field increase for this class of magnet.

While this magnet produced a remarkable 7T more field than any other SC magnet worldwide when it was first tested in 2017, this is not the end of the story, rather just the beginning. The MagLab has initiated development of a 40T SC magnet using similar REBCO technology. While several other labs and commercial firms are now developing or producing ultra-high field (UHF) magnets using the HTS materials, the MagLab has been leading the development of improved Bi-2212 (Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>10</sub>) conductor and coils, which show great potential for future UHF SC magnets, particularly for nuclear magnetic resonance and ion-cyclotron resonance.

In 2018, the generator that powers the 100T multi-shot (100TMS) and 60T long-pulse (60TLP) magnets was damaged and was taken out of service for repair. To continue to provide state-of-the-art facilities to users of the pulsed field facility, a "Magnet Surge" project was introduced to accelerate the development of capacitor-driven magnets at the 75T level in short-pulses (now operational) and the 60T level with longer pulses (to be operational in summer 2021).

Materials development for magnet applications continues to advance with important developments in Bi-2212, Fe-based, Nb<sub>3</sub>Sn superconductors, and qualification of REBCO from multiple suppliers, as well as reinforcing materials for pulsed and SC magnets.

Collaborations with leading industry, academic and government groups are synergistic with the materials and magnets science driver, and our report describes work in this broader context as well. Collaboration with the high-energy physics community continues, particularly regarding development of higher current-density superconductors, both LTS and HTS. The MagLab is one of the four central players in the Magnet Development Program (MDP) funded by the DOE Office of High Energy Physics (HEP) to drive ultra-high field dipole magnet technology.

## Superconducting Magnets & Materials **32T**

The MagLab has the world's highest field all-superconducting (SC) magnet in user service! The 32T all-SC magnet is now operational in the millikelvin facility which is part of the DC field facility at the FSU branch of the MagLab (Figure 4.33). It consists of an outer set of coils using low temperature superconducting (LTS) materials developed by Oxford Instruments that provides 15T in a 25cm

cold bore and an inner set of coils using high temperature superconducting (HTS) materials developed in-house that provides 17T in a 3cm bore.

The 32T SC magnet reached field for the first time at the end of 2017. During partial dis-assembly and relocation from the test site to the user facility in early 2018, some damage was noticed at the ends of the coils due to unexpected motion of the end flanges. A few components were re-designed and subjected to fatigue testing during 2018. The magnet was reassembled and ready for operations by early 2019. While the controls, power, and protection systems had been operational in late 2017 for system testing, they were not in a state suitable for operation by external users; they could only be operated by the individual who had led the development of the protection system. This person left to take a job elsewhere in mid-2018. A replacement did not arrive until mid-2019. By August 2020 the control, power and protection systems were in a state that allowed users to initiate operations at fields up to 26T in September 2020. In early 2021, operations commenced at fields up to 32T.

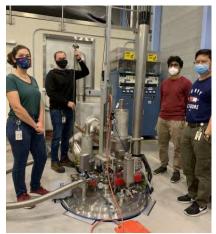


Figure 4.33: The first users of the 32T magnet performing NMR measurements of a frustrated magnet system in September 2020.

#### 40T

The MagLab has initiated the development of a 40T superconducting (40T SC) magnet. This project is being undertaken in a series of phases as used by NSF for projects valued >\$4M. The Research and Development phase began in September 2018. The Conceptual Design phase started in December 2019 (Award number: NSF/DMR #1938789) [1]. A Design proposal has now been submitted the NSF's Mid-Scale research Infrastructure program for the Preliminary and Final Design Phases. If this is successful, it will last five years, and an Implementation proposal will be submitted to the Mid-Scale program in 2025 for the construction of the magnet.

The objective of the conceptual design grant was to create a conceptual design of a robust all-superconducting magnet with peak field well in excess of 32T (a.k.a. 40T) and a bore size of 34mm. If funded, the 40T SC magnet will be installed in the millikelvin building of the DC Field facility at the FSU branch of the MagLab, near the existing 32T SC magnet. The 40T SC magnet will provide a very low noise environment for experiments lasting days at a time, surpassing the time available from present-day powered (resistive and hybrid) magnets. Upon its commissioning, the 40T SC magnet will become a flagship in the MagLab's suite of high-field magnets that exist to serve the User Community.

In 2009 when the 32T SC magnet project started, the only viable superconducting material was REBCO tape and the only coil technology that had been identified used pancake winding with inter-turn insulation. This "I-REBCO" approach was used in the 32T magnet. Since then, a version of REBCO coil without insulation (NI-REBCO) has been used to build several test coils including one at the MagLab that reached 45.5T. In addition, Bi-2212 and Bi-2223 have made a lot pf progress and seemed worth considering for a 40T SC magnet. During the R&D phase, these four options plus a layer-wound REBCO version (Integrated Coil Form or ICF) were investigated. Partway through the R&D phase it was decided that the only two options that showed potential to produce viable designs for reliable 40 T magnets by the end of the second year of work were the I-REBCO and NI-REBCO double-pancake approaches.

The I-REBCO approach evolved into a version using multiple tapes wound in parallel (a simple cable) and is referred to as Multi-Tape Insulated (MTI-) REBCO. The NI-REBCO approach has evolved into a more general concept with controlled inter-turn resistance (Resistive-Insulation, or RI-) REBCO. These two technologies were considered in the Conceptual Design Phase. The major

activities for the conceptual designs consist of validation of the technologies needed for the 40T magnet via components and subscale coil testing, development of HTS coil design codes benchmarked against the test coil results, and optimization of the 40T magnet design. The paragraphs below highlight the achievements in 2020.

It is intended that the magnet will survive 20 years of operation. It is anticipated that it might cycle to full field and back to zero field as many as 50,000 times over its lifetime. Data on the fatigue life of REBCO conductors suited for the 40T was insufficient, SO we performed extensive tests on the fatique life of REBCO tapes. Figure 4.34 shows how many cycles a short sample of tape will survive at various levels of mechanical strain applied at 77K. As is typical for fatigue data, there is significant scatter in the data. Test results

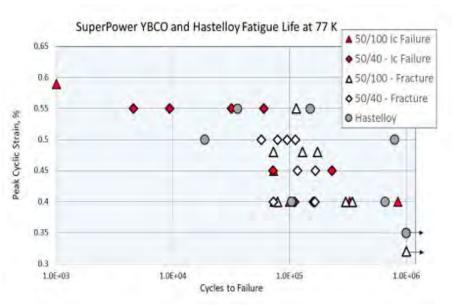


Figure 4.34 shows test results for fatigue of REBCO and Hastelloy tapes at 77K (load-control tension-tension fatigue, r= 0.1). In the legend, "X/Y" indicates REBCO composite tapes that include X microns of Hastelloy substrate and Y microns of copper cladding. "Ic failure" indicates the critical current dropped 10% or more. "Fracture" indicates the material broke.

suggest that tapes operated at 0.45% strain or less will survive 50,000 cycles.

To confirm that measurements made at 77K are relevant for 4.2K applications, a reduced set of fatigue measurements were made at 4.2K. Multiple samples of REBCO tapes were cycled up to 50,000 and 250,000 cycles at 0.4% peak strain. Their critical current ( $I_c$ ) was measured before and after cyclic operation. There was no obvious  $I_c$  drop at 50,000 cycles and about 7%  $I_c$  drop at 250,000 cycles. A miniature coil was fabricated with strain gauges on the outermost turn and cycled 24,000 times without failure in a 12T background field. It exceeded 0.5% strain on each cycle.

In the 32T SC magnet, the ratio of operating current,  $l_{op}$ , to critical current,  $l_c$ , ranges between 10% and 30%. For the 40T SC magnet, we intend to operate between 50% and 70% of  $l_c$  for three reasons: (1) to reduce the temperature margin and the resulting energy required to achieve quench protection; (2) to reduce the screening current magnitude and resulting strain [2]; and (3) to reduce the peak transient current in RI-REBCO coils during quench, as predicted by quench simulations [3]. Achieving a uniform  $l_{op}/l_c$  requires grading the  $l_c$  of the REBCO tapes with high  $l_c$  at the end where the component of field normal to the tapes is high and low  $l_c$  near the mid-plane where the normal component of field is small.

Graded conductor was not available commercially in 2018 when our R&D phase started. We explored two ways to grade the *l*<sub>c</sub>. One is by collaborating with the commercial suppliers of REBCO tape to help them produce different grades of tape by controlling the thickness of the superconductor layer. The other is to anneal the tapes or pancakes in-house to reduce the *l*<sub>c</sub> after tapes arrive from suppliers. Two suppliers, Superpower and SuperOx, have been receptive to the idea of developing graded tapes. We ordered 3.3km of graded tape from Superpower for use in

test coils. It has been received and characterized. A factor of 3.6 variation in  $l_c$  was attained over these samples. It was found that the  $l_c$  can be reduced to 30% of the standard tapes. Further efforts are needed to improve the  $l_c$  reproducibility and overall stability REBCO tape production.

The test results will enable us to establish a database of the  $l_c$  of REBCO tape for the design of future REBCO coils. An additional 6 km of  $l_c$  graded tapes has been ordered in 2020 and more data will be collected on them. These tapes will be used for test coils in 2021 and 2022.

Designing, building, and operating reduced-scale coils (test coils) in a parameter space similar to where the real 40T coils will operate is key to validating the reliability of the 40 T SC magnet design. There are two main types of testing. Fatigue tests focus on operating at similar mechanical stress and/or strain as the real coil for thousands of cycles. Quench tests focus on operating at similar  $l_{op}/l_c$  as the real coils and are intentionally quenched repeatedly. The goal is to also have similar current density in the copper stabilizer after quench starts as the real coils will.

Multiple test coils were planned in the 40T project, ranging from small scale coil (less than a few hundred meters conductor length) to midscale coil (1 to 2km conductor length including splices). Despite COVID's impact on the test coil schedule, we have completed testing of three coils in 2020.

• Mini fatigue test coil: As described above, we completed the fabrication and testing of one miniature fatigue coil. This coil was to investigate the HTS coil performance under fatigue operation. This coil reached 24,000 cyclic operation with a peak strain of more than 0.5% without observing degradation. The coil test results also showed excellent agreement between computed and measured strains in REBCO coils, shown in Figure 4.35. This was accomplished by coupling the rotation due to screening currents into the angle

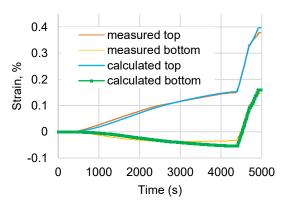


Figure 4.35: Measured and computed hoop strain ( $\sigma_{\theta\theta}$ ) evolution at points 1mm above and below the mid-plane of the conductor of the mini-fatigue coil at the MagLab.

between the field and the tape and the resulting calculation of screening current [2].

• Multi Tape Insulated Test Coil 0 (MTI-TCO): REBCO tape is known to have local defects. In an effort to mitigate the potential impact of such defects on the 40T SC magnet, the MagLab has adopted a two-in-hand winding technique for insulated coil applications. In such an approach, a two-tape turn can be operating at 70% of *l*<sub>c</sub>, but a single tape could have a small defect reducing its local *l*<sub>c</sub> by 60% while the turn (and magnet) can still reach full current. The MagLab's



Figure 4.36: Assembled MTI-TCO with instrumentation

first test coil, MTI Test Coil Zero (MTI-TCO), was fabricated and tested. It consisted of eight double pancakes and demonstrated twoin-hand coil-winding as well as fatigue lifetime. Figure 4.36 shows the assembled test coil. The coil was successfully tested up to a field of 11T in a 12T background field (23T total) and was cycled 225 times up to 450A, which corresponds to a measured strain of 0.4% 1 mm above the mid-plane of the tape on the outermost turn of the end

pancake. The test demonstrated that two-in-hand winding can perform well and provide high stability. The successful test of MTI-TCO enables us to pursue two-in-hand winding technology in the next test coil, MTI-TC1, which should operate at a significantly high  $l_{op}/l_c$  and also graded conductor.

• Resistive Insulation Petten Test Coil 3 (RI-PTC3): Test Coil RI-PTC3 was to investigate the quench protection of an RI coil with a controlled contact resistance between turns compared with an ideal No Insulation (NI) coil. It consists of 6 double pancakes, and Figure 4.37 shows the



Figure 4.37: RI-PTC3 prior to testing.

fabricated test coil. The contact resistance in RI-PTC3 was measured and is on the order of  $10m\Omega$ cm<sup>2</sup> which is 3 orders of magnitude larger than that of a usual NI coil. The coil was quenched at an operating current of 400A at a central field of 9.2T in which 6.5T was provided by the background field. The quench propagation was successfully recorded, and the process is very fast (40ms) as anticipated (shown in Figure 4.38). The test results also confirmed the unbalanced force (measured by load sensors) and the large induced quench transient current (detected by pickup coils) during quench in an RI coil.

• Modeling of screening currents in REBCO coils: REBCO tape is a broad conductor. In the 32T

SC and 40T SC magnets it is used in the form of a 4.1mm wide tape. In a high field solenoid there is typically a radial component of field, *B*<sub>r</sub>, nearly everywhere in the coil. In a REBCO coil, this radial component of field is normal to the broad face of the tape. When the magnet is energized, screening currents are induced in the tape to cancel this radial component of field. These screening currents interact with the axial component of field, *B*<sub>z</sub>, to produce local Lorentz forces. Because the screening currents on the two edges of the tape have opposite sign but the same magnitude, the resulting Lorentz forces also have opposite sign. Although the net force on the conductor is zero, there is a net twisting torque on each turn.

The first attempt to compute the strain due to this torque was published by the MagLab in 2018. Since then the numerical model has been improved by including the fact that rotation of the tapes due to the diamagnetic torque changes the angle between the field and the tape and resulting induced current. The new software has been benchmarked against stain gauge measurements (Fig X3) and measured Screening Current Induced Field (SCIF) shown in Figure 4.39.

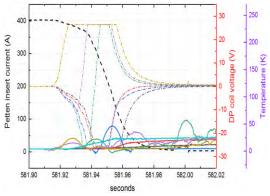


Figure 4.38: Quench propagation of PTC3.

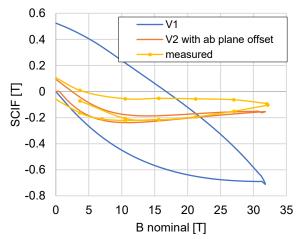


Figure 4.39: The difference between the actual magnetic field (including the effects of screening currents) and that without screening currents is referred to as Screening Current Induced Field (SCIF). Shown above are the actual SCIF in the 32T magnet as measured via NMR, the computed SCIF using the traditional approach that ignores the rotation of the tape (V1), and the newer MagLab computation that includes the rotation of the tape and the misalignment of the ab-plane of the REBCO (V2).

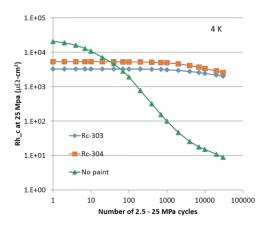


Figure 4.40: Inter-turn resistance versus cyclic loading of wet silver paint (Rc-303 and Rc-304) and stainless steel (No paint) when placed between two pieces of REBCO tape.

shown in Figure 4.40.

Conceptual Design of the 40T SC magnet Figure 4.41 shows a vertical section of the Conceptual Design of the 40T SC magnet. It includes an LTS outsert consisting of two NbTi and two Nb3Sn coils providing 12T in a 32cm bore and an HTS insert consisting of three REBCO coils that provides 28T in a 3cm bore. There are two versions of the HTS insert, one based on MTI-REBCO and one based on RI-REBCO. The major difference between the MTI design and RI design are the surface treatment of the turns: insulating versus a controlled resistance and the resulting differences in the quench protection technologies. Assuming that the NSF funds the Mid-Scale Design proposal, a choice between the MTI and RI versions will be made in September 2022. The MTI coil quench protection will be similar to the 32T guench protection system except that the power supply for the quench heaters will use a Pulse Forming Network instead of a lead-acid battery bank. The RI coil quench protection requires new development which is underway. The copper current density,  $J_{Cu}$ , in the 40T design is more than 700A/mm<sup>2</sup> and this is significantly larger than that of the 32T SC magnet (410A/mm<sup>2</sup>). The stress analyses and quench analyses were performed for the conceptual designs. Currently the designed peak hoop strain with screening current is around 0.45%. We will continue to optimize the 40T design to reduce the strain to a level of 0.4%.

References for 40T SC Magnet

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Marshall, W.S.; Trociewitz, U.P.; Weijers, H.W.; Abraimov, D.V.; Boebinger, G.S., "The 40 T Superconducting Magnet Project at the National High Magnetic Field Laboratory", IEEE Transactions on Applied Superconductivity, 30, 4, 1-5 (2020).

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- [3] Markiewicz, W.D.; Painter, T.A.; Dixon, I.R.; Bird, M. D., Quench transient current and quench propagation limit in pancake wound REBCO coils as a function of contact resistance, critical current, and coil size, Superconductor Science and Technology, 32, 105010-105023 (2019).

As mentioned above, the new code has been benchmarked against the measured strains in the mini-fatigue coil with excellent agreement. It has also been benchmarked against the measured strain in PTC-1 and the measured screening-current induced field in the 32T SC user magnet. Being able to predict the strain in the conductor is critical to predicting the lifetime of the 40T SC magnet.

 Contact resistance control for RI coils The MagLab has demonstrated that for the Ni-REBCO concept to become viable for large coils, the interturn resistance needs to be controlled [3,4,5]. Extensive work has been undertaken attempting to provide consistent control of the inter-turn resistance were [2]. In 2020, a breakthrough was made: the variation in inter-turn resistance during cyclic loading can be reduced from a factor of 1,000 to a factor of 2 by using wet silver paint, as

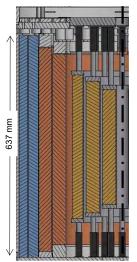


Figure 4.41: 40T Conceptual magnet REBCO design. sections in yellow; Nb<sub>3</sub>Sn in orange; NbTi in blue.

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#### Bi-2212 coils

Development of Bi-2212 conductor and coil technology is being pursued to enable both high field



Figure 4.42: Left: The Pup-9 coil right after heat treatment. No signs of leakage are visible on the coil. The curled-up wire on top of the coil are the pig-tails extending from the coil terminals that are located right under the greyish cover plates. Right image shows the same coil after full instrumentation with all of the voltage taps and copper terminal extensions right after the epoxy impregnation step and ready for characterization.

solenoids and accelerator magnets such as dipoles and quadrupoles for the Future Circular Collider (FCC) and similar applications. While high field solenoids have already been put into service using REBCO tape, Bi-2212 conductor has significant advantages that might enable it to displace REBCO for these applications. It is available in continuous lengths of up to 2km of length compared with less than 0.3km for REBCO. Longer lengths of conductor can result in fewer joints, faster assembly, and lower costs for magnets of the same size and field. It is a round wire with largely decoupled fine (~15 micron diameter) and twisted filaments with versatile architecture that a is macroscopically electro-magnetically isotropic which simplifies coil design. As a round wire it can be easily cabled to provide the high-current conductor frequently

required for large-scale coils. Twisting enables low ac losses and the fine filaments mean low SCIF compared with REBCO.

These advantages, however, come at the price of low mechanical strength and stiffness of the bare conductor compared with REBCO (but still comparable to those of Nb<sub>3</sub>Sn strand) and the need for a complex reaction process after winding.

Ten years ago, the current density of Bi-2212 wire was too low to compete with that of REBCO for high field magnets. A MagLab-led effort funded largely by the DOE-HEP's MDP developed the understanding of how to make high critical current density,  $J_c$ , by using an over-pressure heat treatment (OPHT) that has been made routine here at the MagLab, first in 3 to 5cm diameter and then 14cm diameter furnaces in which many solenoids and racetrack-shaped coils have been

successfully reacted in recent years. (The Table 4.1: Pup-9 coil specifications. racetrack coils are part of HEP's MDP in collaboration with Lawrence Berkeley National Laboratory.)

The main focus in 2020 was the Pup-9 Bi-2212 test coil (Figure 4.42 and Table 4.1) that was intended to explore the uniformity of Ic of the Bi-2212 wire throughout the coil as well as demonstrate a new reinforcement scheme, terminal design, and an updated vacuumpressure impregnation (VPI) approach.

|                       |                       | Pup 9                          |
|-----------------------|-----------------------|--------------------------------|
|                       | Product No.           | PMM180410-1                    |
| 14/1                  | Powder                | nGimat 116 (85 x 18)           |
| Wire                  | Insulation            | In-house coating+mullite braid |
|                       | Diameter [mm]         | Φ 1.0 (bare) / Φ 1.2 (ins.)    |
| ID ; OD ; Height [mm] |                       | 44.5 ; 113.9 ; 40.7            |
| Τι                    | urn ; Layer (Total)   | 30 ; 26 (772)                  |
| Mag                   | net constant [mT/A]   | 11.303                         |
| Cen                   | ter field @ 100 A [T] | 1.13                           |
| I                     | nductance [mH]        | 31.5                           |
| Со                    | nductor length [m]    | ~ 200                          |
|                       | Status                | Tested                         |

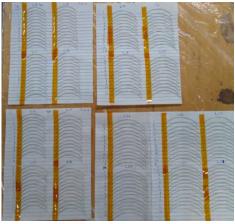


Figure 4.43: Left: Systematically extracted short samples from coil Pup-9 in preparation for short sample transport characterization. Right: A selection of  $J_e$  data measured from these samples.

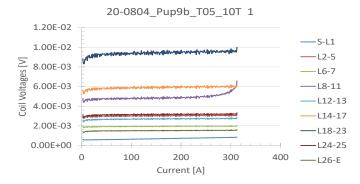


Figure 4.44: Voltage traces of consecutive layers in Pup-9 at 10T background field. The early transition somewhere within layers L8-11 is clearly visible.

The coil did well regarding uniformity of critical current. As the coil was built, extra wire was left extending from the terminals (pig-tails). Prior to reaction of the coil, witness

samples of wire were placed at strategic locations around the coil. After the coil was reacted, the critical currents of the pig-tails and witness samples were measured to confirm a successful heat-treatment. After the coil had been completed and tested, nearly 200 short samples were meticulously extracted from the coil as shown in Figure 4.43. The critical current of these samples is being measured to confirm that it is uniform throughout the coil. Approximately 10% of the samples have been measured with good results so far, confirming the updated VPI approach.

The coil reached 300A in a 10T background field as shown in Figure 4.44 (~60% of the goal). The increasing voltage was seen between layers eight and eleven, nowhere near a terminal, so it seems the new terminal design is working well also. Upon dis-assembly, it was confirmed that the terminals were not damaged, but the coil had delaminated between layers eight and nine, which is now understood to likely be due to stress concentration due to the new reinforcement scheme.

A variety of conductor and coil reinforcement strategies exist for Bi-2212, and an important task ahead of us is to find and apply the most suitable of these strategies for our coils.

As we move forward, a major goal is to resolve the challenges associated with reinforcing the coils and enable Bi-2212 coils to become viable for magnets operating above 20 T. To this end, we partnered with Cryomagnetics, of Oak Ridge, Tennessee, and submitted a Phase I Small Business Innovation Research Proposal in 2018. This evolved into a Phase II grant in 2019 which has led to a Phase IIa proposal in 2021. Figure 4.45 shows a vertical section of the 25T SC magnet that is intended to be the result of this grant. The red outer coils will provide 17T and be provided by Cryomagnetics using Nb-Ti and Nb<sub>3</sub>Sn. The blue inner coil will provide 8 T and be provided by the MagLab using Bi-2212. Cryomagnetics intends to offer similar magnets on a commercial basis in the future.



Figure 4.45: Sketch of a 25T magnet system to be developed in collaboration with Cryomagnetics Inc., which includes an 8T Bi-2212 coil.

In order to refine guench management methods, we continued basic stability margin analysis of Bi-2212 in comparison with LTS conductors. This comparison highlighted the large stability of Bi-2212 in round wire form and particularly in a cable. The margin analysis was also used as a tool to understand Lumped-Element Dynamic Electro-Thermal (LEDET) guench simulations of energy extraction [1] and coupled loss induced quench (CLIQ) protection of Bi-2212 magnets [2]. To further refine our understanding of the stray-capacitance heat detection technique that can be used for guench-detection, we implemented stray-capacitance monitoring in three Bi-2212 magnet geometries in partnership with our LBNL collaborators [3-4]. Monitoring for global changes with sensors on the mechanical structures of the magnets, a quench response comparable to voltage signals was produced without the drawbacks of inductive effects. An example of this is shown in Figure 4.46 for a Bi-2212 canted cosine theta (CCT) coil. Stray capacitance sensors were also demonstrated in a single racetrack coil, showing clear localization of normal zones induced by a heater as well as symmetric responses to the predictable normal zone locations from exceeding the critical current in the highest field region of the windings. We have begun procurement of varistor type energy extraction units and will evaluate them with upcoming test coils including solenoids, so that we can continue to utilize simple quench management even at higher inductances, which is possible due to the medium enthalpy margin of Bi-2212, which is situated between that of LTS and REBCO tapes.

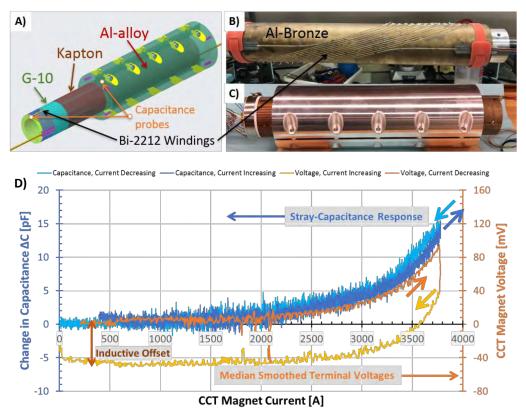


Figure 4.46: A) Sketch of a Bi-2212 cable wound Canted Cosine Theta Outer Layer coil (CCT-OL) assembly showing dielectric layers, metallic structures, and capacitance probe locations. B) Reacted Bi-2212 CCT-OL windings on an aluminum-bronze mandrel. C) The fully assembled and instrumented CCT-OL coil. D) Change in capacitance (blue) of the and median smoothed terminal voltage (orange/yellow) for a ramp of the CCT-OL magnet up to 93% of the quench current and back down without tripping the quench protection voltage criterion.

References for 2212 coil development

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#### 2212 conductors

Under our DOE-HEP contract to thoroughly understand Bi-2212 conductor technology, we manufactured address the powder, the conductor and its reaction by OP-HT into final conductor form. Recently, the small company Engi-Mat has been making powder that enables about 60% higher Jc than the previously favored supplier and this has been sent to the MagLab for assessment of its uniformity via Scanning Electron Microscopy (SEM) analysis prior to being shipped to Bruker OST (B-OST) to fabricate Bi-2212 round wires. Samples of the wire are then typically sent to the MagLab for reaction under OP-HT to evaluate the performance of the resulting wire. Figure 4.47 shows the current density of the whole wire,  $J_E$ , as a function of the maximum temperature during OP-HT, T<sub>max</sub>, for one of these

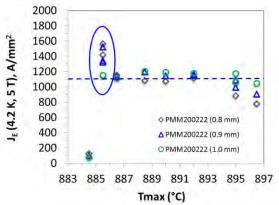


Figure 4.47:  $J_E - T_{max}$  plot for wire fabricated from Engi-Mat powder by B-OST. The plateau  $J_E$  is ~1100A/mm<sup>2</sup>. The  $J_E$  peak is ~40% greater than the plateau.

wires that was drawn to three diameters.  $J_E$  for all three diameters exhibits a plateau over a relatively wide  $T_{max}$  range of ~9°C. Interestingly,  $J_E$  for the smallest wires, 0.8 and 0.9mm diameter, shows a peak at low  $T_{max}$  that is ~40% greater than the plateau. We have seen this  $J_E$  peak for many 0.8 and 0.9mm diam. wires over the past 3 years and believe it is related to the filament architecture, specifically the filament cross sectional area and separation.

To understand if it is possible to increase the  $J_E$  plateau to equal the peak, we began studying the filament architecture, how it changes during the OP-HT, and how these changes affect  $J_E$ . To do these studies, we designed and built an OP quench furnace, which came online in 2020, to freeze in the high-temperature filament architecture at any point during the OP-HT for study at room temperature.

We began by examining the filament microstructure of as-drawn wire. Figure 4.48a shows the bundles of filaments within the wire have three different shapes – tetragonal, pentagonal, and hexagonal (4, 5, and 6 respectively in Figure 4.48). Quantitative analysis of the filaments showed different filament characteristics in each of the three bundle types. Surprisingly, very few of the filaments are round.

We also measured the cross-sectional area of individual filaments as a function of position along the length of the as-drawn wire and found that it varies along the length of the wire. To directly observe these variations, we etched away the Ag sheath and extracted filaments from as-drawn wire, which are shown in Figures 4.48 b and c. The extracted filaments show significant

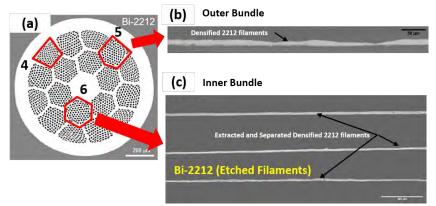


Figure 4.48: (a) Cross section of as-drawn wire showing three bundle types – tetragonal, pentagonal, and hexagonal. (b) and (c) Filaments extracted from as-drawn wire showing the varying filament area, which is particularly evident in the filament extracted from an outer bundle (b).

changes in the filament area that we believe lead to even areater filament non-uniformities during the OP-HT, which degrades  $J_c$ . The quantitative studies show that the tetragonal bundles have the smallest filament area and the smallest separation between also filaments of the three bundle types. Our OP quench studies show that in the tetragonal bundles the filaments bonded together faster, and more filaments bonded together than in the other two bundle types. This increased filament bonding suggests that  $J_E$  in the tetragonal bundles is degraded relative to the other two bundles. We are sharing these quantitative results with B-OST to develop more uniform filament architectures that should increase  $J_F$ .

#### Fe-based conductors

Fe-based superconductors, and in particular K-doped BaFe<sub>2</sub>As<sub>2</sub> (K-Ba122), are materials of interest possible future high-field for applications. However, the critical current density  $(J_c)$  in polycrystalline Ba122 is still quite low, and connectivity issues are suspected to be responsible. In the last year we focused on high-purity processing and synthesis of K-Ba122 bulk samples by using high purity precursors and а high-performance glovebox, which minimizes oxygen and moisture exposure [1]. The obtained samples were free of oxygen and secondary phase segregations at grain boundaries, which are typically recognized as a cause of currentblocking effects. Although our careful

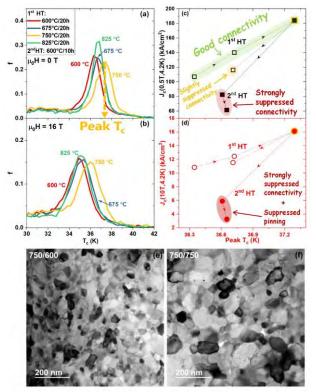


Figure 4.49: FBS1 (a) Superconducting characterizations and microstructure of K-doped BaAs<sub>2</sub>Fe<sub>2</sub> samples after different heat treatments. (a-b)  $T_c$ -distributions at 0 and 16T determined by specific heat of four samples that underwent a 1<sup>st</sup> heat treatment (HT) at different temperatures and the same 2<sup>nd</sup> HT. (c-d) Correlation between the low/high-field  $J_c$  and the peak position of the  $T_c$ -distribution revealing the positive and negative effect of different heat treatments on the connectivity and pinning performance (the arrows show the increasing HT temperature). (e-f) Transmission Electron Microscopy microstructure of the best and worst samples in terms of  $J_c$  performance (figures from ref. [2]). processing results in an increase in  $J_c$ , significant property variations were observed depending on the heat treatment (HT) procedure. For this reason, we performed detailed characterization on samples that underwent two separate heat treatments at various temperatures between 600 and 825°C and investigated their effects.

We performed specific heat characterization up to 16T in order to determine the  $T_{c-}$ distributions of each sample (same examples are shown in Figure 4.49 a-b) and we compared them with magnetic  $T_c$  and  $J_c$  characterizations (Figure 4.49 c-d), and Transmission-Electron-Microscopy (TEM) microstructures (Figure 4.49 e-f) [2]. Interestingly, we found no direct correlation between the magnetic  $T_c$  and  $J_c$ , whereas the specific heat  $T_c$ -distributions did provide valuable insights. In fact, the best J<sub>c</sub>-performing sample, heat treated first at 750°C and then at 600°C, has the peak of the  $T_c$ -distributions at the highest temperatures and the least field sensitivity, thus maximizing  $H_{c2}$ . We also observed that the magnetic  $T_c$  onset was always significantly lower than the specific heat  $T_c$ : although we partially ascribe the lower magnetization  $T_c$  to the small grain size (< 1, the penetration depth) of the K-Ba122 phase. This behavior also implies the presence of some grain-boundary barriers to current flow. Comparing the  $T_c$ -distribution with  $J_c$  (Figure 4.49 cd), our systematic study reveals that increasing the 1st heat treatment temperature up to 750°C (with a fixed  $2^{nd}$  HT at 600°C) improves the connectivity and  $J_c$  (data shaded in green), whereas above this temperature we observed a slight suppression in performance. On the other hand, increasing the 2<sup>nd</sup> HT temperature above 600°C (after a fixed 1<sup>st</sup> HT at 750°C) significantly compromises the connectivity and suppresses the vortex pinning properties (data shaded in red). We conclude that high-purity precursors and clean processing are not yet enough to overcome all  $J_c$  limitations. However, our study suggests that a higher temperature  $T_c$ -distribution, a larger  $H_{c2}$ and a better connectivity could be achieved by lowering the second heat treatment temperature below 600 °C, leading consequently to a higher  $J_c$ . References for Fe-based conductors

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## Low temperature superconducting materials

In recent years there has been an increasing international effort to improve the performance of Nb<sub>3</sub>Sn superconducting strand for high field applications, in particular for the fabrication of conductors suitable for the realization of the Future Circular Collider (FCC) at CERN. This challenging task has led to the investigation of new routes to advance the high-field pinning properties, the irreversibility and the upper critical fields. We have pioneered the addition of hafnium to the standard Nb-4Ta precursor alloy and shown that this new alloy combination is particularly promising. In this work we investigated the intrinsic properties of the Ta-Hf doped Nb<sub>3</sub>Sn phase to understand the origin of the Hf-induced improvement in the properties. From a Ta-Hfdoped Nb<sub>3</sub>Sn wire manufactured at the Applied Superconductivity Center, we extracted a thin lamella from its A15 layer by Focused Ion Beam (FIB) and fabricated a microcircuit (the Scanning-Electron Microscopy [SEM] image of the sample is shown in the inset of Figure 4.50). Transport properties were performed up to 16T in order to determine the  $H_{c2}$  temperature dependence (Figure 4.50 a reports the in-field resistive transitions) and to determine the field dependence of the pinning force  $F_p$  (Figure 4.50 b). We estimated  $H_{c2}(0 \text{ K})$  to be 30.8T, ~1T higher than the values obtained for just Ta-doped Nb<sub>3</sub>Sn, and, even more importantly, we found that the position of the  $F_P$  maximum at 4.2K exceeds 6T, which is a significantly higher field with respect to the typical ~4.5-4.7T of the only Ta-doped material. This shift suggests that the performance is enhanced by the presence of HfO<sub>2</sub> nanoparticles and by an increase in the grain boundary density produced by the hafnium, both of which can act as effective pinning centers. The decrease in grain size was

indeed observed by SEM, and we also verified that the nanoparticle size is dependent on the reaction heat treatment (RHT) temperature. Although they cannot be directly observed for low-to-moderate temperature RHT (such as 670°C), we were able to infer their presence using another technique, Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy, performed on the same wire at the Advanced Photon Source - Argonne National Laboratory. EXAFS spectroscopy, in fact, revealed that most of the hafnium is present as HfO<sub>2</sub> and no detectable amount is entering the A15 structure.

These results show that Hf addition can significantly improve the high-field performance of Nb<sub>3</sub>Sn, bringing its properties closer to the FCC requirements. This work also led to the industrial production of a new Nb-4Ta-1Hf alloy to be used in the realization of high critical-current-density Nb<sub>3</sub>Sn wires and several wire manufactures around the world have started using it to develop new highperformance conductors.

## Structural materials for magnets

Low-temperature superconducting and pulsed high-field magnets need similar reinforcement materials. These materials must provide the mechanical properties that are required for reliable operation of the magnets which are typically used at cryogenic temperatures. Properties of Nitronic-40 stainless steel in both as-forged and heattreated conditions were studied, carefully assessing its potential for use at both cryogenic and room temperatures. Heat treatment at 673K for 30 minutes was applied to the steel to

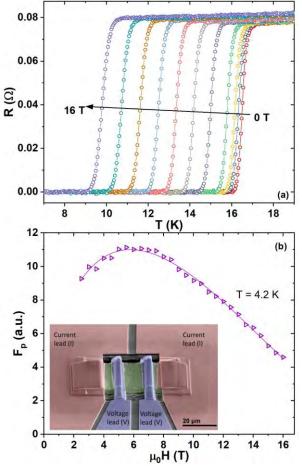


Figure 4.50: LTS-1. Superconducting characterizations of a Ta-Hf-doped Nb<sub>3</sub>Sn microbridge realized by "FIB"-ing the sample from the A15 layer of wire. The false-colored SEM image of the microbridge is shown in the inset. (a) Temperature dependence of resistive transitions at different magnetic field (data taken at 0 T, 0.5T, 1T, 2T and every 2T up to 16T). (b) Field-dependence of the pinning force  $F_P$  obtained at 4.2K

simulate the proposed insulation-curing process to be used for pulsed magnets. After our Nitronic 40 samples were heat-treated, we found that the yield and ultimate strengths at 77K had decreased slightly to as shown in Figure 4.51, indicating that heat treatment had reduced the dislocation density somewhat [1]. Strength values increased thereafter as temperature decreased to cryogenic levels. Magnetic permeability ( $\mu$ ) measurements taken near the fracture region of our samples showed increased  $\mu$  values after cryogenic deformation, indicating that stronger martensite may have formed, which may reduce fracture toughness [2]. When we evaluated the fracture toughness test data, we concluded that the materials were still suitable for use as reinforcements in high field magnets.

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## Resistive magnets & materials Pulsed magnets

The generator that powers the 100T Multi-Shot (100TMS) magnet and 60T Long Pulse (60TLP) magnet was damaged in March of 2018. In addition to the major undertaking of repairing the generator, which is presently underway, the MagLab also initiated a "Magnet Surge" project to provide two alternatives to the 100TMS and 60TLP magnets on very short notice: (1) a 75T Duplex (75TD) and (2) a 60T Mid-Pulse (60TMP).

By a "duplex" magnet we mean one that uses two capacitor banks to power two independent nested coils, unlike our other capacitor-driven magnets that use a single capacitor bank. This additional degree of freedom in the design allows better optimization of the objective function. More specifically, the outer and inner coils can have different pulse durations which means different inductances, current densities and heating rates (Figure 4.52).

The Pulsed Field Facility (PFF) at LANL successfully developed 75T duplex magnet using existing 16kV, 4MJ capacitor bank (cap-bank) [1]. The 4MJ capbank was reconfigured into two sub-systems, 1MJ and 3MJ capbanks, to respectively drive the inner and the outer coil of the duplex magnet. A Metal Oxide Varistor (MOV) bank which can absorb up to 5MJ was built and connected in parallel to the outer coil to protect the capacitor banks and their associated electrical components from the overvoltage in the case of fault condition [2].

The magnet was tested to maximum field of 76.8T and has been safely serving users with magnetic fields up to 75T since February 2020 (Figure 4.53). The magnet has a modular design with cooling space between the inner and outer coils, enabling a short cooling time (~ 1 hour) between the pulses and costeffective operation, since we expect to save/reuse the larger, more expensive outer coil if the inner coil, which is designed to operate at much higher stress level, fails. The first set of user experiments using this magnet has produced cutting-edge high field science which was published in Nature Physics [3]. The

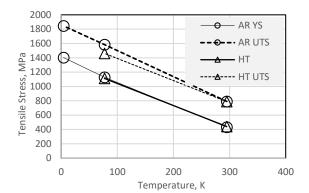


Figure 4.51: Plot shows an almost linear relationship between strength and temperature for both as-received forged Nitronic-40 and the subsequent heat-treated version.

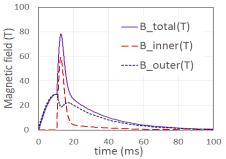


Figure 4.52: Magnetic field waveforms of the duplex magnet, showing the contributions to the total magnetic field from the inner and outer coils. The total magnetic field reaches 76.8T.



Figure 53: Users setting up their experiments in duplex magnets.

successful demonstration of duplex magnet technology opens a new opportunity for the PFF to develop a duplex insert for the 100TMS magnet system to go beyond the present record of high magnetic field and maintain the MagLab's leadership in creating high fields for science.

In 2020, the magnet team developed and built the 60TMP magnet which remains at >90% of full-field for three as long as a standard 65T pulsed magnet (Figure 4.54). The magnet used hard copper CDA107 wire and fabricated by a new continuous winding technique which enable us to reduce the fabrication time by a half. At peak magnetic fields of 60T, the magnet stores 2.3MJ. The magnet was installed in December 2020 and has been in the commissioning phase since then. The magnet is expected to start serving users in the summer of 2021.

The Magnet Surge project also enabled the PFF to upgrade its power infrastructure with a new 30kV-1.2MJ capacitor bank. The bank was ordered and is expected to be commissioned by the end of November, 2021. The new capacitor bank will be integrated with the existing 16kV-4MJ bank to allow us to develop a still higher field, capacitor-driven duplex magnet. The preliminary design for an 85-T duplex magnet using the upgraded capacitor system was completed and will be further refined to the final design in the first half of 2021. We plan to build the first 85T duplex to test with the new 30kV capacitor in the first quarter of 2022.

The large generator-driven coils of the 60TLP and outsert of the 100TMS are now being fabricated at the FSU branch of the MagLab. Eddy-current inspection of the conductor is performed three times for each piece of conductor: once on the extruded pre-cursor prior to final wire-drawing (Figure 4.55), once after final wire-drawing, and a final time after the coil is wound (Figure 4.56).

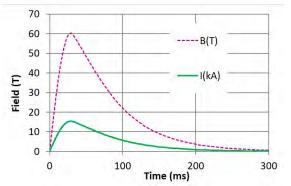


Figure 4.54: Waveforms of magnetic field and driving current for the 60T mid-pulsed magnet being developed at the PFF. At 60T the magnet pulse length of 60T pulses is about 300ms considerably longer than our standard capacitor driven magnets.



Figure 4.55: PFF4. Inspection of the precursor material for Coil 7 of the 60T CW magnet. The inset photograph shows the eddy current response to a detected inclusion, which is subsequently removed.

In 2020 upgraded versions of coils 1 and 2 of the outsert were fabricated. These new coils used high-strength, nano-structured Cu-Nb conductor developed by the MagLab in collaboration with our commercial partner, Nano-Electro. This new conductor is approximately 50% stronger than the glidcop AL60 wires used in the existing version. The upgraded coils #1 and 2 are expected to provide more conservative operating margin, which will increase the lifetime of the 100T outsert magnet. The LANL magnet team plans to install the stainless steel 301 strip and Zylon fiber reinforcement to these coils in 2022. The upgraded coils then will be installed and commissioned when the generator returns to service.

Coils 3, 4, and 7 of the 60T long pulse magnet have worn out and need to be replaced. Conductor inspection, winding and epoxy-impregnation of these coils has also been completed at the FSU branch of the MagLab. The coils are now ready for installation of the Zylon fiber reinforcement. In 2020, MagLab researchers tested and confirmed a new route to fabricate large cross-section Cu+alumina conductors for coil #7 of the 60TCW magnet by using more hotextrusion to produce a precursor of smaller diameter than was used in the past. This then requires less wire drawing to reach final form, thereby reducing the probability of developing internal Chevron cracks in the final conductors. With the new route, we expect to be able to produce enough high-quality conductors for coil # 7 in 2021 and complete the fabrication of the coil in the first half of 2022, ensuring the 60T CW magnet is ready for users when the generator is back online. *References for pulsed magnets at LANL* 

- [1] J. R. Michel, D. N. Nguyen and J. D. Lucero, "Design, Construction, and Operation of New Duplex Magnet at Pulsed Field Facility-NHMFL," IEEE Trans. On Appl. Supercond. 30, 4, JUNE 2020, 0500105. doi: 10.1109/TASC.2020.2970670.
- [2] Q. V. M. Nguyen, L. Torres, and D. N. Nguyen, "Electromagnetic interaction between the component coils of multiplex magnets," IEEE Trans. Appl. Supercond., 28, 3, APRIL 2018, 4300804. doi: 10.1109/TASC.2017.2779793.
- [3] Z.Xiang, L.Chen, K-W.Chen, C.Tinsman, Y.Sato, T.Asaba, H.Lu, Y.Kasahara, M.Jaime, F.Balakirev, F.Iga, Y.Matsuda, J.Singleton, L.Li, Unusual high-field metal in a Kondo Insulator, Nature Physics, (2021) doi.org/10.1038/s41567-021-01216-0.



Figure 4.56: The conductor of a large pulsed coil is inspected after winding to verify that no cracking occurred during the winding process.

## High strength high conductivity materials

The fabrication of our high-strength conductors for high-field pulsed magnets typically includes: consolidation or solidification; forging and/or extrusion; aging, restacking, and/or annealing; and wire drawing. Precipitates or particles of ~50 nm spacing are required to immobilize atomic-scale dislocations and reach the wire strength required for next-generation pulsed magnets.

Most of the pulsed magnets at the MagLab include some conductor made from copper dispersion strengthened with alumina. In this conductor, the alumina particles are hard particles that are formed during the consolidation stage and maintain their size and shape throughout processing. For many years it has been known that this material reaches its maximum strength after a relatively low amount of cold work. Recently, MagLab researchers discovered a 500-fold

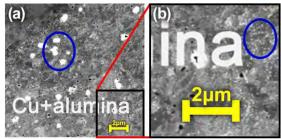


Figure 4.57: Scanning electron microscope image of the micro-structure of a present-day Cualumina conductor. The white spots in blue circles are (a) four micron-sized and (b) dozens of nanoscale alumina particles. For Cu+alumina to be suitable for use in a 120T magnet, this 500-fold variation in size must be reduced by eliminating the large particles.

variation in the size of alumina particles (from 10 nm to 5µm) in this material as shown in Figure 4.57. We believe the larger particles prevent this material from reaching its full potential as a conductor for pulsed magnets. For many years, the Cu+alumina conductor was consolidated and extruded at one commercial supplier and then shipped directly to another one for final wire drawing. Recently the MagLab started to inspect the pre-cursor after extrusion and before wiredrawing. Surface flaws >100 microns were identified in most precursors. Non-destructive testing methods have now been developed for use on the pre-cursors and the surface flaws are now removed at the MagLab prior to final wire drawing [1]. The MagLab is now also

collaborating with the commercial consolidating and extrusion firm to identify the source and reduce the prevalence of these surface flaws.

We also used our newly developed parameters to make and inspect two spools continuous-length of conductors (longer than 200 meters with cross-section area of 71mm<sup>2</sup>) for coil #7 to be used in the rebuilding of our 60T long-pulsed magnet. Our optimization has given us a better understanding of the relationship between critical properties and particle distribution in composite conductors. This paves the way

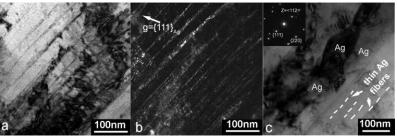


Figure 4.58: TEM observation of the microstructure in the as-drawn Cu-Ag wire. a. Bright field image showing the Cu/Ag lamellar structure in proeutectic component with Zone axis close to <011>. b. Dark field image from the same region in a showing Ag fibers using the {111} Ag diffraction spot. c. evident strain field around Ag-rich eutectic component. Dislocations were observed at the Cu/Ag interfaces. A selected area diffraction pattern in c inset indicates no cube-oncube orientation relationship between Cu and Ag phase in eutectic region. The dash lines represents the fine Ag fibers in the proeutectic component. The poor contrast in the proeutectic component is the result of the orientation difference between the proeutectic and eutectic components.

for future manufacture of high-quality, high-strength conductors for use in other pulsed magnets.

Unlike Cu+alumina, Cu-Ag composites have not been traditionally used pulsed magnets. MagLab researchers have recently been able to alter the activation energies and reaction temperatures required to increase the volume of fine-to-coarse precipitates by a factor of four by doping the composite with a third alloying element [2]. Consequently, Cu-Ag now shows potential for use in pulsed magnets. We subjected our aged Cu-Ag composite ingots to cold drawing to create high-strength nanostructured wires with both Cu-rich pro-eutectic and Ag-rich eutectic components. These wires reached strength values greater than 900MPa, greater than that of the strongest Cu-alumina alloy. The maximum true strain for achieving high strength of 900 MPa was only 4.8, allowing us to fabricate wire with a cross-section area around 17mm<sup>2</sup> from relatively small ingots (diameter  $\sim$ 50mm). During drawing, a fine lamellar structure (average spacing 20 ± 6nm) developed in the pro-eutectic component, which contained a high density of Ag fibers (average diameter below 5nm) embedded in the matrix. In the eutectic component, a relatively coarse structure developed, with an average Ag grain size around 100nm (Figure 4.58). The result of such a bimodal size of Ag fibers was ultra-high bending plasticity, i.e., the drawn wires tolerated 59% bending strain at the outermost edge, 15 times the tensile elongation of the composites (3.6%). This ultra-high plasticity should allow us to make a coil as small as 6.4mm diameter using a 3mmthick wire without causing instability [3]. This feature provides us an option to build pulsed magnets with fields higher than 100T.

References for high-strength, high-conductivity materials

- J. Lu, T. Adkins, I. Dixon, D. Nguyen, K. Han, IEEE Transactions on Applied Superconductivity 30 (2020) 1-5.
- [2] Zhao CC, Zuo XW, Wang EG, Niu RM, Han K. Simultaneously increasing strength and electrical conductivity in nanostructured Cu-Ag composite Materials Science and Engineering a-Structural Materials Properties Microstructure and Processing 652:296-304, 2016. DOI:10.1016/j.msea.2015.11.067.
- [3] R. Niu, K. Han, Z. Xiang, L. Qiao, T.M. Siegrist, Journal of Materials Science 55 (2020) 15167-15182.

## DC resistive

2020 has been a very successful fourth year of operation of the MagLab's 36T, 1ppm Series-Connected Hybrid magnet, the world's highest field 1ppm magnet. The resistive insert for this magnet provides 23T while operating in the background 13T provided by the superconducting outsert. The insert has now accumulated more than 3,100 hours of operation over a four-year period without any maintenance. Most of the MagLab's resistive magnets running at similar stress levels require replacement after two or three years. The reduced maintenance requirements for this magnet are believed to be due to the fact that it is primarily used for NMR, which results in very fewer high field sweeps and fewer fatigue cycles per day of operation than is experienced by other high field magnets.

The MagLab installed a 20T, 195mm bore resistive magnet in 1998. It was used extensively as a test facility for test coils for the 32T SC magnet development effort. In 2016, it was taken out of service to allow the housing and outer coils to be used in a new 41.5T, 32mm bore magnet which is now fully operational as the highest field resistive magnet worldwide. In 2020, a detailed disk and coil design, as well as a cost plan, was developed for a replacement large bore magnet to exploit the higher power now available from the power supplies. The new magnet is expected to provide 10% higher field (22T vs 20T of the old magnet) while also providing higher reliability. Construction of the new magnet is not yet funded.

In 2020, the dc resistive magnet operations were greatly reduced compared to typical years due to the COVID pandemic. While commercial production of spare parts was maintained at a level close to that of normal years, less on-site work in the magnet shop building and installing spare coils was required.

2020 MagLab Annual Report - 5. Publications



The Laboratory continued its strong record of publishing, with 485 articles appearing in peer-reviewed scientific and engineering journals in 2020. Among these, 433 acknowledge NSF support for the operation of the NHMFL and 237 (49 percent) appeared in significant journals.

Table 5.1 provides an overview about NSF-acknowledged peer-reviewed and significant peer reviewed publications by division then non-NSF funded units.

Table 5.1: Submitted peer-reviewed publications from OPMS live database. The point-in-time snapshot was on May 17, 2021. A total number of publications per year should NOT be drawn from this report because a submitter may, as appropriate, link a publication to two or more facilities. We note that the State of Florida contributes significantly to NHMFL and hired faculty at UF and FSU to enhance NHMFL programs. Publications from these professors are included as they significantly enhance the NHMFL research effort and are listed here in the UF physics and CMT/E categories.

| Facility                      | 2020 Peer Reviewed | 2020 Significant<br>Peer Reviewed | Acknowledges<br>Core Grant |
|-------------------------------|--------------------|-----------------------------------|----------------------------|
| AMRIS Facility at UF          | 43                 | 11                                | 35                         |
| DC Field Facility at FSU      | 129                | 85                                | 126                        |
| EMR Facility at FSU           | 43                 | 21                                | 43                         |
| High B/T Facility at UF       | 1                  | -                                 | 1                          |
| ICR Facility at FSU           | 52                 | 26                                | 52                         |
| NMR Facility at FSU           | 80                 | 34                                | 76                         |
| Pulsed Field Facility at LANL | 34                 | 26                                | 33                         |
| ASC                           | 24                 | 19                                | 22                         |
| MS & T                        | 36                 | 20                                | 35                         |
| Education at FSU              | 3                  | -                                 | 3                          |
| CMT/E                         | 46                 | 36                                | NA <sup>1</sup>            |
| Geochemistry Facility         | 16                 | 1                                 | NA1                        |
| MBI at UF                     | 37                 | 1                                 | NA <sup>1</sup>            |
| UF Physics                    | 9                  | 4                                 | NA <sup>1</sup>            |

<sup>1</sup>Research not funded by NSF.

433 of the 485 publications acknowledge NSF support for the operation of the MagLab. Table 5.2 summarizes the publications generated by external users and in-house research activities. A detailed list of these publications can be found below Table 5.2.

Table 5.2: Overview of publications generated by external users and in-house research activities. A total number of publications per year should NOT be drawn from this report because a submitter may, as appropriate, link a publication to two or more facilities.

| E III                                 |                               | All Internal<br>Authors<br>Authors<br>Author Corresponding<br>Author(s) with<br>External<br>Co Authors<br>Co Authors |                               | Corresponding<br>Author(s) with<br>External |                               | Corresponding<br>Author(s) with<br>Internal |                               |                                      | Totals                        |                                      | Total                            |
|---------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------|-------------------------------|---------------------------------------------|-------------------------------|--------------------------------------|-------------------------------|--------------------------------------|----------------------------------|
| Facility                              | NSF<br>Core<br>Grant<br>Cited | NSF<br>Core<br>Grant<br>Not<br>Cited                                                                                 | NSF<br>Core<br>Grant<br>Cited | NSF<br>Core<br>Grant<br>Not<br>Cited        | NSF<br>Core<br>Grant<br>Cited | NSF<br>Core<br>Grant<br>Not<br>Cited        | NSF<br>Core<br>Grant<br>Cited | NSF<br>Core<br>Grant<br>Not<br>Cited | NSF<br>Core<br>Grant<br>Cited | NSF<br>Core<br>Grant<br>Not<br>Cited | Pubs for<br>(selected<br>period) |
| AMRIS Facility at<br>UF               | -                             | -                                                                                                                    | 10                            | 3                                           | 18                            | 4                                           | 7                             | 1                                    | 35                            | 8                                    | 43                               |
| DC Field Facility<br>at FSU           | 2                             | -                                                                                                                    | 18                            | -                                           | 91                            | 3                                           | 15                            | -                                    | 126                           | 3                                    | 129                              |
| EMR Facility at<br>FSU                | -                             | -                                                                                                                    | 4                             | -                                           | 37                            | -                                           | 2                             | -                                    | 43                            | -                                    | 43                               |
| High B/T Facility<br>at UF            | -                             | -                                                                                                                    | 1                             | -                                           | -                             | -                                           | -                             | -                                    | 1                             | -                                    | 1                                |
| ICR Facility at<br>FSU                | 5                             | -                                                                                                                    | 6                             | -                                           | 40                            | -                                           | 1                             | -                                    | 52                            | -                                    | 52                               |
| NMR Facility at<br>FSU                | 9                             | -                                                                                                                    | 15                            | -                                           | 47                            | 4                                           | 5                             | -                                    | 76                            | 4                                    | 80                               |
| Pulsed Field Fa-<br>cility at LANL    | 4                             | -                                                                                                                    | 11                            | -                                           | 18                            | 1                                           | -                             | -                                    | 33                            | 1                                    | 34                               |
| ASC                                   | 5                             | -                                                                                                                    | 8                             | 1                                           | 9                             | 1                                           | -                             | -                                    | 22                            | 2                                    | 24                               |
| MS & T                                | 13                            | -                                                                                                                    | 13                            | -                                           | 9                             | 1                                           | -                             | -                                    | 35                            | 1                                    | 36                               |
| Education at FSU                      | 1                             | -                                                                                                                    | 1                             | -                                           | -                             | -                                           | 1                             | -                                    | 3                             | -                                    | 3                                |
| CMT/E <sup>1</sup>                    | 10                            | -                                                                                                                    | 19                            | -                                           | 14                            | 2                                           | 1                             | -                                    | 44                            | 2                                    | 46                               |
| Geochemistry<br>Facility <sup>1</sup> | 2                             | -                                                                                                                    | 3                             | 1                                           | 9                             | 1                                           | -                             | -                                    | 14                            | 2                                    | 16                               |
| MBI at UF <sup>1</sup>                | -                             | -                                                                                                                    | 1                             | 3                                           | 1                             | 10                                          | 5                             | 17                                   | 7                             | 30                                   | 37                               |
| UF Physics <sup>1</sup>               | -                             | -                                                                                                                    | 5                             | -                                           | 2                             | 1                                           | 1                             | -                                    | 8                             | 1                                    | 9                                |
| Total of Publica-<br>tions            | 46                            | -                                                                                                                    | 97                            | 8                                           | 257                           | 26                                          | 33                            | 18                                   | 433                           | 52                                   | 485                              |
| % of Publications                     | 9%                            | 0%                                                                                                                   | 20%                           | 2%                                          | 53%                           | 5%                                          | 7%                            | 4%                                   | 89%                           | 11%                                  | 100%                             |

<sup>1</sup>Research not funded by NSF.

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Besides 485 peer reviewed publications, the following other products have also been published at the MagLab in 2020:

| • | Books:   | 5 |
|---|----------|---|
| • | Patents: | 3 |

- Patents: 3
  Disseminations: 19
- Awards: 9
- Grants: 12
- M.S. Theses: 20
  - o Local: 11
  - o External: 9
  - Ph.D. Theses: 85 o Local: 26
    - o External: 59

AMRIS

## Publications generated by facilities: AMRIS Facility at UF (43)

| Authors                                                                                                                                                             | Title                                                                                                                                                                                                                       | Journal<br>Name                                                                           | Vol | Issue | Pages         | DOI                                              | Cites<br>NSF<br>Core<br>Grant |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----|-------|---------------|--------------------------------------------------|-------------------------------|
| Aydemir, T.B.; Thorn,<br>T.L.; Ruggiero, C.H.;<br>Pompilus, M.; Febo, M.;<br>Cousins, R.J.,                                                                         | Intestine-specific deletion<br>of metal transporter Zip14<br>(Slc39a14) causes brain<br>manganese overload and<br>locomotor defects of man-<br>ganism                                                                       | American<br>Journal of<br>Physiology-<br>Gastroin-<br>testinal<br>and Liver<br>Physiology | 318 | 4     | G673-<br>G681 | 10.1152/aj-<br>pgi.00301.2<br>019                | Yes                           |
| Baniani, A.; Berens, S.J.;<br>Rivera, M.P.; Lively, R.P.;<br>Vasenkov, S.,                                                                                          | Potentials and challenges<br>of high-field PFG NMR diffu-<br>sion studies with sorbates in<br>nanoporous media                                                                                                              | Adsorption                                                                                |     | Aug   | 117           | 10.1007/s10<br>450-020-<br>00255-y               | Yes                           |
| Barter, J.; Kumar, A.;<br>Rani, A.; Colon-Perez,<br>L.M.; Febo, M.; Foster,<br>T.C.,                                                                                | Differential Effect of Re-<br>peated Lipopolysaccha-<br>ride Treatment and Aging<br>on Hippocampal Function<br>and Biomarkers of Hippo-<br>campal Senescence                                                                | Molecular<br>Neurobiol-<br>ogy                                                            | 57  |       | 4045-<br>4059 | 10.1007/s12<br>035-020-<br>02008-y               | Yes                           |
| Berens, S.J.; Yahya, A.;<br>Fang, J.; Angelopoulos,<br>A.; Nickels, J.D.;<br>Vasekov, S.,                                                                           | Transition between Differ-<br>ent Diffusion Regimes and<br>Its Relationship with Struc-<br>tural Properties in Nafion by<br>High Field Diffusion NMR in<br>Combination with Small-<br>Angle X-ray and Neutron<br>Scattering | Journal of<br>Physical<br>Chemistry<br>B                                                  | 124 | 40    | 8943<br>8950  | 10.1021/acs<br>.jpcb.0c072<br>49                 | Yes                           |
| Bogoian, H.R.; King, T.Z.;<br>Turner, J.A.; Semmel,<br>E.S.; Dotson, V.M.,                                                                                          | Linking depressive symp-<br>tom dimensions to cerebel-<br>lar subregion volumes in<br>later life                                                                                                                            | Transla-<br>tional<br>Psychiatry                                                          | 10  | 1     | 18            | 10.1038/s41<br>398-020-<br>00883-6               | Yes                           |
| Bousquet, M.S.;<br>Ratnayake, R.; Pope,<br>J.L.; Chen, Q.Y.; Zhu,<br>F.C.; Chen, S.X.; Car-<br>ney, T.J.; Gharaibeh,<br>R.Z.; Jobin, C.; Paul,<br>V.J.; Luesch, H., | Seaweed natural products<br>modify the host inflamma-<br>tory response via Nrf2 sig-<br>naling and alter colon mi-<br>crobiota composition and<br>gene expression                                                           | Free Radi-<br>cal Biology<br>and<br>Medicine                                              | 146 |       | 306<br>323    | 10.1016/j.fre<br>eradbio-<br>med.2019.0<br>9.013 | No                            |
| Brumley, D.A.;<br>Gunasekera, S.P.;<br>Chen, Q.Y.; Paul, V.J.;<br>Luesch, H.,                                                                                       | Discovery, Total Synthesis,<br>and SAR of Anaenamides<br>A and B: Anticancer Cya-<br>nobacterial Depsipeptides<br>with a Chlorinated Phar-<br>macophore                                                                     | Organic<br>Letters                                                                        | 22  | 11    | 4235-<br>4239 | 10.1021/acs<br>.or-<br>glett.0c0128<br>1         | No                            |
| Chu, W.T.; DeSimone,<br>J.C.; Riffe, C.J.; Liu, H.;<br>Chakrabarty, P.;<br>Giasson, B.I.; Vedam-<br>Mai, V.; Vaillancourt,<br>D.E.,                                 | a-Synuclein Induces Pro-<br>gressive Changes in Brain<br>Microstructure and Sen-<br>sory-Evoked Brain Function<br>That Precedes Locomotor<br>Decline                                                                        | Journal of<br>Neurosci-<br>ence                                                           | 40  | 34    | 6649<br>6659  | 10.1523/JNE<br>UROSCI.018<br>9-20.2020           | Yes                           |
| Du, Y.; Behera, R.;<br>Maligal-Ganesh, R.;<br>Chen, M.; Chekmenev,<br>E.; Huang, W.; Bowers,<br>C.,                                                                 | Cyclopropane Hydrogena-<br>tion vs Isomerization over Pt<br>and PtSn Intermetallic Na-<br>noparticle Catalysts: A Par-<br>ahydrogen Spin-Labeling<br>Study                                                                  | Journal of<br>Physical<br>Chemistry<br>C                                                  | 124 | 15    | 8304<br>8309  | 10.1021/acs<br>.jpcc.0c024<br>93                 | Yes                           |
| Du, Y.; Zhou, R.; Ferrer,<br>M.; Chen, M.; Graham,<br>J.; Malphurs, B.; Labbe,<br>G.; Huang, W.; Bowers,<br>C.,                                                     | An Inexpensive Apparatus<br>for up to 97% Continuous-<br>Flow Parahydrogen Enrich-<br>ment Using Liquid Helium                                                                                                              | Journal of<br>Magnetic<br>Reso-<br>nance                                                  | 321 |       | 10686<br>9    | 10.1016/j.jmr<br>.2020.10686<br>9                | Yes                           |

| Authors                                                                                                                                                                                                                                                                 | Title                                                                                                                                                                                          | Journal<br>Name                                               | Vol | Issue | Pages           | DOI                                             | Cites<br>NSF<br>Core<br>Grant |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-----|-------|-----------------|-------------------------------------------------|-------------------------------|
| Febo, M.; Perez, P.D.;<br>Ceballos-Diaz, C.; Co-<br>Ion-Perez, L.M.; Zeng,<br>H.D.; Ofori, E.; Golde,<br>T.E.; Vaillancourt, D.E.;<br>Chakrabarty, P.,                                                                                                                  | Diffusion magnetic reso-<br>nance imaging-derived<br>free water detects neuro-<br>degenerative pattern in-<br>duced by interferon-y                                                            | Brain<br>Structure<br>and<br>Function                         | 225 | 1     | 427-<br>439     | 10.1007/s00<br>429-019-<br>02017-1              | Yes                           |
| Febo, M.; Rani, A.;<br>Yegla, B.; Barter, J.; Ku-<br>mar, A.; Wolff, C.A.;<br>Esser, K.; Foster, T.C.,                                                                                                                                                                  | Longitudinal Characteriza-<br>tion and Biomarkers of Age<br>and Sex Differences in the<br>Decline of Spatial Memory                                                                            | Frontiers in<br>Aging<br>Neurosci-<br>ence                    | 12  |       | 340             | 10.3389/fna<br>gi.2020.0003<br>4                | No                            |
| Flint, J.J.; Menon, K.;<br>Hansen, B.; Forder, J.R.;<br>Blackband, S.J.,                                                                                                                                                                                                | Visualization of Live, Mam-<br>malian Neurons During<br>Kainate-Infusion Using<br>Magnetic Resonance Mi-<br>croscopy                                                                           | Neu-<br>rolmage                                               | 219 |       | 11699<br>7      | 10.1016/j.ne<br>uroimage.2<br>020.116997        | Yes                           |
| Forman, E.M.; Baniani,<br>A.; Fan, L.; Ziegler, K.J.;<br>Zhou, E.K.; Zhang, F.Y.;<br>Lively, R.P.; Vasenkov,<br>S.,                                                                                                                                                     | Relationship between<br>ethane and ethylene diffu-<br>sion inside ZIF-11 crystals<br>confined in polymers to<br>form mixed-matrix mem-<br>branes                                               | Journal of<br>Mem-<br>brane<br>Science                        | 593 |       | 11744<br>0      | 10.1016/j.m<br>em-<br>sci.2019.117<br>440       | Yes                           |
| Gatto, R.G.; Weiss-<br>mann, C.; Amin, M.;<br>Finkielsztein, A.; Sum-<br>agin, R.; Mareci, T.H.;<br>Uchitel, O.D.; Magin,<br>R.L.,                                                                                                                                      | Assessing neuraxial micro-<br>structural changes in a<br>transgenic mouse model of<br>early stage Amyotrophic<br>Lateral Sclerosis by ultra-<br>high field MRI and diffusion<br>tensor metrics | Animal<br>Models<br>and Exper-<br>imental<br>Medicine         | 3   | 2     | 117-<br>129     | 10.1002/am<br>e2.12112                          | Yes                           |
| Jaiswal, M.; Tran, T.T.; Li,<br>Q.; Yan, X.; Zhou, M.;<br>Kundu, K.; Fanucci,<br>G.E.; Guo, Z.,                                                                                                                                                                         | A metabolically engi-<br>neered spin-labeling ap-<br>proach for studying gly-<br>cans on cells                                                                                                 | Chemical<br>Science                                           | 11  | 46    | 12522-<br>12532 | 10.1039/D0S<br>C03874A                          | Yes                           |
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| Kelley, R.C.;<br>McDonagh, B.;<br>Brumback, B.; Walter,<br>G.A.; Vohra, R.; Ferreira,<br>L.F.,                                                                                                                                                                          | Diaphragm weakness and<br>proteomics (global and re-<br>dox) modifications in heart<br>failure with reduced ejec-<br>tion fraction in rats                                                     | Journal of<br>Molecular<br>and<br>Cellular<br>Cardiol-<br>ogy | 139 |       | 238-<br>249     | 10.1016/j.yj<br>mcc.2020.0<br>2.002             | Yes                           |
| Lyu, S.; Xing, H.;<br>DeAndrade, M.P.;<br>Perez, P.D.; Yokoi, F.;<br>Febo, M.; Walters, A.S.;<br>Li, Y.Q.,                                                                                                                                                              | The role of BTBD9 in the<br>cerebellum, sleep-like be-<br>haviors and the restless<br>legs syndrome                                                                                            | Neurosci-<br>ence                                             | 440 |       | 85-96           | 10.1016/j.ne<br>urosci-<br>ence.2020.0<br>5.021 | Yes                           |
| Magdoom, K.N.;<br>Sarntinoranont, M.;<br>Mareci, T.H.,                                                                                                                                                                                                                  | An MRI-based switched<br>gradient impulse response<br>characterization method<br>with uniform eigenmode<br>excitation                                                                          | Journal of<br>Magnetic<br>Reso-<br>nance                      | 313 |       | 10672<br>0      | 10.1016/j.jmr<br>.2020.10672<br>0               | Yes                           |
| Mahar, R.; Dona-<br>bedian, P.L.; Merritt,<br>M.E.,                                                                                                                                                                                                                     | HDO production from [2H7]<br>glucose Quantitatively                                                                                                                                            | Nature<br>Scientific<br>Reports                               | 10  | 1     | 8885            | 10.1038/s41<br>598-020-<br>65839-8              | Yes                           |

| Authors                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Title                                                                                                                                                                | Journal<br>Name                                              | Vol          | Issue | Pages           | DOI                                       | Cites<br>NSF<br>Core<br>Grant |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Identifies Warburg Metab-<br>olism                                                                                                                                   |                                                              |              |       |                 |                                           |                               |
| Meyerspeer, M.;<br>Boesch, C.; Cameron,<br>D.; Dezortova, M.;<br>Forbes, S.C.; Heer-<br>schap, A.; Jeneson,<br>J.A.L.; Kan, H.M.E.; Kent,<br>J.; Layec, G.; Prompers,<br>J.J.; Reyngoudt, H.;<br>Sleigh, A.; Valkovic, L.;<br>Kemp, G.J.; Baligand,<br>C.; Carlier, P.G.; Chatel,<br>B.; Damon, B.;<br>Heskamp, L.; Hajek, M.;<br>Jooijmans, M.; Krssak,<br>M.; Reichenbach, J.;<br>Schmid, A.; Slade, J.;<br>Vandenborne, K.H.E.;<br>Walter, G.A.; Willis, D., | <sup>31</sup> P magnetic resonance<br>spectroscopy in skeletal<br>muscle: Experts' consensus<br>recommendations                                                      | NMR in Bio-<br>medicine                                      | Spe-<br>cial |       | 122             | 10.1002/nb<br>m.4246                      | No                            |
| Morla, L.; Shore, O.;<br>Lynch, I.; Merritt, M.E.;<br>Wingo, C.,                                                                                                                                                                                                                                                                                                                                                                                                | A non-invasive method to<br>study evolution of extracel-<br>lular fluid volume in mice<br>using time domain nuclear<br>magnetic resonance.                           | American<br>Journal of<br>Physiology-<br>Renal<br>Physiology | 319          | 1     | F115-<br>124    | 10.1152/aj-<br>prenal.0037<br>7.2019      | No                            |
| Muyyarikkandy, M.S.;<br>McLeod, M.; Maguire,<br>M.; Mahar, R.;<br>Kattapuram, N.; Zhang,<br>C.E.; Surugihalli, C.;<br>Muralidaran, V.;<br>Vavilikolanu, K.;<br>Mathews, C.E.; Merritt,<br>M.E.; Sunny, N.E.,                                                                                                                                                                                                                                                    | Branched chain amino ac-<br>ids and carbohydrate re-<br>striction exacerbate keto-<br>genesis and hepatic mito-<br>chondrial oxidative dys-<br>function during NAFLD | FASEB<br>Journal                                             | 34           | 11    | 14832-<br>14849 | 10.1096/fj.20<br>2001495R                 | Yes                           |
| Myer, C.; Abdelrah-<br>man, L.; Banerjee, S.;<br>Khattri, R.; Merritt, M.E.;<br>Junk, A.; Lee, R.;<br>Bhattacharya, S.,                                                                                                                                                                                                                                                                                                                                         | Aqueous humor metabo-<br>lite profile of pseudoexfoli-<br>ation glaucoma is distinc-<br>tive                                                                         | Molecular<br>Omics                                           | 16           | 5     | 425-<br>435     | 10.1039/C9<br>MO00192A                    | Yes                           |
| Nasser, A.A.; Eissa, I.H.;<br>Oun, M.R.; El-Zahabi,<br>M.A.; Taghour, M.S.;<br>Belal, A.; Saleh, A.M.;<br>Mehany, A.B.M.;<br>Luesch, H.; Mostafa,<br>A.E.; Afifi, W.M.; Rocca,<br>J.R.; Mahdy, H.,                                                                                                                                                                                                                                                              | Discovery of new pyrimi-<br>dine-5-carbonitrile deriva-<br>tives as anticancer agents<br>targeting EGFR <sup>WI</sup> and<br>EGFR <sup>T790M</sup>                   | Organic<br>and Bio-<br>molecular<br>Chemistry                | 18           | 38    | 7608-<br>7634   | 10.1039/d0o<br>b01557a                    | Yes                           |
| Norwood, V.M.; Brice-<br>Tutt, A.C.; Eans, S.O.;<br>Stacy, H.M.; Shi, G.;<br>Ratnayake, R.; Rocca,<br>J.R.; Abboud, K.A.; Li,<br>C.; Luesch, H.;<br>McLaughlin, J.P.;<br>Huigens, R.W.,                                                                                                                                                                                                                                                                         | Preventing Morphine Seek-<br>ing Behavior through the<br>Re-engineering of Vin-<br>camin <b>e'</b> s Biological Activity                                             | Journal of<br>Medicinal<br>Chemistry                         | 63           | 10    | 5119-<br>5138   | 10.1021/acs<br>.jmed-<br>chem.9b01<br>924 | Yes                           |
| Pei, Y.; Chen, M.;<br>Zhong, X.; Zhao, T.; Fer-<br>rer, M.; Maligal-Ganesh,<br>R.; Ma, T.; Zhang, B.; Qi,<br>Z.; Zhou, L.; Bowers, C.;<br>Liu, C.; Huang, W.,                                                                                                                                                                                                                                                                                                   | Pairwise semi-hydrogena-<br>tion of alkyne to cis-alkene<br>on platinum-tin intermetal-<br>lic compounds                                                             | Nanoscale<br>Research<br>Letters                             | 12           | 15    | 8519<br>8524    | 10.1039/D0<br>NR00920B                    | Yes                           |

| Authors                                                                                                                                         | Title                                                                                                                                                | Journal<br>Name                                                          | Vol  | Issue | Pages       | DOI                                     | Cites<br>NSF<br>Core<br>Grant |
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| Punchi Hewage, A.N.;<br>Fontenot, L.; Guidry, J.;<br>Weldeghiorghis, T.;<br>Mehta, A.K.; Donnar-<br>umma, F.; Rivera, M.,                       | Mobilization of Iron Stored<br>in Bacterioferritin Is Re-<br>quired for Metabolic Ho-<br>meostasis in Pseudomonas<br>aeruginosa                      | Pathogens                                                                | 9    | 12    | 980         | 10.3390/pat<br>ho-<br>gens912098<br>0   | Yes                           |
| Reddy, K.R.; Vardan-<br>yan, L.; Hu, J.; Vil-<br>lapando, O.; Bhomia,<br>R.K.; Smith, T.; Harris,<br>W.G.; Newman, S.,                          | Soil phosphorus forms and<br>storage in stormwater<br>treatment areas of the Ev-<br>erglades: Influence of veg-<br>etation and nutrient load-<br>ing | Science of<br>the Total<br>Environ-<br>ment                              | 725  |       | 13844<br>2  | 10.1016/j.sci<br>totenv.2020.<br>138442 | Yes                           |
| Saleh, M.G.; Wang, M.;<br>Mikkelsen, M.; Hui,<br>S.C.N.; Oeltzschner, G.;<br>Boissoneault, J.;<br>Stennett, B.; Edden,<br>R.A.E.; Porges, E.C., | Simultaneous edited MRS<br>of GABA, glutathione, and<br>ethanol                                                                                      | NMR in Bio-<br>medicine                                                  | 33   | 4     | e4227       | 10.1002/nb<br>m.4227                    | Yes                           |
| Sambuco, N.; Bradley,<br>M.M.; Herring, D.R.;<br>Lang, P.J.,                                                                                    | Common circuit or para-<br>digm shift? The functional<br>brain in emotional scene<br>perception and emotional<br>imagery                             | Psycho-<br>physiology                                                    | 57   | 4     | e1352<br>2  | 10.1111/psy<br>p.13522                  | Yes                           |
| Song, B.; Choi, D.; Xin,<br>Y.; Bowers, C.R.;<br>Hagelin-Weaver, H.,                                                                            | Ultra-Low Loading Pt/CeO2<br>Catalysts: Ceria Facet Ef-<br>fect Affords Improved Pair-<br>wise Selectivity for Parahy-<br>drogen Enhanced NMR        | An-<br>gewandte<br>Chemie                                                |      |       |             | 10.1002/ani<br>e.202012469              | Yes                           |
| Spearman, B.S.;<br>Agrawal, N.K.; Rubiano,<br>A.; Simmons, C.S.;<br>Mobini, S.; Schmidt,<br>C.E.,                                               | Tunable methacrylated hy-<br>aluronic acid-based hydro-<br>gels as scaffolds for soft tis-<br>sue engineering applica-<br>tions                      | Journal of<br>Biomedi-<br>cal<br>Materials<br>Research<br>Part A         | 108  | 2     | 279-<br>291 | 10.1002/jbm<br>.a.36814                 | Yes                           |
| Tomitaka, A.; Arami, H.;<br>Ahmadivand, A.; Pala,<br>N.; McGoron, A.J.;<br>Takemura, Y.; Febo, M.;<br>Nair, M.,                                 | Magneto-plasmonic<br>nanostars for image-<br>guided and NIR-triggered<br>drug delivery                                                               | Scientific<br>Reports                                                    | 10   | 1     | 110         | 10.1038/s41<br>598-020-<br>66706-2      | Yes                           |
| Tran, N.; Mentink-Vigier,<br>F.; Long, J.R.,                                                                                                    | Dynamic Nuclear Polariza-<br>tion of Biomembrane As-<br>semblies                                                                                     | Biomole-<br>cules                                                        | 10   | 9     | 1246        | 10.3390/bio<br>m10091246                | Yes                           |
| Tran, T.T.; Liu, Z.L.; Fa-<br>nucci, G.E.,                                                                                                      | Conformational landscape<br>of non-B variants of HIV-1<br>protease: A pulsed EPR<br>study                                                            | Biochemi-<br>cal and Bi-<br>ophysical<br>Research<br>Communi-<br>cations | 532  | 2     | 219-<br>224 | 10.1016/j.bb<br>rc.2020.08.0<br>30      | No                            |
| Van Aalst, E.;<br>Yekefallah, M.; Mehta,<br>A.K.; Eason, I.; Wylie, B.,                                                                         | Codon Harmonization of a<br>Kir3.1-KirBac1.3 Chimera for<br>Structural Study Optimiza-<br>tion                                                       | Biomole-<br>cules                                                        | 10   | 3     | 430         | 10.3390/bio<br>m10030430                | Yes                           |
| von Morze, C.;<br>Engelbach, J.; Reed,<br>G.; Chen, A.; Quirk, J.;<br>Blazey, T.; Mahar, R.;<br>Malloy, C.; Garbow, J.;<br>Merritt, M.E.,       | 15N-carnitine, a novel en-<br>dogenous hyperpolarized<br>MRI probe with long signal<br>lifetime                                                      | Magnetic<br>Reso-<br>nance in<br>Medicine                                | ePub |       | 17          | 10.1002/mr<br>m.28578                   | Yes                           |

| Authors                                                                                                                                                                                     | Title                                                                                                                                                                         | Journal<br>Name                     | Vol  | Issue | Pages         | DOI                                | Cites<br>NSF<br>Core<br>Grant |
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| Wilkes, B.J.; Bass, C.;<br>Korah, H.; Febo, M.;<br>Lewis, M.H.,                                                                                                                             | Volumetric magnetic reso-<br>nance and diffusion tensor<br>imaging of C58/J mice:<br>neural correlates of repeti-<br>tive behavior                                            | Brain<br>Imaging<br>and<br>Behavior | 14   | 6     | 2084-<br>2096 | 10.1007/s11<br>682-019-<br>00158-9 | Yes                           |
| Xing, H.; Andrud, K.W.;<br>Soti, F.; Rouchaud, A.;<br>Jahn, S.C.; Lu, Z.; Cho,<br>Y.H.; Habibi, S.; Corsino,<br>P.; Slavov, S.; Rocca,<br>J.R.; Lindstrom, J.S.; Lu-<br>kas, R.J.; Kem, W., | A Methyl Scan of the Pyr-<br>rolidinium Ring of Nicotine<br>Reveals Significant Differ-<br>ences in Its Interactions<br>with a7 and a4β2 Nicotinic<br>Acetylcholine Receptors | Molecular<br>Pharma-<br>cology      | 97   | 6     | 158           | 10.1124/mol<br>.119.118786         | No                            |
| Ziegler, E.W.; Brown,<br>A.B.; Nesnas, N.;<br>Chouinard, C.; Mehta,<br>A.K.; Palmer, A.G.,                                                                                                  | β-Cyclodextrin encapsula-<br>tion of synthetic AHLs: drug<br>delivery implications and<br>quorum-quenching ex-<br>ploits.                                                     | ChemBio-<br>Chem                    | ePub |       | 112           | 10.1002/cbi<br>c.202000773         | Yes                           |

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| Ashbrook, S.E.; Dawson,<br>D.M.; Gan, Z.; Hooper,<br>J.E.; Hung, I.;<br>Macfarlane, L.E.;<br>McKay, D.; McLeod,<br>L.K.; Walton, R.I.,                                          | Application of NMR Crys-<br>tallography to Highly Disor-<br>dered Templated Materi-<br>als: Extensive Local Struc-<br>tural Disorder in the Gallo-<br>phosphate GaPO-34A | Inorganic<br>Chemistry                                | 59  | 16    | 11616-<br>11626 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>450 | Yes                           |
| Bristow, M.; Reiss, P.;<br>Haghighirad, A.A.;<br>Zajicek, Z.; Singh, S.J.;<br>Wolf, T.; Graf, D.E.;<br>Knafo, W.; McCollam,<br>A.; Coldea, A.I.,                                | Anomalous high-magnetic<br>field electronic state of the<br>nematic superconductors<br>FeSe1-xSx                                                                         | Physical<br>Review<br>Research                        | 2   |       | 13309           | 10.1103/Phy<br>sRevResear<br>ch.2.013309   | Yes                           |
| Cao, G.; Zheng, H.;<br>Zhao, H.; Ni, Y.; Pocs,<br>C.A.; Zhang, Y.; Ye, F.;<br>Hoffmann, C.; Wang,<br>X.; Lee, M.; Hermele,<br>M.; Kimchi, I.,                                   | Quantum liquid from<br>strange frustration in the tri-<br>mer magnet Ba4lr3O10                                                                                           | Nature<br>Partner<br>Journals<br>Quantum<br>Materials | 5   |       | 26              | 10.1038/s41<br>535-020-<br>0232-6          | Yes                           |
| Cao, Y.; Dzuba, B.;<br>Magill, B.A.; Senichev,<br>A.; Nguyen, T.; Diaz,<br>R.E.; Manfra, M.J.;<br>McGill, S.A.; Garcia, C.;<br>Khodaparast, G.A.;<br>Malis, O.,                 | Photoluminescence study<br>of non-polar m-plane<br>InGaN and nearly strain-<br>balanced InGaN/AlGaN<br>superlattices                                                     | Journal of<br>Applied<br>Physics                      | 127 | 18    | 18570<br>2      | 10.1063/5.0<br>003740                      | Yes                           |
| Chan, M.K.; McDonald,<br>R.; Ramshaw, B.J.; Betts,<br>J.; Shehter, A.; Bauer,<br>E.D.; Harrison, N.,                                                                            | Extent of Fermi-surface re-<br>construction in the high-<br>temperature superconduc-<br>tor HgBa <sub>2</sub> CuO <sub>4+6</sub>                                         | Proceed-<br>ings of the<br>National<br>Academy<br>of  | 117 |       | 9782            | 10.1073/pn<br>as.19141661<br>17            | Yes                           |

| Authors                                                                                                                                                                                                                                  | Title                                                                                                                                                             | Journal<br>Name                                      | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Chapai, R.; Browne,<br>D.A.; Graf, D.E.; DiTusa,<br>J.F.; Jin, R.,                                                                                                                                                                       | Quantum oscillations with<br>angular dependence in<br>PdTe2 single crystals                                                                                       | Journal of<br>Physics-<br>Con-<br>densed<br>Matter   | 33  |       | 35601           | 10.1088/136<br>1-<br>648X/abb54<br>8       | Yes                           |
| Chappell, G.L.; Gal-<br>lagher, A.; Graf, D.E.;<br>Riseborough, P.;<br>Baumbach, R.,                                                                                                                                                     | Influence of hydrostatic<br>pressure on hidden order,<br>the Kondo lattice, and<br>magnetism in URu2Si2:xPx                                                       | Physical<br>Review B                                 | 102 |       | 24515<br>2      | 10.1103/Phy<br>sRevB.102.2<br>45152        | Yes                           |
| Che, H.; Zhao, Z.Y.; Rao,<br>X.Y.; Chu, G.L.; Li, N.;<br>Chu, W.J.; Gao, P.; Yue,<br>X.Y.; Zhou, Y.; Li, Q.J.;<br>Huang, Q.; Choi, E.S.;<br>Han, Y.Y.; He, Z.Z.; Zhou,<br>H.D.; Zhao, X.; Sun, X.F.,                                     | Absence of long-range or-<br>der in an XY pyrochlore an-<br>tiferromagnet Er2AlSbO7                                                                               | Physical<br>Review<br>Materials                      | 4   |       | 54406           | 10.1103/Phy<br>sRevMateri-<br>als.4.054406 | Yes                           |
| Che, S.; Shi, Y.; Yang, J.;<br>Tian, H.; Chen, R.;<br>Taniguchi, T.;<br>Watanabe, K.; Smirnov,<br>D.; Lau, C.N.; Shimshoni,<br>E.; Murthy, G.; Fertig, H.,                                                                               | Helical Edge States and<br>Quantum Phase Transitions<br>in Tetralayer Graphene                                                                                    | Physical<br>Review<br>Letters                        | 125 |       | 36803           | 10.1103/Phy<br>sRevLett.125<br>.036803     | Yes                           |
| Chen, K.; Horstmeier, S.;<br>Nguyen, V.; Bin, W.;<br>Crossley, S.; Pham, T.;<br>Gan, Z.; Hung, I.; White,<br>J.,                                                                                                                         | Structure and Catalytic<br>Characterization of a Sec-<br>ond Framework Al(IV) Site<br>in Zeolite Catalysts Re-<br>vealed by NMR at 35.2 T                         | Journal of<br>the<br>American<br>Chemical<br>Society | 142 | 16    | 7514-<br>7523   | 10.1021/jacs<br>.0c00590                   | Yes                           |
| Das, P.; Nash, J.; Webb,<br>M.; Burns, R.; Mapara,<br>V.N.; Ghimire, G.;<br>Divan, R.; Rosenmann,<br>D.; Karaiskaj, D.; McGill,<br>S.A.; Sumant, A.; Dai,<br>Q.; Ray, P.; Tawade,<br>B.V.; Raghavan, D.;<br>Karim, A.; Pradhan,<br>N.R., | High Broadband Photo-<br>conductivity of few-lay-<br>ered MoS₂ Field-effect<br>Transistor Measured in<br>Multi-terminal Method: Ef-<br>fect of Contact Resistance | Nanoscale                                            | 12  |       | 22904-<br>22916 | 10.1039/D0<br>NR07311C                     | Yes                           |
| Davydov, A.B.;<br>Oveshnikov, L.N.;<br>Suslov, A.; Ril, A I.;<br>Marenkin, S.F.; Aronzon,<br>B.A.,                                                                                                                                       | Superconductivity in Thin<br>Films of the Dirac Semi-<br>metal Cd <sub>3</sub> As <sub>2</sub>                                                                    | Physics of<br>the Solid<br>State                     | 62  | 3     | 419-<br>422     | 10.1134/S10<br>6378342003<br>0063          | Yes                           |
| Dhital, C.; DiTusa, J.F.,                                                                                                                                                                                                                | Entropic signatures of the skyrmion lattice phase in MnSi1-xAlx and Fe1-yCoySi                                                                                    | Physical<br>Review B                                 | 102 |       | 22440<br>8      | 10.1103/Phy<br>sRevB.102.2<br>24408        | Yes                           |
| Ding, L.; Lee, M.; Hong,<br>T.; Dun, Z.; Sinclair, R.;<br>Chi, S.; Agrawal, H.;<br>Choi, E.S.;<br>Chakoumakos, B.;<br>Zhou, H.D.; Cao, H.,                                                                                               | Noncollinear magnetic<br>structure and magnetoe-<br>lectric coupling in buckled<br>honeycomb Co4Nb2O9:A<br>single-crystal neutron dif-<br>fraction study          | Physical<br>Review B                                 | 102 |       | 17444<br>3      | 10.1103/Phy<br>sRevB.102.1<br>74443        | Yes                           |
| Ding, L.; Lee, M.S.; Choi,<br>E.S.; Zhang, J.; Wu, Y.;<br>Sinclair, R.;<br>Chakoumakos, B.;<br>Chai, Y.; Zhou, H.D.;<br>Cao, H.,                                                                                                         | Large spin-driven dielectric<br>response and magnetoe-<br>lectric coupling in the<br>buckledhoneycomb<br>Fe4Nb2O9                                                 | Physical<br>Review<br>Materials                      | 4   |       | 84403           | 10.1103/Phy<br>sRevMateri-<br>als.4.084403 | Yes                           |

| Authors                                                                                                                                                                                                                                                                                   | Title                                                                                                                         | Journal<br>Name                                       | Vol | Issue | Pages         | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Authors                                                                                                                                                                                                                 | Title                                                                                                                                                  | Journal<br>Name                                       | Vol | Issue | Pages         | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Authors                                                                                                                                                                                                                                                                                                                              | Title                                                                                                                                                                        | Journal<br>Name                                       | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Madsen, R.; Qiao, A.;<br>Sen, J.; Hung, I.; Chen,<br>K.; Gan, Z.; Sen, S.; Yue,<br>Y.,                                                                                                                                          | Ultrahigh-field <sup>67</sup> Zn NMR re-<br>veals short-range disorder<br>in zeolitic imidazolate<br>framework glasses                     | Science                                               | 367 |       | 1473-<br>1476   | 10.1126/sci-<br>ence.aaz02<br>51       | Yes                           |
| Magill, B.A.; Thapa, S.;<br>Holleman, J.; McGill,<br>S.A.; Munekata, H.;<br>Stanton, C.J.;<br>Khodaparast, G.A.,                                                                                                                | Magnetic field enhanced<br>detection of coherent<br>phonons in a GaM-<br>nAs/GaAs film                                                     | Physical<br>Review B                                  | 102 |       | 45306           | 10.1103/Phy<br>sRevB.102.0<br>45306    | Yes                           |
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| Authors                                                                                                                                                                                                                                           | Title                                                                                                                                   | Journal<br>Name                                    | Vol | Issue | Pages         | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Authors                                                                                                                                                                                                                                                                                                       | Title                                                                                                             | Journal<br>Name                         | Vol | Issue     | Pages         | DOI                                      | Cites<br>NSF<br>Core<br>Grant |
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| Qiu, G.; Niu, C.; Wang,<br>Y.; Si, M.; Zhang, Z.; Wu,<br>W.; Ye, P.D.,                                                                                                                                                                                                                                        | Quantum Hall effect of<br>Weyl fermions in n-type<br>semiconducting tellurene                                     | Nature<br>Nanotech-<br>nology           | 15  |           | 585–<br>591   | 10.1038/s41<br>565-020-<br>0715-4        | Yes                           |
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| Authors                                                                                                                                                                                                                                | Title                                                                                                                                                              | Journal<br>Name                                      | Vol | Issue | Pages           | DOI                                      | Cites<br>NSF<br>Core<br>Grant |
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| Shi, Z.; Kuhn, S.J.; Flicker,<br>F.; Helm, T.; Lee, J.;<br>Steinhardt, W.;<br>Dissanayake, S.; Graf,<br>D.E.; Ruff, J.; Fabbris, G.;<br>Haskel, D.; Haravifard,<br>S.,                                                                 | Incommensurate two-di-<br>mensional checkerboard<br>charge density wave in the<br>low-dimensional supercon-<br>ductor Ta4Pd3Te16                                   | Physical<br>Review<br>Research                       | 2   |       | 42042           | 10.1103/Phy<br>sRevResear<br>ch.2.042042 | Yes                           |
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| Authors                                                                                                                                                                                                         | Title                                                                                                                                            | Journal<br>Name                                       | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Tin, P.; Stavretis, S.E.;<br>Ozerov, M.; Krzystek, J.;<br>Ponomaryov, A.N.;<br>Zvyagin, S.A.; Wosnitza,<br>J.; Chen, C.C.; Chen,<br>P.P.Y.; Telser, J.; Xue,<br>Z.L.,                                           | Advanced Magnetic Reso-<br>nance Studies of Tetra-<br>phenylporphyrinatoiron(III)<br>Halides                                                     | Applied<br>Magnetic<br>Reso-<br>nance                 | 51  | 11    | 1411-<br>1432   | 10.1007/s00<br>723-020-<br>01236-8         | Yes                           |
| Tran, T.T.; Pocs, C.A.;<br>Zhang, Y.; Winiarski,<br>M.J.; Sun, J.; Lee, M.;<br>McQueen, T.M.,                                                                                                                   | Spinon excitations in the<br>quasi-one-dimensional S =<br>1/2 chain compound<br>Cs4CuSb2Cl <sub>12</sub>                                         | Physical<br>Review B                                  | 101 |       | 23510<br>7      | 10.1103/Phy<br>sRevB.101.2<br>35107        | Yes                           |
| Vakaliuk, O.; Werfel, F.;<br>Jaroszynski, J.;<br>Halbedel, B.,                                                                                                                                                  | Trapped field potential of<br>commercial Y-Ba-Cu-O<br>bulk superconductors de-<br>signed for applications                                        | Supercon-<br>ductor<br>Science<br>and Tech-<br>nology | 33  | 9     | 95005           | 10.1088/136<br>1-<br>6668/ab9fc<br>4       | Yes                           |
| Vanderlaan, M.;<br>Brumm, T.,                                                                                                                                                                                   | Supercritical helium expan-<br>sivity effects on magnet<br>protection                                                                            | Advances<br>in Cryo-<br>genic En-<br>gineering        | 755 |       | 12130           | 10.1088/175<br>7-<br>899X/755/1/<br>012130 | Yes                           |
| Vasquez, G.; Wei, K.;<br>Choi, E.S.; Baumbach,<br>R.; Latturner, S.E.,                                                                                                                                          | Magnesium-Based Flux<br>Growth and Structural Re-<br>lationships of a Large Fam-<br>ily of Tetrelide Semimetals                                  | Crystal<br>Growth<br>and<br>Design                    | 20  |       | 2632-<br>2643   | 10.1021/acs<br>.cgd.0c000<br>12            | Yes                           |
| Viciano-Chumillas, M.;<br>Blondin, G.;<br>Clemancey, M.;<br>Krzystek, J.; Ozerov, M.;<br>Armentano, D.;<br>Schnegg, A.; Lohmiller,<br>T.; Telser, J.; Lloret, F.;<br>Cano, J.,                                  | Single-Ion Magnetic Be-<br>haviour in an Iron(III) Por-<br>phyrin Complex: A Dichot-<br>omy Between High Spin<br>and 5/2–3/2 Spin Admix-<br>ture | Chemistry<br>a<br>European<br>Journal                 | 26  |       | 14242-<br>14251 | 10.1002/che<br>m.20200305<br>2             | Yes                           |
| Wang, Q.; Li, W.; Hung,<br>I.; Mentink-Vigier, F.;<br>Wang, X.; Qi, G.; Wang,<br>X.; Gan, Z.; Xu, J.; Deng,<br>F.,                                                                                              | Mapping the oxygen struc-<br>ture of γ-Al2O3 by high-<br>field solid-state NMR spec-<br>troscopy                                                 | Nature<br>Communi-<br>cations                         | 11  | 1     | 3620            | 10.1038/s41<br>467-020-<br>17470-4         | Yes                           |
| Wang, T.; Li, Z.; Lu, Z.; Li,<br>Y.; Miao, S.; Lian, Z.;<br>Meng, Y.; Blei, M.;<br>Taniguchi, T.;<br>Watanabe, K.; Tongay,<br>S.; Yao, W.; Smirnov, D.;<br>Zhang, C.; Shi, S.,                                  | Observation of Quantized<br>Exciton Energies in Mono-<br>layer WSe2 under a Strong<br>Magnetic Field                                             | Physical<br>Review X                                  | 10  |       | 21024           | 10.1103/Phy<br>sRevX.10.02<br>1024         | Yes                           |
| Wang, T.; Miao, S.; Li, Z.;<br>Meng, Y.; Lu, Z.; Lian, Z.;<br>Blei, M.; Taniguchi, T.;<br>Watanabe, K.; Tongay,<br>S.; Smirnov, D.; Shi, S.,                                                                    | Giant Valley-Zeeman Split-<br>ting from Spin-Singlet and<br>Spin-Triplet Interlayer Exci-<br>tons in WSe2/MoSe2 Heter-<br>ostructure             | American<br>Chemical<br>Society<br>Nano Let-<br>ters  | 20  | 1     | 694             | 10.1021/acs<br>.nano-<br>lett.9b04528      | Yes                           |
| Weiland, A.; Wei, K.;<br>McCandless, G.T.;<br>Felder, J.B.; Eddy, L.J.;<br>Baumbach, R.; Chan,<br>J.Y.,                                                                                                         | Strongly correlated elec-<br>tron behavior in a new<br>member of the<br>An+1BnX3n+1homologous se-<br>ries: Ce7Co6Ge19                            | Physical<br>Review<br>Materials                       | 4   |       | 74408           | 10.1103/Phy<br>sRevMateri-<br>als.4.074408 | Yes                           |

| Authors                                                                                                                                                                 | Title                                                                                                                                                                                                                          | Journal<br>Name                                                                  | Vol | Issue | Pages           | DOI                                           | Cites<br>NSF<br>Core<br>Grant |
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| Widener, C.; Bone, A.;<br>Ozerov, M.; Richardson,<br>R.; Lu, Z.;<br>Thirunavukkuarasu, K.;<br>Smirnov, D.; Chen,<br>XUE.TAI.; Xue, ZI.LIANG.,                           | Direct Observation of Mag-<br>netic Transitions in a<br>Nickel(II) complex with<br>Large Anisotropy                                                                                                                            | Chinese<br>Journal of<br>Inorganic<br>Chemistry                                  | 36  | 6     | 1149-<br>1156   | 10.11862/CJ<br>IC.2020.126                    | Yes                           |
| Xin, Y.; Stolt, I.; Song, Y.;<br>Dai, P.; Halperin, W.P.,                                                                                                               | Stripe antiferromagnetism<br>and disorder in the Mott in-<br>sulator NaFe₁-xCuxAs<br>(x.≤0.5)                                                                                                                                  | Physical<br>Review B                                                             | 101 |       | 64410           | 10.1103/Phy<br>sRevB.101.0<br>64410           | Yes                           |
| Xing, J.; Feng, E.; Liu, Y.;<br>Emmanouilidou, E.; Hu,<br>C.; Liu, J.; Graf, D.E.;<br>Ramirez, A.P.; Chen, G.;<br>Cao, H.; Ni, N.,                                      | Nèel-type antiferromag-<br>netic order and magnetic<br>fieldtemperature phase<br>diagram in the spin-1/2<br>rare-earth honeycomb<br>compound YbCl <sub>3</sub>                                                                 | Physical<br>Review B                                                             | 102 |       | 14427           | 10.1103/Phy<br>sRevB.102.0<br>14427           | Yes                           |
| Xu, K.J.; Chen, S.D.; He,<br>Y.; He, J.; Tang, S.; Jia,<br>C.; Ma, E. Y.; Mo, S.K.;<br>Lu, D.H.; Hashimoto, M.;<br>Devereaux, T. P.; Shen,<br>Z.X.,                     | Metallic surface states in a<br>correlated d-electron top-<br>ological Kondo insulator<br>candidate FeSb2                                                                                                                      | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA | 117 | 27    | 15409-<br>15413 | 10.1073/pn<br>as.20023611<br>17               | Yes                           |
| Xu, X.; Peng, X.; Roch-<br>ester, J.; Lee, J.;<br>Sumption, M.,                                                                                                         | High critical current density<br>in internally-oxidized Nb3Sn<br>superconductors and its<br>origin                                                                                                                             | Scripta<br>Materialia                                                            | 186 |       | 317 -<br>320    | 10.1016/j.scr<br>ip-<br>tamat.2020.<br>05.043 | Yes                           |
| Xu, X.; Sumption, M.D.;<br>Lee, J.; Rochester, J.;<br>Peng, X.,                                                                                                         | Persistent compositions of<br>non-stoichiometric com-<br>pounds with low bulk diffu-<br>sivity: A theory and appli-<br>cation to Nb3Sn supercon-<br>ductors                                                                    | Journal of<br>Alloys and<br>Com-<br>pounds                                       | 845 |       | 15618<br>2      | 10.1016/j.jall<br>com.2020.1<br>56182         | Yes                           |
| Yang, H.; Singh, B.; Lu,<br>B.; Huang, C.; Bahrami,<br>F.; Chiu, W.; Graf, D.E.;<br>Huang, S.; Wang, B.;<br>Lin, H.; Torchinsky, D.;<br>Bansil, A.; Tafti, F.,          | Transition from intrinsic to<br>extrinsic anomalous Hall ef-<br>fect in the ferromagnetic<br>Weyl semimetal PrAIGe1-xSix                                                                                                       | APL<br>Materials                                                                 | 8   | 1     | 11111           | 10.1063/1.5<br>132958                         | Yes                           |
| Yang, J.; Wang, K.;<br>Che, S.; Tuchfeld, Z.J.;<br>Watanabe, K.;<br>Taniguchi, T.;<br>Shcherbakov, D.;<br>Moon, S.; Smirnov, D.;<br>Chen, R.; Bockrath, M.;<br>Lau, C., | Equilibration and filtering of<br>quantum Hall edge states<br>in few-layer black phos-<br>phorus                                                                                                                               | Physical<br>Review<br>Materials                                                  | 4   |       | 11400<br>8      | 10.1103/Phy<br>sRevMateri-<br>als.4.114008    | Yes                           |
| Yang, M.; Robert, C.;<br>Lu, Z.; Van Tuan, D.;<br>Smirnov, D.; Marie, X.;<br>Dery, H.,                                                                                  | Exciton valley depolariza-<br>tion in monolayer transi-<br>tion-metal dichalcogeni-<br>des                                                                                                                                     | Physical<br>Review B                                                             | 101 |       | 11530<br>7      | 10.1103/Phy<br>sRevB.101.1<br>15307           | Yes                           |

| Authors                                                                                                                                                                                                         | Title                                                                                                                                                               | Journal<br>Name                                       | Vol | Issue | Pages         | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Yuan Huang, K.; Shi, Y.;<br>Srpcic, J.; D Ainslie, M.;<br>Kumar Namburi, D.; R<br>Dennis, A.; Zhou, D.;<br>Boll, M.; Filipenko, M.;<br>Jaroszynski, J.;<br>Hellstrom, E.; A Card-<br>well, D.; Hay Durrell, J., | Composite stacks for relia-<br>ble > 17 T trapped fields in<br>bulk superconductor mag-<br>nets                                                                     | Supercon-<br>ductor<br>Science<br>and Tech-<br>nology | 33  |       | 10347<br>1    | 10.1088/136<br>1-<br>6668/ab5e1<br>2       | Yes                           |
| Yuan, X.; Zhang, C.;<br>Zhang, Y.; Yan, Z.; Lyu,<br>T.; Zhang, M.; Li, Z.;<br>Song, S.; Zhao, M.;<br>Leng, P.; Ozerov, M.;<br>Chen, X.; Wang, N.; Shi,<br>Y.; Yan, H.; Xiu, F.,                                 | The discovery of dynamic<br>chiral anomaly in a Weyl<br>semimetal NbAs                                                                                              | Nature<br>Communi-<br>cations                         | 11  |       | 1259          | 10.1038/s41<br>467-020-<br>14749-4         | Yes                           |
| Zhang, S.; Chappell,<br>G.L.; Pouse, N.;<br>Baumbach, R.; Maple,<br>M.B.; Greene, L.H.; Park,<br>W.K.,                                                                                                          | Origin of gaplike behaviors<br>in URu <sub>2</sub> Si <sub>2</sub> : Combined study<br>via quasiparticle scattering<br>spectroscopy and resistivity<br>measurements | Physical<br>Review B:<br>Rapid<br>Comm/<br>Letters    | 102 | 8     | 81101         | 10.1103/Phy<br>sRevB.102.0<br>81101        | Yes                           |
| Zheng, W.;<br>Schoenemann, R.U.;<br>Mozaffari, S.; Chiu, Y.C.;<br>Goraum, Z.B.; Aryal, N.;<br>Manousakis, E.; Siegrist,<br>T.M.; Wei, K.; Balicas, L.,                                                          | Bulk Fermi surfaces of the<br>Dirac type-II semimetallic<br>candidate NiTe2                                                                                         | Physical<br>Review B                                  | 102 |       | 12510<br>3    | 10.1103/Phy<br>sRevB.102.1<br>25103        | Yes                           |
| Zhu, Y.; Gui, X.; Wang,<br>Y.; Graf, D.E.; Xie, W.;<br>Hu, J.; Mao, Z.,                                                                                                                                         | Evidence from transport<br>measurements for YRh <sub>6</sub> Ge <sub>4</sub><br>being a triply degenerate<br>nodal semimetal                                        | Physical<br>Review B                                  | 101 |       | 35133         | 10.1103/Phy<br>sRevB.101.0<br>35133        | Yes                           |
| Zhu, Y.; Singh, B.; Wang,<br>Y.; Huang, C.; Chiu, W.;<br>Wang, B.; Graf, D.E.;<br>Zhang, Y.; Lin, H.; Sun,<br>J.; Bansil, A.; Mao, Z.,                                                                          | Exceptionally large anom-<br>alous Hall effect due to an-<br>ticrossing of spin-split bands<br>in the antiferromagnetic<br>half-Heusler compound<br>TbPtBi          | Physical<br>Review B:<br>Rapid<br>Comm/<br>Letters    | 101 |       | 16110<br>5    | 10.1103/Phy<br>sRevB.101.1<br>61105        | Yes                           |
| Zolnhofer, E.M.; Wije-<br>ratne, G.B.; Jackson,<br>T.A.; Fortier, S.; Heine-<br>mann, F.W.; Meyer, K.;<br>Krzystek, J.; Ozarowski,<br>A.; Mindiola, D.J.; Telser,<br>J.,                                        | Electronic structure and<br>magnetic properties of a ti-<br>tanium(II) coordination<br>complex                                                                      | Inorganic<br>Chemistry                                | 59  | 9     | 6187-<br>6201 | 10.1021/acs<br>.inorg-<br>chem.0c00<br>311 | Yes                           |

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| Aryal, C.; Bui, N.N.;<br>Khadka, N.K.; Song, L.;<br>Pan, J.P.,                                                                                            | The helix 0 of endophilin<br>modifies membrane mate-<br>rial properties and induces<br>local curvature | Biochimica<br>et Biophys-<br>ica Acta<br>Biomem-<br>branes | 1862 | 10    | 18339<br>7 | 10.1016/j.bb<br>amem.2020<br>.183397   | Yes                  |

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| Bindra, J.; Singh, K.; van<br>Tol, J.; Dalal, N.; Strouse,<br>G.,                                                                                                                                                   | Spin Dynamics in Mn: ZnSe<br>Quantum Dots: A Pulsed<br>High-Frequency EPR Study                                                                                                                                | Journal of<br>Physical<br>Chemistry<br>C               | 124 | 35    | 19348-<br>-19354 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>231 | Yes                           |
| Bone, A.N.; Stavretis,<br>S.E.; Krzystek, J.; Liu, Z.;<br>Chen, Q.; Gai, Z.;<br>Wang, X.; Steren, C.A.;<br>Powers, X.B.;<br>Podlesnyak, A.A.;<br>Chen, X.T.; Telser, J.;<br>Zhou, H.; Xue, Z.L.,                    | Manganese tetra-<br>phenylporphyrin bromide<br>and iodide. Studies of<br>structures and magnetic<br>properties                                                                                                 | Polyhe-<br>dron                                        | 184 |       | 11448<br>8       | 10.1016/j.po<br>ly.2020.1144<br>88         | Yes                           |
| Chakarawet, K.; At-<br>anasov, M.E.; Marbey,<br>J.; Bunting, P.C.; Neese,<br>F.; Hill, S.; Long, J.R.,                                                                                                              | Strong Electronic and<br>Magnetic Coupling in M <sub>4</sub><br>(M = Ni, Cu) Clusters via Di-<br>rect Orbital Interactions Be-<br>tween Low-Coordinate<br>Metal Centers                                        | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 |       | 19161-<br>19169  | 10.1021/jacs<br>.0c08460                   | Yes                           |
| Chen, J.; Hu, C.; Stan-<br>ton, J.F.; Hill, S.; Cheng,<br>H.; Zhang, X.,                                                                                                                                            | Decoherence in Molecular<br>Electron Spin Qubits: In-<br>sights from Quantum<br>Many-Body Simulations                                                                                                          | Journal of<br>Physical<br>Chemistry<br>Letters         | 11  | 0     | 2074-<br>2078    | 10.1021/acs<br>.jpclett.0c00<br>193        | Yes                           |
| Das Gupta, S.; Stewart,<br>R.; Chen, D.; Abboud,<br>K.A.; Cheng, H.P.; Hill,<br>S.; Christou, G.,                                                                                                                   | Long-Range Ferromag-<br>netic Exchange Interac-<br>tions Mediated by Mn-<br>Ce <sup>IV</sup> -Mn Superexchange<br>Involving Empty 4f Orbitals                                                                  | Inorganic<br>Chemistry                                 | 59  | 13    | 8716-<br>8726    | 10.1021/acs<br>.inorg-<br>chem.0c00<br>332 | Yes                           |
| Fataftah, M.S.; Bayliss,<br>S.L.; Laorenza, D.W.;<br>Wang, X.; Phelan, B.T.;<br>Wilson, C.B.; Mintun,<br>P.J.; Kovos, B.D.;<br>Wasielewski, M.R.; Han,<br>S.; Sherwin, M.S.;<br>Awschalom, D.D.;<br>Freedman, D.E., | Trigonal Bipyramidal V <sup>3+</sup><br>Complex as an Optically<br>AddressableMolecular<br>Qubit Candidate                                                                                                     | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 |       | 20400-<br>20408  | 10.1021/jacs<br>.0c08986                   | Yes                           |
| Fleming, C.; Chung, D.;<br>Ponce, S.; Brook, D. J.<br>R.; DaRos, J.; Das, R.;<br>Ozarowski, A.; Stoian,<br>S.,                                                                                                      | Valence tautomerism in a<br>cobalt-verdazyl coordina-<br>tion compound                                                                                                                                         | Chemical<br>Communi-<br>cations                        | 56  | 32    | 4400-<br>4403    | 10.1039/d0c<br>c01770a                     | Yes                           |
| Goodwin, C.A.P.;<br>Giansiracusa, M.J.;<br>Greer, S.M.; Nicholas,<br>H.M.; Evans, P.; Vonci,<br>M.; Hill, S.; Chilton, N.F.;<br>Mills, D.P.,                                                                        | Isolation and electronic<br>structures of derivatized<br>manganocene, ferrocene<br>and cobaltocene anions                                                                                                      | Nature<br>Chemistry                                    | 13  |       | 243-<br>248      | 10.1038/s41<br>557-020-<br>00595-w         | Yes                           |
| Greer, S.; Gramigna, K.;<br>Thomas, C.; Stoian, S.;<br>Hill, S.,                                                                                                                                                    | Insights into Molecular<br>Magnetism in Metal-Metal<br>Bonded Systems as Re-<br>vealed by a Spectroscopic<br>and Computational Analy-<br>sis of Diiron Complexes                                               | Inorganic<br>Chemistry                                 | 59  |       | 18141-<br>18155  | 10.1021/acs<br>.inorg-<br>chem.0c02<br>605 | Yes                           |
| Gumerova, N.I.; Roller,<br>A.; Giester, G.; Krzystek,<br>J.; Cano, J.; Rompel, A.,                                                                                                                                  | Incorporation of Cr(III) into<br>a Keggin polyoxometalate<br>as a chemical strategy to<br>stabilize a labile CrIIIO4 tet-<br>rahedral conformation and<br>promote unattended sin-<br>gle-ion magnet properties | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 | 7     | 3336-<br>3339    | 10.1021/jacs<br>.9b12797                   | Yes                           |

| Authors                                                                                                                                                                                                        | Title                                                                                                                                                                                               | Journal<br>Name                | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Impert, O.; Kozakiewicz,<br>A.; Wrzeszcz, G.;<br>Katafias, A.; Bienko, A.;<br>van Eldik, R.; Ozarowski,<br>A.,                                                                                                 | Characterization of a<br>Mixed-Valence Ru(II)/Ru(III)<br>Ion-Pair Complex. Unex-<br>pected High-Frequency<br>Electron Paramagnetic<br>Resonance Evidence for<br>Ru(III)/Ru(III) Dimer Cou-<br>pling | Inorganic<br>Chemistry         | 59  |       | 8609-<br>8619   | 10.1021/acs<br>.inorg-<br>chem.0c01<br>068 | Yes                           |
| Jackson, C.E.; Lin, C.;<br>van Tol, J.; Zadrozny,<br>J.M.,                                                                                                                                                     | Orientation dependence<br>of phase memory relaxa-<br>tion in the V(IV) ion at high<br>frequencies                                                                                                   | Chemical<br>Physics<br>Letters | 739 |       | 13703<br>4      | 10.1016/j.cp<br>lett.2019.137<br>034       | Yes                           |
| Jaiswal, M.; Tran, T.T.; Li,<br>Q.; Yan, X.; Zhou, M.;<br>Kundu, K.; Fanucci,<br>G.E.; Guo, Z.,                                                                                                                | A metabolically engi-<br>neered spin-labeling ap-<br>proach for studying gly-<br>cans on cells                                                                                                      | Chemical<br>Science            | 11  | 46    | 12522-<br>12532 | 10.1039/D0S<br>C03874A                     | Yes                           |
| Kaniewska, K.; Poni-<br>kiewski, Ł.; Szynkiewicz,<br>N.; Cieślik, B.; Pikies, J.;<br>Krzystek, J.;<br>Dragulescu-Andrasi, A.;<br>Stoian, S.A.; Grubba, R.,                                                     | Homoleptic mono-, di-,<br>and tetra-iron complexes<br>featuring phosphido lig-<br>ands: a synthetic, struc-<br>tural, and spectroscopic<br>study                                                    | Dalton<br>Transac-<br>tions    | 49  |       | 10091-<br>10103 | 10.1039/D0<br>DT01503B                     | Yes                           |
| Kinyon, J.S.; Clark, R.;<br>Dalal, N.S.; Wang, Z.;<br>van Tol, J.; Rakvin, B.,                                                                                                                                 | High-frequency EPR study<br>of the unusual multiferroic<br>NH₄CuCl₃                                                                                                                                 | Polyhe-<br>dron                | 177 |       | 11425<br>5      | 10.1016/j.po<br>ly.2019.1142<br>55         | Yes                           |
| Krzystek, J.; Schnegg,<br>A.; Aliabadi, A.;<br>Holldack, K.; Stoian,<br>S.A.; Ozarowski, A.;<br>Hicks, S.D.; Abu-Omar,<br>M.M.; Thomas, K.E.;<br>Gosh, A.; Caulfield,<br>K.P.; Tonzetich, Z.J.;<br>Telser, J., | Advanced paramagnetic<br>resonance studies on man-<br>ganese and iron corroles<br>with a formal d4 electron<br>count                                                                                | Inorganic<br>Chemistry         | 59  | 2     | 1075-<br>1090   | 10.1021/acs<br>.inorg-<br>chem.9b02<br>635 | Yes                           |
| Kumar, P.; SantaLucia,<br>D.J.; Kaniewska-Las-<br>kowska, K.; Lindeman,<br>S.V.; Ozarowski, A.;<br>Krzystek, J.; Ozerov, M.;<br>Telser, J.; Berry, J.F.;<br>Fiedler, A.T.,                                     | Probing the Magnetic Ani-<br>sotropy of Co(II) Com-<br>plexes Featuring Redox-<br>Active Ligands                                                                                                    | Inorganic<br>Chemistry         | 59  | 22    | 16178-<br>16193 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>812 | Yes                           |
| Lee, I.; Utermohlen,<br>F.G.; Weber, D.;<br>Hwang, K.; Zhang, C.;<br>van Tol, J.; Goldberger,<br>J.E.; Trivedi, N.; Ham-<br>mel, P.C.,                                                                         | Fundamental Spin Interac-<br>tions Underlying the Mag-<br>netic Anisotropy in the<br>Kitaev Ferromagnet Crl3                                                                                        | Physical<br>Review<br>Letters  | 124 | 1     | 17201           | 10.1103/Phy<br>sRevLett.124<br>.017201     | Yes                           |
| Li, J.; Yin, L.; Xiong, S.;<br>Wu, X.; Yu, F.; Ouyang,<br>Z.; Xia, Z.; Zhang, Y.; van<br>Tol, J.; Song, Y.; Wang,<br>Z.,                                                                                       | Controlling Electron Spin<br>Decoherence in Nd-based<br>Complexes via Symmetry<br>Selection                                                                                                         | iScience                       | 23  | 3     | 10092<br>6      | 10.1016/j.isci<br>.2020.10092<br>6         | Yes                           |
| Liu, J.L.; Pedersen, K.;<br>Greer, S.; Oyarzabal, I.;<br>Mondal, A.; Hill, S.; Wil-<br>helm, F.; Rogalev, A.;<br>Tressaud, A.; Durand, E.;<br>Long, J.; Clerac, R.,                                            | Access to Heteroleptic<br>Fluorido-Cyanido Com-<br>plexes with a Large Mag-<br>netic Anisotropy via Fluo-<br>ride Abstraction                                                                       | An-<br>gewandte<br>Chemie      | 59  |       | 10306-<br>10310 | 10.1002/an<br>ge.2019149<br>34             | Yes                           |

| Authors                                                                                                                                                                                                                                                                                                                                                                                   | Title                                                                                                                                                                                                                                                                                                | Journal<br>Name                              | Vol | Issue | Pages               | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
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| Manson, J. L.; Manson,<br>Z. E.; Sargent, A.; Villa,<br>D. Y.; Etten, N. L.; Black-<br>more, W. J.; Curley, S.<br>P.; Williams, R. C.;<br>Brambleby, J.; God-<br>dard, P. A.; Ozarowski,<br>A.; Wilson, M. N.; Hud-<br>dart, B. M.; Lancaster,<br>T.; Johnson, R. D.; Blun-<br>dell, S. J.; Bendix, J.;<br>Wheeler, K. A.; Lapidus,<br>S. H.; Xiao, F.; Birnbaum,<br>S.M.; Singleton, J., | Enhancing easy-plane ani-<br>sotropy in bespoke Ni(II)<br>quantum magnets                                                                                                                                                                                                                            | Polyhe-<br>dron                              | 180 |       | 11437<br>9          | 10.1016/j.po<br>ly.2020.1143<br>79           | Yes                           |
| Obaleye, J.; Ajibola, A.;<br>Bernardus, V.; Hosten,<br>E.C.; Ozarowski, A.,                                                                                                                                                                                                                                                                                                               | Synthesis, spectroscopic,<br>structural and antimicro-<br>bial studies of a dimeric<br>complex of copper(II) with<br>trichloroacetic acid and<br>metronidazole                                                                                                                                       | Inorganica<br>Chimica<br>Acta                | 503 |       | 11940<br>4          | 10.1016/j.ic<br>a.2019.1194<br>04            | Yes                           |
| Palacios, M.A.; Díaz-Or-<br>tega, I.F.; Nojiri, H.; Su-<br>turina, E.A.; Ozerov, M.;<br>Krzystek, J.; Colacio, E.,                                                                                                                                                                                                                                                                        | Tuning magnetic anisot-<br>ropy by the $\pi$ -bonding fea-<br>tures of the axial ligands<br>and the electronic effects<br>of gold(I) atoms in 2D<br>{Co(L) <sub>2</sub> [Au(CN) <sub>2</sub> ] <sub>2</sub> } <sub>n</sub> metal-<br>organic frameworks with<br>field-induced single-ion<br>behavior | Inorganic<br>Chemistry<br>Frontiers          | 7   |       | 4611-<br>4630       | 10.1039/D0<br>Q100996B                       | Yes                           |
| Plugis, N.M.; Rudd, N.D.;<br>Krzystek, J.; Swenson,<br>D.C.; Telser, J.; Larra-<br>bee, J.A.,                                                                                                                                                                                                                                                                                             | Cobalt(II) scorpionate<br>complexes as models for<br>cobalt-substituted zinc en-<br>zymes: electronic structure<br>investigation by magnetic<br>circular dichroism                                                                                                                                   | Journal of<br>Inorganic<br>Biochemis-<br>try | 203 |       | 11087<br>6          | 10.1016/j.jin<br>or-<br>gbio.2019.1<br>10876 | Yes                           |
| Premuzic, D.; Holynska,<br>M.; Ozarowski, A.;<br>Pietzonka, C.;<br>Roseborough, A.;<br>Stoian, S.A.,                                                                                                                                                                                                                                                                                      | Model Dimeric Manga-<br>nese(IV) Complexes Fea-<br>turing Terminal Tris-hydroxo-<br>tetraazaadamantane and<br>Various Bridging Ligands                                                                                                                                                               | Inorganic<br>Chemistry                       | 59  | 15    | 10768-<br>10784     | 10.1021/acs<br>.inorg-<br>chem.0c01<br>242   | Yes                           |
| Reinholdt, A.; Pividori,<br>D.; Laughlin, A.L.;<br>DiMucci, I.M.; MacMil-<br>Ian, S.N.; Jafari, M.G.;<br>Gau, M.R.; Carroll, P.J.;<br>Krzystek, J.; Ozarowski,<br>A.; Telser, J.; Lancaster,<br>K.M.; Meyer, K.;<br>Mindiola, D.J.,                                                                                                                                                       | A mononuclear and high-<br>spin tetrahedral Ti(II) com-<br>plex                                                                                                                                                                                                                                      | Inorganic<br>Chemistry                       | 59  | 24    | 17834<br>-<br>17850 | 10.1021/acs<br>.inorg-<br>chem.0c02<br>586   | Yes                           |
| Rōōm, T.; Viirok, J.;<br>Peedu, L.; Nagel, U.;<br>Farkas, D.G.; Szaller, D.;<br>Kocsis, V.; Bordács, S.;<br>Kézsmárki, I.; Ka-<br>menskyi, D.L.;<br>Engelkamp, H.; Ozerov,<br>M.; Smirnov, D.;<br>Krzystek, J.;<br>Thirunavukkuarasu, K.;<br>Ozaki, Y.; Tomioka, Y.;<br>Ito, T.; Datta, T.; Fish-<br>man, R.S.,                                                                           | Magnetoelastic distortion<br>of multiferroic BiFeO3 in the<br>canted antiferromagnetic<br>state                                                                                                                                                                                                      | Physical<br>Review B                         | 102 |       | 21441<br>0          | 10.1103/Phy<br>sRevB.102.2<br>14410          | Yes                           |

| Authors                                                                                                                                                                                                        | Title                                                                                                                                                                                                        | Journal<br>Name                       | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Saber, M.R.;<br>Thirunavukkuarasu, K.;<br>Greer, S.; Hill, S.;<br>Dunbar, K.R.,                                                                                                                                | Magneto-Structural and<br>EPR Studies of Anisotropic<br>Vanadium trans-Dicyanide<br>Molecules                                                                                                                | Inorganic<br>Chemistry                | 59  | 18    | 13262-<br>13269 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>595 | Yes                           |
| Sanakis, Y.; Krzystek, J.;<br>Maganas, D.;<br>Grigoropoulos, A.;<br>Ferentinos, E.; Kostakis,<br>M.G.; Petroulea, V.;<br>Pissas, M.;<br>Thirunavukkuarasu, K.;<br>Wernsdorfer, F.; Neese,<br>W.; Kyritsis, P., | Magnetic Properties and<br>Electronic Structure of the S<br>= 2 Complex<br>[Mn(III)(OPPh2)2N3] Show-<br>ing Field-Induced Slow<br>Magnetization Relaxation                                                   | Inorganic<br>Chemistry                | 59  | 18    | 13281-<br>13294 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>636 | Yes                           |
| Sanakis, Y.; Pisas, M.;<br>Krzystek, J.; Ozarowski,<br>A.; Telser, J.; Raptis,<br>R.G.,                                                                                                                        | Ferromagnetically-cou-<br>pled, triangular<br>[Bu4N]2[Cu3(µ3-Br)2(µ-4-<br>O2N-pz)3Br3 complex revis-<br>ited: The effect of coordi-<br>nated halides on spin re-<br>laxation properties                      | Polyhe-<br>dron                       | 177 |       | 11425<br>8      | 10.1016/j.po<br>ly.2019.1142<br>58         | Yes                           |
| Sarkis, C.L.; Rau, J.G.;<br>Sanjeewa, L.D.; Powell,<br>M.; Kolis, J.; Marbey, J.;<br>Hill, S.; Rodriguez-Ri-<br>vera, J.A.; Nair, H.S.;<br>Yahne, D.R.; Säubert, S.;<br>Gingras, M.J.P.; Ross,<br>K.A.,        | Unravelling competing mi-<br>croscopic interactions at a<br>phase boundary: A single-<br>crystal study of the meta-<br>stable antiferromagnetic<br>pyrochlore Yb <sub>2</sub> Ge <sub>2</sub> O <sub>7</sub> | Physical<br>Review B                  | 102 |       | 13441<br>8      | 10.1103/Phy<br>sRevB.102.1<br>34418        | Yes                           |
| Soler, M.; Mahalay, P.;<br>Wernsdorfer, W.;<br>Lubert-Perquel, D.V.;<br>Huffman, J.C.; Abboud,<br>K.A.; Hill, S.; Christou, G.,                                                                                | Extending the family of re-<br>duced<br>[Mn12O12(O2CR)16(H2O)x] <sup>n-</sup><br>complexes, and their sensi-<br>tivity to environmental fac-<br>tors                                                         | Polyhe-<br>dron                       | 195 |       | 11496<br>8      | 10.1016/j.po<br>ly.2020.1149<br>68         | Yes                           |
| Stetsiuk, O.; Plyuta, N.;<br>Avarvari, N.; Goreshnik,<br>E.; Kokozay, N.;<br>Petrusenko, S.;<br>Ozarowski, A.,                                                                                                 | Mn(III) Chain Coordination<br>Polymers Assembled by<br>Salicylidene-2-ethanola-<br>mine Schiff Base Ligands:<br>Synthesis, Crystal Structures,<br>and HFEPR Study                                            | Crystal<br>Growth<br>and De-<br>sign  | 20  | 3     | 1491-<br>1502   | 10.1021/acs<br>.cgd.9b011<br>50            | Yes                           |
| Switlicka, A.; Machura,<br>B.; Penkala, M.; Bienko,<br>A.; Bienko, D.C.; Titis, J.;<br>Rajnak, C.; Boca, R.;<br>Ozarowski, A.,                                                                                 | Slow magnetic relaxation<br>in hexacoordinated co-<br>balt(ii) field-induced single-<br>ion magnets                                                                                                          | Inorganic<br>Chemistry<br>Frontiers   | 7   |       | 2637-<br>2650   | 10.1039/D0<br>QI00257G                     | Yes                           |
| Teixeira, F.J.; Flores, L.S.;<br>Escobar, L.B.L.; dos San-<br>tos, T.C.; Yoshida, M.I.;<br>Reis, M.S.; Hill, S.;<br>Ronconi, C.M.; Corrêa,<br>C.C.,                                                            | 3D interpenetrated Co(II)<br>coordination polymer: syn-<br>thesis, crystal structure,<br>magnetic and adsorption<br>properties                                                                               | Inorganica<br>Chimica<br>Acta         | 511 |       | 11979<br>1      | 10.1016/j.ic<br>a.2020.1197<br>91          | Yes                           |
| Tin, P.; Stavretis, S.E.;<br>Ozerov, M.; Krzystek, J.;<br>Ponomaryov, A.N.;<br>Zvyagin, S.A.; Wosnitza,<br>J.; Chen, C.C.; Chen,<br>P.P.Y.; Telser, J.; Xue,<br>Z.L.,                                          | Advanced Magnetic Reso-<br>nance Studies of Tetra-<br>phenylporphyrinatoiron(III)<br>Halides                                                                                                                 | Applied<br>Magnetic<br>Reso-<br>nance | 51  | 11    | 1411-<br>1432   | 10.1007/s00<br>723-020-<br>01236-8         | Yes                           |
| Vaidya, P.; Morley, S.A.;<br>van Tol, J.; Liu, Y.;<br>Cheng, R.; Brataas, A.;<br>Lederman, D.; del<br>Barco, E.,                                                                                               | Subterahertz spin pumping<br>from an insulating antiferro-<br>magnet                                                                                                                                         | Science                               | 368 | 6487  | 160<br>165      | 10.1126/sci-<br>ence.aaz42<br>47           | Yes                           |

#### 2020 MagLab Annual Report - 5. Publications

| Authors                                                                                                                                                                                                                                                                                                                                | Title                                                                                                                                    | Journal<br>Name                                        | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-------|-----------------|--------------------------------------------|-------------------------------|
| Viciano-Chumillas, M.;<br>Blondin, G.;<br>Clemancey, M.;<br>Krzystek, J.; Ozerov, M.;<br>Armentano, D.;<br>Schnegg, A.; Lohmiller,<br>T.; Telser, J.; Lloret, F.;<br>Cano, J.,                                                                                                                                                         | Single-Ion Magnetic Be-<br>havior in an Iron(III) Porphy-<br>rin Complex: A Dichotomy<br>Between High Spin and<br>5/2–3/2 Spin Admixture | Chemistry<br>a Euro-<br>pean Jour-<br>nal              | 26  |       | 14242-<br>14251 | 10.1002/che<br>m.20200305<br>2             | Yes                           |
| Williams, R.C.; Black-<br>more, W.J.; Curley, S.P.;<br>Lees, M.R.; Birnbaum,<br>S.M.; Singleton, J.;<br>Huddart, B.M.; Hicken,<br>T.J.; Lancaster, T.;<br>Blundell, S.J.; Xiao, F.;<br>Ozarowski, A.; Pratt,<br>F.L.; Voneshan, D.J.;<br>Giguchia, Z.; Baines, C.;<br>Schlueter, J.A.; Villa,<br>D.Y.; Manson, J.L.;<br>Goddard, P.A., | Near-ideal molecule-<br>based Haldane spin chain                                                                                         | Physical<br>Review Re-<br>search                       | 2   |       | 13082           | 10.1103/Phy<br>sRevResear<br>ch.2.013082   | Yes                           |
| Wojnar, M. K.;<br>Laorenza, D. W.; Schal-<br>Ier, R. D.; Freedman, D.<br>E.,                                                                                                                                                                                                                                                           | Nickel(II) Metal Complexes<br>as Optically Addressable<br>Qubit Candidates                                                               | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 |       | 14826-<br>14830 | 10.1021/jacs<br>.0c06909                   | Yes                           |
| Zolnhofer, E.M.; Wije-<br>ratne, G.B.; Jackson,<br>T.A.; Fortier, S.; Heine-<br>mann, F.W.; Meyer, K.;<br>Krzystek, J.; Ozarowski,<br>A.; Mindiola, D.J.; Telser,<br>J.,                                                                                                                                                               | Electronic structure and<br>magnetic properties of a<br>titanium(II) coordination<br>complex                                             | Inorganic<br>Chemistry                                 | 59  | 9     | 6187-<br>6201   | 10.1021/acs<br>.inorg-<br>chem.0c00<br>311 | Yes                           |

## Publications generated by facilities: High B/T Facility at UF (1)

| Authors                                                                                   | Title                                                              | Journal<br>Name                               | Vol | Issue | Pages | DOI                                | Cites<br>NSF<br>Core<br>Grant |
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| Huan, C.; Adams, J.;<br>Lewkowitz, M.;<br>Masuhara, N.; Can-<br>dela, D.; Sullivan, N.S., | NMR Studies of the Dynam-<br>ics of 1D 3He in 4He Plated<br>MCM-41 | Journal of<br>Low Tem-<br>perature<br>Physics | 201 |       | 146   | 10.1007/s10<br>909-020-<br>02358-w | Yes                           |

## Publications generated by facilities: ICR Facility at FSU (52)

| Authors                                                                                                                                                                                                              | Title                                                                                                                                                                                                      | Journal<br>Name     | Vol | Issue | Pages           | DOI                                          | Cites<br>NSF<br>Core<br>Grant |  |
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| Acevedo, N.; Moulian,<br>R.; Chacon Patino,<br>M.L.; Mejia, A.; Radji, S.;<br>Daridon, J.L.; Barrère-<br>Mangote, C.; Giusti, P.;<br>Rodgers, R.P.; Piscitelli,<br>V.; Castillo, J.; Carrier,<br>H.; Bouyssiere, B., | Understanding Asphaltene<br>Fraction Behavior through<br>Combined Quartz Crystal<br>Resonator Sensor, FT-ICR<br>MS, GPC ICP HR-MS, and<br>AFM Characterization. Part<br>I: Extrography Fractiona-<br>tions | Energy<br>and Fuels | 34  | 11    | 13903-<br>13915 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>687 | Yes                           |  |
| Ballard, D.A.; Chacon<br>Patino, M.L.; Qiao, P.;<br>Roberts, K.J.; Rae, R.;                                                                                                                                          | Molecular Characteriza-<br>tion of Strongly and Weakly                                                                                                                                                     | Energy<br>and Fuels | 34  | 11    | 13966-<br>13976 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>752 | Yes                           |  |

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| Authors                                                                                                                                                                                              | Title                                                                                                                                                                                                                                                                       | Journal<br>Name                                        | Vol | Issue | Pages                 | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-------|-----------------------|----------------------------------------------|-------------------------------|
| Dowding, P.J.; Xu, Z.;<br>Harbottle, D.,                                                                                                                                                             | Interfacially Active Asphal-<br>tenes by High-Resolution<br>Mass Spectrometry                                                                                                                                                                                               |                                                        |     |       |                       |                                              | Clain                         |
| Bowman, A.P.; Blakney,<br>G.T.; Hendrickson, C.L.;<br>Ellis, S.R.; Heeren,<br>R.M.A.; Smith, D.F.,                                                                                                   | Ultra-High Mass Resolving<br>Power, Mass Accuracy,<br>and Dynamic Range<br>MALDI Mass Spectrometry<br>Imaging by 21-T FT-ICR MS                                                                                                                                             | Analytical<br>Chemistry                                | 92  | 4     | 3133-<br>3142         | 10.1021/acs<br>.anal-<br>chem.9b04<br>768    | Yes                           |
| Casas-Ruiz, J.P.;<br>Spencer, R.G.M.;<br>Guillemette, F.; von<br>Schiller, D.; Obrador, B.;<br>Podgorski, D.C.;<br>Kellerman, A.M.;<br>Hartmann, J.; Gomez-<br>Gener, L.; Sabater, S.;<br>Marce, R., | Delineating the Continuum<br>of Dissolved Organic Mat-<br>ter in Temperate River Net-<br>works                                                                                                                                                                              | Global Bio-<br>geochemi-<br>cal Cycles                 | 34  | 8     | e2019<br>GB006<br>495 | 10.1029/201<br>9GB006495                     | Yes                           |
| Chacon Patino, M.L.;<br>Moulian, R.; Barrère-<br>Mangote, C.; Putman,<br>J.; Weisbrod, C.;<br>Blakney, G.T.;<br>Bouyssiere, B.; Rodgers,<br>R.P.; Giusti, P.,                                        | Compositional Trends for<br>Total Vanadium Content<br>and Vanadyl Porphyrins in<br>Gel Permeation Chroma-<br>tography Fractions Reveal<br>Correlations Between As-<br>phaltene Aggregation and<br>Ion Production Efficiency in<br>Atmospheric Pressure Pho-<br>toionization | Energy<br>and Fuels                                    | 34  | 12    | 16158-<br>16172       | 10.1021/acs<br>.ener-<br>gyfuels.0c03<br>349 | Yes                           |
| Chacon Patino, M.L.;<br>Niles, S.; Marshall, A.G.;<br>Hendrickson, C.L.;<br>Rodgers, R.P.,                                                                                                           | Role of Molecular Structure<br>in the Production of Water-<br>Soluble Species by Photo-<br>oxidation of Petroleum                                                                                                                                                           | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy | 54  | 16    | 9968-<br>9979         | 10.1021/acs<br>.est.0c01158                  | Yes                           |
| Chacon Patino, M.L.;<br>Smith, D.F.;<br>Hendrickson, C.L.;<br>Marshall, A.G.; Rodgers,<br>R.P.,                                                                                                      | Advances in Asphaltene<br>Petroleomics. Part 4. Com-<br>positional Trends of Solubil-<br>ity Subfractions Reveal that<br>Polyfunctional Oxygen-<br>Containing Compounds<br>Drive Asphaltene Chemis-<br>try                                                                  | Energy<br>and Fuels                                    | 34  | 3     | 3013-<br>3030         | 10.1021/acs<br>.ener-<br>gyfuels.9b0<br>4288 | Yes                           |
| Cheng, F.;<br>Dehghanizadeh, M.;<br>Audu, M.A.; Jarvis, J.M.;<br>Holguin, O.; Brewer,<br>C.E.,                                                                                                       | Characterization and Eval-<br>uation of Guayule Pro-<br>cessing Residues as Poten-<br>tial Feedstock for Biofuel<br>and Chemical Production                                                                                                                                 | Industrial<br>Crops and<br>Products                    | 150 |       | 11231<br>1            | 10.1016/j.in<br>dcrop.2020.<br>112311        | Yes                           |
| Cui, Z.; Cheng, F.;<br>Jarvis, J.M.; Brewer,<br>C.E.; Jena, U.,                                                                                                                                      | Roles of Co-solvents in Hy-<br>drothermal Liquefaction of<br>Low-Lipid, High-Protein<br>Algae                                                                                                                                                                               | Biore-<br>source<br>Technol-<br>ogy                    | 310 |       | 12345<br>4            | 10.1016/j.bi<br>or-<br>tech.2020.1<br>23454  | Yes                           |
| Dehghanizadeh, M.;<br>Cheng, F.; Jarvis, J.M.;<br>Holguin, F.O.; Brewer,<br>C.E.,                                                                                                                    | Characterization of Resin<br>Extracted from Guayule<br>(Parthenium Argentatum):<br>A Dataset Including GC-<br>MS and FT-ICR MS                                                                                                                                              | Data in<br>Brief                                       | 31  |       | 10598<br>9            | 10.1016/j.di<br>b.2020.1059<br>89            | Yes                           |
| Drake, T.W.; Podgorski,<br>D.C.; Dinga, B.;<br>Chanton, J.P.; Six, J.;<br>Spencer, R.G.M.,                                                                                                           | Land-use Controls on<br>Carbon Biogeochemistry in<br>Lowland Streams of the<br>Congo Basin                                                                                                                                                                                  | Global<br>Change<br>Biology                            | 26  | 3     | 1374-<br>1389         | 10.1111/gc<br>b.14889                        | Yes                           |
| Fathabad, S.G.;<br>Tabatabai, B.; Walker,<br>D.; Chen, H.; Lu, J.;<br>Aslan, K.; Uddin, J.;<br>Ghann, W.; Sitther, V.,                                                                               | Impact of Zero-Valent Iron<br>Nanoparticles on Fremyella<br>diplosiphon Transesterified<br>Lipids and Fatty Acid Me-<br>thyl Esters                                                                                                                                         | American<br>Chemical<br>Society<br>Omega               | 5   |       | 12166-<br>12173       | 10.1021/acs<br>omega.0c0<br>0566             | Yes                           |

| Authors                                                                                                                                                                                                     | Title                                                                                                                                                                        | Journal<br>Name                                                       | Vol | Issue | Pages                 | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----|-------|-----------------------|----------------------------------------------|-------------------------------|
| Fellman, J.B.; Hood, E.;<br>Behnke, M.I.; Welker,<br>J.M.; Spencer, R.G.M.,                                                                                                                                 | Stormflows Drive Stream<br>Carbon Concentration,<br>Speciation and Dissolved<br>Organic Matter Composi-<br>tion in Coastal Temperate<br>Rainforest Watersheds                | Journal of<br>Geophysi-<br>cal Re-<br>search Bio-<br>geosci-<br>ences | 125 |       | e2020<br>JG005<br>804 | 10.1029/202<br>0JG005804                     | Yes                           |
| Glattke, T.; Chacon<br>Patino, M.L.; Marshall,<br>A.G.; Rodgers, R.P.,                                                                                                                                      | Molecular Characteriza-<br>tion of Photochemically<br>Produced Asphaltenes via<br>Photooxidation of<br>Deasphalted Crude Oils                                                | Energy<br>and Fuels                                                   | 34  | 11    | 14419-<br>14428       | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>654 | Yes                           |
| He, L.; Rockwood, A.L.;<br>Agarwal, A.M.;<br>Anderson, L.C.;<br>Weisbrod, C.;<br>Hendrickson, C.L.;<br>Marshall, A.G.,                                                                                      | Top-down proteomics—A<br>Near-future Technique for<br>Clinical Diagnosis                                                                                                     | Annals of<br>Transla-<br>tional<br>Medicine                           | 8   | 4     | 136                   | 10.21037/at<br>m.2019.12.6<br>7              | Yes                           |
| Johansen, C.;<br>Marcelloni, L.; Natter,<br>M.; Silva, M.; Woosley,<br>M.; Woolsey, A.;<br>Diercks, A.R.; Hill, J.;<br>Viso, R.; Marty, E.;<br>Lobodin, V.V.; Shedd,<br>W.; Joye, S.B.;<br>MacDonald, I.R., | Hydrocarbon Migration<br>Pathway and Methane<br>Budget for a Gulf of Mex-<br>ico Natural Seep Site:<br>Green Canyon 600                                                      | Earth and<br>Planetary<br>Science<br>Letters                          | 545 | 1     | 11641<br>1            | 10.1016/j.ep<br>sl.2020.1164<br>11           | Yes                           |
| Johnston, S.E.; Striegl,<br>R.G.; Bogard, M.J.;<br>Dornblaser, M.M.;<br>Butman, D.E.; Keller-<br>man, A.M.; Wickland,<br>K.P.; Podgorski, D.C.;<br>Spencer, R.G.M.,                                         | Hydrologic Connectivity<br>Determines Dissolved Or-<br>ganic Matter Biogeochem-<br>istry in Northern High-lati-<br>tude Lakes                                                | Limnology<br>and<br>Oceanog-<br>raphy                                 | 65  | 8     | 1764-<br>1780         | 10.1002/lno.<br>11417                        | Yes                           |
| Kujawinski, E.B.; Reddy,<br>C.M.; Rodgers, R.P.;<br>Thrash, J.C.; Valentine,<br>D.L.; White, H.K.,                                                                                                          | The First Decade of Scien-<br>tific Insights from the Deep-<br>water Horizon Oil Release                                                                                     | Nature Re-<br>views Earth<br>and Envi-<br>ronment                     | 1   |       | 237-<br>250           | 10.1038/s43<br>017-020-<br>0046-x            | Yes                           |
| Kurek, M.R.; Poulin, B.A.;<br>McKenna, A.M.;<br>Spencer, R.G.M.,                                                                                                                                            | Deciphering Dissolved Or-<br>ganic Matter: Ionization,<br>Dopant, and Fragmenta-<br>tion Insights via Fourier<br>Transform-Ion Cyclotron<br>Resonance Mass Spec-<br>trometry | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy                | 54  | 24    | 16249-<br>16259       | 10.1021/acs<br>.est.0c05206                  | Yes                           |
| Leewis, M.C.;<br>Berlemont, R.;<br>Podgorski, D.C.; Srini-<br>vas, A.; Zito, P.; Spen-<br>cer, R.G.M.; McFarland,<br>J.; Douglas, T.A.; Cona-<br>way, C.H.; Waldrop, M.;<br>Mackelprang, R.,                | Life at the Frozen Limit: Mi-<br>crobial Carbon Metabo-<br>lism Across a Late Pleisto-<br>cene Permafrost Chrono-<br>sequence                                                | Frontiers in<br>Microbiol-<br>ogy                                     | 11  |       | 1753                  | 10.3389/fmi<br>cb.2020.017<br>53             | Yes                           |
| Letourneau, M.L.; Hop-<br>kinson, B.M.; Fitt, W.K.;<br>Medeiros, P.M.,                                                                                                                                      | Molecular composition<br>and biodegradation of<br>loggerhead sponge Sphe-<br>ciospongia vesparium ex-<br>halent dissolved organic<br>matter                                  | Marine En-<br>vironmen-<br>tal Re-<br>search                          | 162 |       | 10513<br>0            | 10.1016/j.m<br>aren-<br>vres.2020.10<br>5130 | Yes                           |
| Li, R.; Zhang, Z.; Chen,<br>H.; McKenna, A.M.;<br>Chen, G.; Li, L.; Tang, Y.,                                                                                                                               | Speciation and Conversion<br>of Carbon and Nitrogen in<br>Young Landfill Leachate<br>During Anaerobic Biologi-<br>cal Pretreatment                                           | Waste<br>Manage-<br>ment                                              | 106 |       | 88-98                 | 10.1016/j.w<br>as-<br>man.2020.0<br>3.011    | Yes                           |

| Authors                                                                                                                                                                                                         | Title                                                                                                                                                                                          | Journal<br>Name                                        | Vol | Issue | Pages           | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-------|-----------------|----------------------------------------------|-------------------------------|
| Liberatore, H.K.;<br>Westerman, D.C.; Allen,<br>J.M.; Plewa, M.J.;<br>Wagner, E.D.;<br>McKenna, A.M.;<br>Weisbrod, C.; McCord,<br>J.P.; Liberatore, R.J.;<br>Burnett, D.B.; Cizmas,<br>L.H.; Richardson, S.D.,  | High-Resolution Mass Spec-<br>trometry Identification of<br>Novel Surfactant-Derived<br>Sulfur-Containing Disinfec-<br>tion By-Products from Gas<br>Extraction Wastewater                      | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy | 54  | 15    | 9374-<br>9386   | 10.1021/acs<br>.est.0c01997                  | Yes                           |
| Liu, P.; Gao, X.; Lundin,<br>V.; Shi, C.; Adem, Y.;<br>Lin, K.; Jiang, G.; Kao,<br>Y.H.; Yang, F.; Michels,<br>D.; Marshall, A.G.;<br>Zhang, H.M.,                                                              | Probing the Impact of the<br>Knob-into-Hole Mutations<br>on the Structure and Func-<br>tion of a Therapeutic Anti-<br>body                                                                     | Analytical<br>Chemistry                                | 92  | 1     | 1582-<br>1588   | 10.1021/acs<br>.anal-<br>chem.9b04<br>855    | Yes                           |
| McDonough, L.K.;<br>O'Carroll, D.M.;<br>Meredith, K.; Andersen,<br>M.S.; Brügger, C.;<br>Huang, H.; Rutlidge, H.;<br>Behnke, M.I.; Spencer,<br>R.G.M.; McKenna, A.M.;<br>Marjo, C.E.; Oudone, P.;<br>Baker, A., | Changes in Groundwater<br>Dissolved Organic Matter<br>Character in a Coastal<br>Sand Aquifer Due to Rain-<br>fall Recharge                                                                     | Water Re-<br>search                                    | 169 |       | 11520<br>1      | 10.1016/j.w<br>atres.2019.1<br>15201         | Yes                           |
| McDonough, L.K.;<br>Rutlidge, H.; O'Carroll,<br>D.M.; Andersen, M.S.;<br>Meredith, K.; Behnke,<br>M.I.; Spencer, R.G.M.;<br>McKenna, A.M.; Marjo,<br>C.E.; Oudone, P.; Baker,<br>A.,                            | Characterisation of Shal-<br>low Groundwater Dissolved<br>Organic Matter in Aeolian,<br>Alluvial and Fractured<br>Rock Aquifers                                                                | Geo-<br>chimica et<br>Cosmo-<br>chimica<br>Acta        | 273 |       | 163-<br>176     | 10.1016/j.gc<br>a.2020.01.02<br>2            | Yes                           |
| Moulian, R.; Chacon<br>Patino, M.L.; Lacroix-<br>Andrivet, O.; Mounicou,<br>S.; Mendes-Siqueira,<br>A.L.; Afonso, C.; Rodg-<br>ers, R.P.; Giusti, P.;<br>Bouyssiere, B.; Barrère-<br>Mangote, C.,               | Speciation of Metals in As-<br>phaltenes by High-perfor-<br>mance Thin-layer Chroma-<br>tography and Solid-liquid<br>Extraction Hyphenated<br>with Elemental and Molec-<br>ular Identification | Energy<br>and Fuels                                    | 34  | 10    | 12449-<br>12456 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>525 | Yes                           |
| Moulian, R.; Le Maitre,<br>J.; Leroy, H.; Rodgers,<br>R.P.; Bouyssiere, B.;<br>Afonso, C.; Giusti, P.;<br>Barrère-Mangote, C.,                                                                                  | Chemical Characterization<br>Using Different Analytical<br>Techniques to Understand<br>Processes: The Case of the<br>Paraffinic Base Oil Produc-<br>tion Line                                  | Processes                                              | 8   | 11    | 1472            | 10.3390/pr8<br>111472                        | Yes                           |
| Niles, S.; Chacon<br>Patino, M.L.; Marshall,<br>A.G.; Rodgers, R.P.,                                                                                                                                            | Molecular Composition of<br>Photooxidation Products<br>Derived from Sulfur-Con-<br>taining Compounds Iso-<br>lated from Petroleum Sam-<br>ples                                                 | Energy<br>and Fuels                                    | 34  | 11    | 14493-<br>14504 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>869 | Yes                           |
| Niles, S.; Chacon<br>Patino, M.L.; Putnam,<br>S.P.; Rodgers, R.P.;<br>Marshall, A.G.,                                                                                                                           | Characterization of an As-<br>phalt Binder and Photo-<br>products by Fourier Trans-<br>form Ion Cyclotron Reso-<br>nance Mass Spectrometry<br>Reveals Abundant Water-<br>Soluble Hydrocarbons  | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy | 54  | 24    | 8830-<br>8836   | 10.1021/acs<br>.est.0c02263                  | Yes                           |

| Authors                                                                                                                                                                                                                          | Title                                                                                                                                                                                                                                                  | Journal<br>Name                                                               | Vol | Issue | Pages           | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----|-------|-----------------|----------------------------------------------|-------------------------------|
| Niles, S.; Chacon<br>Patino, M.L.; Smith, D.F.;<br>Rodgers, R.P.; Marshall,<br>A.G.,                                                                                                                                             | Comprehensive Composi-<br>tional and Structural Com-<br>parison of Coal and Petro-<br>leum Asphaltenes Based<br>on Extrography Fractiona-<br>tion Coupled with Fourier<br>Transform Ion Cyclotron<br>Resonance MS and MS/MS<br>Analysis                | Energy<br>and Fuels                                                           | 34  | 2     | 1492-<br>1505   | 10.1021/acs<br>.ener-<br>gyfuels.9b0<br>3527 | Yes                           |
| Putman, J.; Moulian, R.;<br>Barrère-Mangote, C.;<br>Rodgers, R.P.;<br>Bouyssiere, R.; Giusti, P.;<br>Marshall, A.G.,                                                                                                             | Probing Aggregation<br>Tendencies in Asphaltenes<br>by Gel Permeation Chro-<br>matography. Part 1: Online<br>Inductively Coupled<br>Plasma Mass Spectrometry<br>and Offline Fourier Trans-<br>form Ion Cyclotron Reso-<br>nance Mass Spectrometry      | Energy<br>and Fuels                                                           | 34  | 7     | 8308-<br>8315   | 10.1021/acs<br>.ener-<br>gyfuels.0c01<br>522 | Yes                           |
| Putman, J.; Moulian, R.;<br>Smith, D.F.; Weisbrod,<br>C.; Chacon Patino,<br>M.L.; Corilo, Y.E.D.;<br>Blakney, G.T.;<br>Rumancik, L.E.; Barrère-<br>Mangote, C.; Rodgers,<br>R.P.; Giusti, P.; Marshall,<br>A.G.; Bouyssiere, B., | Probing Aggregation<br>Tendencies in Asphaltenes<br>by Gel Permeation Chro-<br>matography. Part 2: Online<br>Detection by Fourier Trans-<br>form Ion Cyclotron Reso-<br>nance Mass Spectrometry<br>and Inductively Coupled<br>Plasma Mass Spectrometry | Energy<br>and Fuels                                                           | 34  | 9     | 10915-<br>10925 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>158 | Yes                           |
| Rodriguez-Cardona,<br>B.M.; Coble, A.A.;<br>Wymore, A.S.; Kolosov,<br>R.; Podgorski, D.C.; Zito,<br>P.; Spencer, R.G.M.;<br>Prokushkin, A.S.;<br>McDowell, W.H.,                                                                 | Wildfires Lead to De-<br>creased Carbon and In-<br>creased Nitrogen Concen-<br>trations in Upland Arctic<br>Streams                                                                                                                                    | Scientific<br>Reports                                                         | 10  |       | 8722            | 10.1038/s41<br>598-020-<br>65520-0           | Yes                           |
| Schaffer, L.V.; Ander-<br>son, L.C.; Butcher, D.S.;<br>Shortreed, M.R.; Miller,<br>R.M.; Pavelec, C.;<br>Smith, L.M.,                                                                                                            | Construction of Human<br>Proteoform Families from<br>21 Tesla Fourier Transform<br>Ion Cyclotron Resonance<br>Mass Spectrometry Top-<br>Down Proteomic Data                                                                                            | Journal of<br>Proteome<br>Research                                            | 20  | 1     | 317-<br>325     | 10.1021/acs<br>.jprote-<br>ome.0c0040<br>3   | Yes                           |
| Sert, M.F.; D'Andrilli, J.;<br>Gründger, F.; Niemann,<br>H.; Granskog, M.A.;<br>Pavlov, A.K.; Ferré, B.;<br>Silyakova, A.,                                                                                                       | Compositional Differences<br>in Dissolved Organic Mat-<br>ter Between Arctic Cold<br>Seeps Versus Non-Seep<br>Sites at the Svalbard Conti-<br>nental Margin and the Bar-<br>ents Sea                                                                   | Frontiers in<br>Earth Sci-<br>ence                                            | 8   |       | 599             | 10.3389/fea<br>rt.2020.5527<br>31            | Yes                           |
| Smith, D.F.; Blakney,<br>G.T.; Beu, S.C.;<br>Anderson, L.C.;<br>Weisbrod, C.D.;<br>Hendrickson, C.L.,                                                                                                                            | Ultrahigh Resolution Ion Iso-<br>lation by Stored Waveform<br>Inverse Fourier Transform 21<br>T Fourier Transform Ion Cy-<br>clotron Resonance Mass<br>Spectrometry                                                                                    | Analytical<br>Chemistry                                                       | 92  | 4     | 3213-<br>3219   | 10.1021/acs<br>.anal-<br>chem.9b04<br>954    | Yes                           |
| Srzentić, K., et all                                                                                                                                                                                                             | Inter-laboratory Study for<br>Characterizing Monoclonal<br>Antibodies by Top-Down<br>and Middle-Down Mass<br>Spectrometry                                                                                                                              | Journal of<br>the Ameri-<br>can Soci-<br>ety for<br>Mass<br>Spectrom-<br>etry | 31  | 9     | 1783-<br>1802   | 10.1021/jas<br>ms.0c00036                    | Yes                           |

| Authors                                                                                                                                                                                                                                 | Title                                                                                                                                                                                                                                     | Journal<br>Name                                        | Vol | Issue | Pages           | DOI                                            | Cites<br>NSF<br>Core<br>Grant |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-------|-----------------|------------------------------------------------|-------------------------------|
| Takemori, A.; Butcher,<br>D.S.; Harman, V.M.;<br>Brownbridge, P.; Shima,<br>K.; Higo, D.; Ishizaki, J.;<br>Hasegawa, H.; Suzuki,<br>J.; Yamashita, M.; Loo,<br>J.A.; Ogorzalek, R.R.;<br>Beynon, R.J.; Anderson,<br>L.C.; Takemori, N., | PEPPI-MS: Polyacrylamide<br>Gel-based Prefractionation<br>for Analysis of Intact Pro-<br>teoforms and Protein Com-<br>plexes by Mass Spectrome-<br>try                                                                                    | Journal of<br>Proteome<br>Research                     | 19  | 9     | 3779-<br>3791   | 10.1021/acs<br>.jprote-<br>ome.0c0030<br>3     | Yes                           |
| Valencia, A.; Ordonez,<br>D.; Wen, D.; McKenna,<br>A.M.; Chang, N.B.;<br>Wanielista, M.P.,                                                                                                                                              | The Interaction of Dissolved<br>Organic Nitrogen Removal<br>and Microbial Abundance<br>in Iron-filings Based Green<br>Environmental Media for<br>Stormwater Treatment                                                                     | Environ-<br>mental Re-<br>search                       | 188 |       | 10981<br>5      | 10.1016/j.en<br>vres.2020.10<br>9815           | Yes                           |
| Wang, H.; Lu, L.; Chen,<br>H.; McKenna, A.M.; Lu,<br>J.; Jin, S.; Zuo, Y.;<br>Rosario-Ortiz, F.L.; Ren,<br>Z.,                                                                                                                          | Molecular Transformation<br>of Crude Oil Contami-<br>nated Soil after Bioelectro-<br>chemical Degradation Re-<br>vealed by FT-ICR Mass<br>Spectrometry                                                                                    | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy | 54  | 4     | 2500-<br>2509   | 10.1021/acs<br>.est.9b06164                    | Yes                           |
| Ware, R.; Rodgers, R.P.;<br>Marshall, A.G.; Mante,<br>O.D.; Dayton, D.C.;<br>Verdier, S.; Gabrielsen,<br>J.; Rowland, S.M.,                                                                                                             | Detailed Chemical Com-<br>position of an Oak Bi-<br>ocrude and its Hy-<br>drotreated Product Deter-<br>mined by Positive Atmos-<br>pheric Pressure Photoioni-<br>zation Fourier Transform Ion<br>Cyclotron Resonance Mass<br>Spectrometry | Sustaina-<br>ble Energy<br>and Fuels                   | 4   |       | 2404-<br>2410   | 10.1039/C9S<br>E00837C                         | Yes                           |
| Ware, R.; Rodgers, R.P.;<br>Marshall, A.G.; Mante,<br>O.D.; Dayton, D.C.;<br>Verdier, S.; Gabrielsen,<br>J.; Rowland, S.M.,                                                                                                             | Tracking Elemental Com-<br>position through Hy-<br>drotreatment of an Up-<br>graded Pyrolysis Oil<br>Blended with a Light Gas<br>Oil                                                                                                      | Energy<br>and Fuels                                    | 34  | 12    | 16181-<br>16186 | 10.1021/acs<br>.ener-<br>gyfuels.0c02<br>437   | Yes                           |
| Weisbrod, C.;<br>Anderson, L.C.; Greer,<br>J.B.; DeHart, C.J.;<br>Hendrickson, C.L.,                                                                                                                                                    | Increased Single-Spectrum<br>Top-Down Protein Se-<br>quence Coverage in Trap-<br>ping Mass Spectrometers<br>with Chimeric Ion Loading                                                                                                     | Analytical<br>Chemistry                                | 92  | 18    | 12193-<br>12200 | 10.1021/acs<br>.anal-<br>chem.0c01<br>064      | Yes                           |
| Wen, D.; Ordonez, D.;<br>McKenna, A.M.;<br>Chang, N.B.,                                                                                                                                                                                 | Fate and Transport Pro-<br>cesses of Nitrogen in Bio-<br>sorption Activated Media<br>for Stormwater Treatment<br>at Varying Field Conditions<br>of a Roadside Linear Ditch                                                                | Environ-<br>mental Re-<br>search                       | 181 |       | 10891<br>5      | 10.1016/j.en<br>vres.2019.10<br>8915           | Yes                           |
| Wen, D.; Ordonez, D.;<br>Valencia, A.; McKenna,<br>A.M.; Chang, N.B.,                                                                                                                                                                   | Copper Impact on Enzy-<br>matic Cascade and Extra-<br>cellular Sequestration via<br>Distinctive Pathways of Ni-<br>trogen Removal in Green<br>Sorption Media at Varying<br>Stormwater Field condi-<br>tions                               | Chemo-<br>sphere                                       | 243 |       | 12539<br>9      | 10.1016/j.ch<br>emo-<br>sphere.2019<br>.125399 | Yes                           |
| Williams, H.N.; Chen, H.,                                                                                                                                                                                                               | Environmental Regulation<br>of the Distribution and<br>Ecology of Bdellovibrio and<br>Like Organisms                                                                                                                                      | Frontiers in<br>Microbiol-<br>ogy                      | 11  |       | 2670            | 10.3389/fmi<br>cb.2020.545<br>070              | Yes                           |
| Zhang, Y.; Siskin, M.;<br>Gray, M.R.; Walters,<br>C.C.; Rodgers, R.P.,                                                                                                                                                                  | Mechanisms of Asphaltene<br>Aggregation: Puzzles and a<br>New Hypothesis                                                                                                                                                                  | Energy<br>and Fuels                                    | 43  | 8     | 9094–<br>9107   | 10.1021/acs<br>.ener-<br>gyfuels.0c01<br>564   | Yes                           |

#### 2020 MagLab Annual Report - 5. Publications

| Authors                                                                                                                                                                                                                                                                     | Title                                                                                                                                                                                          | Journal<br>Name                                           | Vol | Issue | Pages         | DOI                                          | Cites<br>NSF<br>Core<br>Grant |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----|-------|---------------|----------------------------------------------|-------------------------------|
| Zhang, Z.; Xiong, Y.;<br>Chen, H.; Tang, Y.,                                                                                                                                                                                                                                | Understanding the Com-<br>position and Spatial Distri-<br>bution of Biological Sele-<br>nate Reduction Products<br>for Potential Selenium Re-<br>covery                                        | Environ-<br>mental Sci-<br>ence and<br>Technol-<br>ogy    | 6   | 8     | 2153-<br>2163 | 10.1039/D0E<br>W00376J                       | Yes                           |
| Zherebker, A.; Kim, S.;<br>Schmitt-Kopplin, P.;<br>Spencer, R.G.M.;<br>Lechtenfeld, O.;<br>Podgorski, D.C.;<br>Hertkorn, N.; Harir, M.;<br>Nurfajin, N.; Koch, B.;<br>Nikolaev, E.N.; Shirshin,<br>E.A.; Berezin, S.A.; Kats,<br>D.S.; Rukhovich, G.D.;<br>Perminova, I.V., | Interlaboratory Compari-<br>son of Humic Substances<br>Compositional Space as<br>Measured by Fourier Trans-<br>form Ion Cyclotron Reso-<br>nance Mass Spectrometry<br>(IUPAC Technical Report) | Pure and<br>Applied<br>Chemistry                          | 92  | 9     | 1447-<br>1467 | 10.1515/pa<br>c-2019-0809                    | Yes                           |
| Zito, P.; Podgorski, D.C.;<br>Bartges, T.E.;<br>Guillemette, F.; Roe-<br>buck, Jr., A.; Spencer,<br>R.G.M.; Rodgers, R.P.;<br>Tarr, M.A.,                                                                                                                                   | Sunlight Induced Molecular<br>Progression of Oil Into Oxi-<br>dized Oil Soluble Species,<br>Interfacial Material, and<br>Dissolved Organic Matter                                              | Energy<br>and Fuels                                       | 34  | 4     | 4721-<br>4726 | 10.1021/acs<br>.ener-<br>gyfuels.9b0<br>4408 | Yes                           |
| Zito, P.; Smith, D.F.; Cao,<br>X.; Ghannam, R.; Tarr,<br>M.A.,                                                                                                                                                                                                              | Barium Ion Adduct Mass<br>Spectrometry to Identify<br>Carboxylic Acid Photo-<br>products from Crude Oil-<br>water Systems Under Solar<br>Irradiation                                           | Environ-<br>mental Sci-<br>ence Pro-<br>cess Im-<br>pacts | 22  | 12    | 2313-<br>2321 | 10.1039/D0E<br>M00390E                       | Yes                           |

## Publications generated by facilities: NMR Facility at FSU (80)

NMR

| Authors                                                                                                                                | Title                                                                                                                                                                    | Journal<br>Name                            | Vol  | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------|-------|-----------------|--------------------------------------------|-------------------------------|
| Affram, K.; Smith, T.;<br>Helsper, S.; Rosenberg,<br>J.T.; Han, B.; Trevino, J.;<br>Agyare, E.,                                        | Comparative study on<br>contrast enhancement of<br>Magnevist and Magnevist-<br>loaded nanoparticles in<br>pancreatic cancer PDX<br>model monitored by MRI                | Cancer<br>Nanotech-<br>nology              | 2020 | 11    | 61              | 10.1186/s12<br>645-020-<br>00061-9         | Yes                           |
| Altenhof, A.;<br>Jaroszewicz, M.J.;<br>Lindquist, A.W.; Foster,<br>L.D.D.; Veinberg, S.L.;<br>Schurko, R.W.,                           | Practical Aspects of Re-<br>cording Ultra-Wideline NMR<br>Patterns Under Magic-An-<br>gle Spinning Conditions                                                            | Journal of<br>Physical<br>Chemistry<br>C   | 124  |       | 14730-<br>14744 | 10.1021/acs<br>.jpcc.0c045<br>10           | Yes                           |
| Amouzandeh, G.;<br>Mentink-Vigier, F.;<br>Helsper, S.;<br>Bagdasarian, F.A.;<br>Rosenberg, J.T.; Grant,<br>S.C.,                       | Magnetic resonance elec-<br>trical property mapping at<br>21.1 T: a study of conduc-<br>tivity and permittivity in<br>phantoms, ex vivo tissue<br>and in vivo ischemia   | Physics in<br>Medicine<br>and Biol-<br>ogy | 65   | 5     | 55007           | 10.1088/136<br>1-<br>6560/ab325<br>9       | Yes                           |
| Ashbrook, S.E.; Dawson,<br>D.M.; Gan, Z.; Hooper,<br>J.E.; Hung, I.;<br>Macfarlane, L.E.;<br>McKay, D.; McLeod,<br>L.K.; Walton, R.I., | Application of NMR Crys-<br>tallography to Highly Disor-<br>dered Templated Materi-<br>als: Extensive Local Struc-<br>tural Disorder in the Gallo-<br>phosphate GaPO-34A | Inorganic<br>Chemistry                     | 59   | 16    | 11616-<br>11626 | 10.1021/acs<br>.inorg-<br>chem.0c01<br>450 | Yes                           |

| Authors                                                                                                                                                                                                 | Title                                                                                                                                                                           | Journal<br>Name                                                 | Vol | Issue | Pages           | DOI                                                   | Cites<br>NSF<br>Core<br>Grant |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----|-------|-----------------|-------------------------------------------------------|-------------------------------|
| Cai, S.; Hao, S.; Luo, Z.;<br>Li, X.; Hadar, I.; Bailey,<br>T.P.; Hu, X.; Uher, C.; Hu,<br>Y.; Wolverton, C.;<br>Dravid, V.P.; Kanatzidis,<br>M.G.,                                                     | Discordant nature of Cd in<br>PbSe: off-centering and<br>core-shell nanoscale CdSe<br>precipitates lead to high<br>thermoelectric perfor-<br>mance                              | Energy<br>and Envi-<br>ronmental<br>Science                     | 13  | 1     | 200<br>211      | 10.1039/C9E<br>E03087E                                | Yes                           |
| Chakraborty, A.;<br>Deligey, F.; Quach, J.;<br>Mentink-Vigier, F.;<br>Wang, P.; Wang, T.,                                                                                                               | Biomolecular complex<br>viewed by dynamic nu-<br>clear polarization solid-<br>state NMR spectroscopy                                                                            | Biochemi-<br>cal Society<br>Transac-<br>tions                   | 48  | 3     | 1089-<br>1099   | 10.1042/BST<br>20191084                               | Yes                           |
| Chaudhary, B.P.;<br>Zoetewey, D.; Mohanty,<br>S.,                                                                                                                                                       | 1H, 13C, 15N resonance as-<br>signments and secondary<br>structure of yeast oligosac-<br>charyltransferase subunit<br>Ost4 and its functionally im-<br>portant mutant Ost4V23D  | Biomolec-<br>ular NMR<br>Assign-<br>ments                       | 14  |       | 205-<br>209     | 10.1007/s12<br>104-020-<br>09946-7                    | Yes                           |
| Chen, C.; Gaillard, E.;<br>Mentink-Vigier, F.;<br>Chen, K.; Gan, Z.;<br>Gaveau, P.; Rebiere, B.;<br>Berthelot, R.; Florian, P.;<br>Bonhomme, C.; Smith,<br>M.; Metro, T.; Alonso, B.;<br>Laurencin, D., | Direct 17 O Isotopic Label-<br>ing of Oxides Using Mecha-<br>nochemistry                                                                                                        | Journal of<br>Biological<br>Inorganic<br>Chemistry              | 59  | 18    | 13050-<br>13066 | 10.1021/acs<br>.inorg-<br>chem.0c00<br>208            | Yes                           |
| Chen, K.,                                                                                                                                                                                               | A Practical Review of NMR<br>Lineshapes for Spin-1/2 and<br>Quadrupolar Nuclei in Dis-<br>ordered Materials                                                                     | Interna-<br>tional Jour-<br>nal of Mo-<br>lecular Sci-<br>ences | 21  |       | 5666            | 10.3390/ijms<br>21165666                              | Yes                           |
| Chen, K.; Horstmeier, S.;<br>Nguyen, V.; Bin, W.;<br>Crossley, S.; Pham, T.;<br>Gan, Z.; Hung, I.; White,<br>J.,                                                                                        | Structure and Catalytic<br>Characterization of a Sec-<br>ond Framework Al(IV) Site<br>in Zeolite Catalysts Re-<br>vealed by NMR at 35.2 T                                       | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society          | 142 | 16    | 7514-<br>7523   | 10.1021/jacs<br>.0c00590                              | Yes                           |
| Chien, P.; Griffith, K.J.;<br>Liu, H.; Gan, Z.; Hu, Y.,                                                                                                                                                 | Recent Advances in Solid-<br>State Nuclear Magnetic<br>Resonance Techniques for<br>MaterialsResearch                                                                            | Annual Re-<br>view of<br>Materials<br>Research                  | 50  | 1     | 493<br>520      | 10.1146/an-<br>nurev-<br>matsci-<br>091019-<br>011049 | Yes                           |
| Chien, P.; Harada, J.K.;<br>Liu, H.; Patel, S.; Huang,<br>C.; Rondinelli, J.M.;<br>Poeppelmeier, K.R.; Hu,<br>Y.,                                                                                       | Microscopic Insights into<br>the Reconstructive Phase<br>Transition of KNaNbOF5<br>with 19F NMR Spectros-<br>copy                                                               | Chemistry<br>of Materi-<br>als                                  | 32  | 13    | 5715-<br>5722   | 10.1021/acs<br>.chem-<br>mater.0c01<br>439            | Yes                           |
| Conti III, C.R.; Quiroz-<br>Delfi, G.I.; Schwarck,<br>J.S.; Chen, B.; Strouse,<br>G.F.,                                                                                                                 | Carrier Density, Effective<br>Mass, and Nuclear Relaxa-<br>tion Pathways in Plasmonic<br>Sn:In2O3 Nanocrystals                                                                  | Journal of<br>Physical<br>Chemistry<br>C                        | 124 |       | 28220-<br>28229 | 10.1021/acs<br>.jpcc.0c094<br>48                      | Yes                           |
| Dahal, S.R.; Lewellen,<br>J.L.; Chaudhary, B.P.;<br>Mohanty, S.,                                                                                                                                        | 1H, 13C, and 15N reso-<br>nance assignment and<br>secondary structure of the<br>pheromone-binding pro-<br>tein2 from the agricultural<br>pest Ostrinia furnacalis<br>(OfurPBP2) | Biomolec-<br>ular NMR<br>Assign-<br>ments                       | 14  |       | 115-<br>118     | 10.1007/s12<br>104-020-<br>09930-1                    | Yes                           |
| Dasari, A.K.R.; Hung, I.;<br>Michael, B.; Gan, Z.;<br>Kelly, J.W.; Connors,<br>L.H.; Griffin, R.G.; Lim, K.,                                                                                            | Structural Characterization<br>of Cardiac Ex Vivo Trans-<br>thyretin Amyloid: Insight<br>into the Transthyretin Mis-<br>folding Pathway In Vivo                                 | Journal of<br>Nutritional<br>Biochemis-<br>try                  | 59  | 19    | 1800<br>1803    | 10.1021/acs<br>.bio-<br>chem.0c00<br>091              | Yes                           |

| Authors                                                                                                                              | Title                                                                                                                                                                                   | Journal<br>Name                                        | Vol | Issue | Pages           | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----|-------|-----------------|--------------------------------------------|-------------------------------|
| Ding, X.Y.; Fu, R.; Tian,<br>F.,                                                                                                     | De novo resonance assign-<br>ment of the transmem-<br>brane domain of<br>LR11/SorLA in E. coli mem-<br>branes                                                                           | Journal of<br>Magnetic<br>Reso-<br>nance               | 310 |       | 10663<br>9      | 10.1016/j.jmr<br>.2019.10663<br>9          | Yes                           |
| Dorn, R.W.; Cendejas,<br>M.C.; Chen, K.; Hung, I.;<br>Altvater, N.R.;<br>McDermott, W.P.; Gan,<br>Z.; Hermans, I.; Rossini,<br>A.J., | Structure Determination of<br>Boron-Based Oxidative De-<br>hydrogenation Heteroge-<br>neous Catalysts With Ultra-<br>high Field 35.2 T <sup>11</sup> B Solid-<br>State NMR Spectroscopy | American<br>Chemical<br>Society<br>Catalysis           | 10  |       | 13852-<br>13866 | 10.1021/acs<br>catal.0c037<br>62           | Yes                           |
| Drover, M.W.; Dufour,<br>M.C.; Lesperance-<br>Nantau, L.A.; Noriega,<br>R.P.; Levin, K.; Schurko,<br>R.W.,                           | Octaboraneyl Complexes<br>of Nickel: Monomers for Re-<br>dox-Active Coordination<br>Polymers                                                                                            | Chemistry<br>a Euro-<br>pean Jour-<br>nal              | 26  | 49    | 11180-<br>11186 | 10.1002/che<br>m.20200121<br>8             | Yes                           |
| Feng, X.; Chien, P.;<br>Patel, S.; Wang, Y.; Hu,<br>Y.,                                                                              | Enhanced Ion Conduction<br>in Li2.5Zn0.25PS4 via Anion<br>Doping                                                                                                                        | Chemistry<br>of Materi-<br>als                         | 32  | 7     | 3036<br>3042    | 10.1021/acs<br>.chem-<br>mater.0c00<br>025 | Yes                           |
| Feng, X.; Chien, P.;<br>Wang, Y.; Patel, S.;<br>Wang, P.; Liu, H.;<br>Immediato-Scuotto, M.;<br>Hu, Y.,                              | Enhanced ion conduction<br>by enforcing structural dis-<br>order in Li-deficient argy-<br>rodites Li6-xPS5-xCl1-x                                                                       | Energy<br>Storage<br>Materials                         | 30  |       | 6773            | 10.1016/j.en<br>sm.2020.04.<br>042         | Yes                           |
| Fernando, L.D.; Zhao,<br>W.; Dickwella<br>Widanage, M.C.;<br>Mentink-Vigier, F.;<br>Wang, T.,                                        | Solid-state NMR and DNP<br>investigations of carbohy-<br>drates and cell-wall bio-<br>materials                                                                                         | eMagRes                                                | 9   | 3     | -               | 10.1002/978<br>0470034590.<br>emrstm1624   | Yes                           |
| Fu, R.; Miao, Y.; Qin, H.;<br>Cross, T.A.,                                                                                           | Observation of the Imidaz-<br>ole-Imidazolium Hydrogen<br>Bonds Responsible for Se-<br>lective Proton Conduct-<br>ance in the Influenza A M2<br>Channel                                 | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 |       | 2115-<br>2119   | 10.1021/jacs<br>.9b09985                   | Yes                           |
| Ghaffari, H.; Grant, S.C.;<br>Petzold, L.R.; Harring-<br>ton, M.G.,                                                                  | Regulation of CSF and<br>Brain Tissue Sodium Levels<br>by the Blood-CSF and<br>Blood-Brain Barriers During<br>Migraine                                                                  | Frontiers in<br>Computa-<br>tional Neu-<br>roscience   | 14  |       | 4               | 10.3389/fnc<br>om.2020.00<br>004           | No                            |
| Ghosh, R.; Madrid, C.L.;<br>Frederick, K.K.,                                                                                         | Segmental Labeling: Appli-<br>cations to Protein NMR and<br>DNP                                                                                                                         | eMagRes                                                | 9   |       | 71-80           | 10.1002/978<br>0470034590.<br>emrstm1613   | Yes                           |
| Guo, C.; Wu, J.;<br>Rosenberg, J.T.;<br>Roussel, T.; Cai, S.; Cai,<br>C.,                                                            | Fast chemical exchange<br>saturation transfer imaging<br>based on PROPELLER ac-<br>quisition and deep neural<br>network reconstruction                                                  | Magnetic<br>Reso-<br>nance in<br>Medicine              | 84  | 6     | 3192            | 10.1002/mr<br>m.28376                      | Yes                           |
| Hicks, A.; Escobar<br>Bravo, C.A.; Cross, T.A.;<br>Zhou, H.,                                                                         | Sequence-Dependent<br>Correlated Segments in the<br>Intrinsically Disordered Re-<br>gion of ChiZ                                                                                        | Biomole-<br>cules                                      | 10  | 6     | 946             | 10.3390/bio<br>m10060946                   | Yes                           |
| Holmes, S.; Engl, O.G.;<br>Srnec, M.N.; Madura,<br>J.D.; Quinones, R.;<br>Harper, J.K.; Schurko,<br>R.W.; Iuliucci, R.J.,            | Chemical Shift Tensors of<br>Cimetidine Form A Mod-<br>eled with Density Func-<br>tional Theory Calculations:<br>Implications for NMR Crys-<br>tallography                              | Journal of<br>Physical<br>Chemistry<br>A               | 124 |       | 3109-<br>3119   | 10.1021/acs<br>.jpca.0c004<br>21           | Yes                           |
| Holmes, S.; Vojvodin,<br>C.; Schurko, R.W.,                                                                                          | Dispersion-Corrected DFT<br>Methods for Applications in<br>NMR Crystallography                                                                                                          | Journal of<br>Physical                                 | 124 |       | 10312-<br>10323 | 10.1021/acs<br>.jpca.0c063<br>72           | Yes                           |

| Authors                                                                                                                                                                                                                                                   | Title                                                                                                                                                                                         | Journal<br>Name                                                                            | Vol | Issue | Pages            | DOI                                 | Cites<br>NSF<br>Core<br>Grant |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-----|-------|------------------|-------------------------------------|-------------------------------|
|                                                                                                                                                                                                                                                           |                                                                                                                                                                                               | Chemistry<br>A                                                                             |     |       |                  |                                     | Grant                         |
| Huang, W.; Chien, P.;<br>McMillen, K.; Patel, S.;<br>Tedesco, J.; Zeng, L.;<br>Mukherjee, S.; Wang,<br>B.; Chen, Y.; Wang, G.;<br>Wang, Y.; Gao, Y.;<br>Bedzyk, M.J.;<br>DeLongchamp, D.M.;<br>Hu, Y.; Medvedeva,<br>J.E.; Marks, T.J.;<br>Facchetti, A., | Experimental and theoreti-<br>cal evidence for hydrogen<br>doping in polymer solution-<br>processed indium gallium<br>oxide                                                                   | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA<br>(PNAS) | 117 | 31    | 18231-<br>-18239 | 10.1073/pn<br>as.20078971<br>17     | Yes                           |
| Hung, I.; Altenhof, A.R.;<br>Schurko, R.W.; Bryce,<br>D.L.; Hee Han, O.C.;<br>Gan, Z.,                                                                                                                                                                    | Field-stepped ultra-wide-<br>line NMR at up to 36 T: On<br>the inequivalence be-<br>tween field and frequency<br>stepping                                                                     | Magnetic<br>Reso-<br>nance in<br>Chemistry                                                 | 0   |       | 0                | 10.1002/mrc<br>.5128                | Yes                           |
| Hung, I.; Gan, Z.,                                                                                                                                                                                                                                        | High Resolution NMR of S =<br>3/2 Quadrupole Nuclei by<br>Detection of Double-<br>Quantum Satellite-Transi-<br>tions via Protons                                                              | Journal of<br>Physical<br>Chemistry<br>Letters                                             | 11  | 12    | 4734<br>4740     | 10.1021/acs<br>.jpclett.0c01<br>236 | Yes                           |
| Hung, I.; Gan, Z.,                                                                                                                                                                                                                                        | Low-power STMAS - break-<br>ing through the limit of<br>large quadrupolar interac-<br>tions in high-resolution<br>solid-state NMR spectros-<br>copy                                           | Physical<br>Chemistry<br>Chemical<br>Physics                                               | 22  | 37    | 21119-<br>21123  | 10.1039/d0c<br>p04274a              | Yes                           |
| Hung, I.; Gor'kov, P.L.;<br>Gan, Z.,                                                                                                                                                                                                                      | Using the heteronuclear<br>Bloch-Siegert shift of pro-<br>tons for B-1 calibration of<br>insensitive nuclei not pre-<br>sent in the sample                                                    | Journal of<br>Magnetic<br>Reso-<br>nance                                                   | 310 |       | 10663<br>6       | 10.1016/j.jmr<br>.2019.10663<br>6   | Yes                           |
| Janani, H.; Alamo, R.G.,                                                                                                                                                                                                                                  | Effect of melt miscibility,<br>polymorphism, and crystal<br>morphology on tensile de-<br>formation of blends of iso-<br>tactic polypropylene and<br>propylene-1-hexene ran-<br>dom copolymers | Polymer<br>Crystalliza-<br>tion                                                            | 3   |       | e1011<br>1       | 10.1002/pcr<br>2.10111              | Yes                           |
| Karimineghlani, P.;<br>Zheng, J.; Hu, Y.;<br>Sukhishvili, S.,                                                                                                                                                                                             | Solvation and diffusion of<br>poly(vinyl alcohol) chains<br>in a hydrated inorganic<br>ionic liquid                                                                                           | Physical<br>Chemistry<br>Chemical<br>Physics                                               | 22  |       | 17705-<br>-17712 | 10.1039/D0<br>CP02679D              | No                            |
| Kleimaier, D.; Schepkin,<br>V.D.; Hu, R.; Schad, L.,                                                                                                                                                                                                      | Protein conformational<br>changes affect the sodium<br>triple-quantumMR signal                                                                                                                | NMR in Bio-<br>medicine                                                                    | 33  | 10    | 12-<br>Jan       | 10.1002/nb<br>m.4367                | Yes                           |
| Kleimaier, D.; Schepkin,<br>V.D.; Nies, C.;<br>Gottwald, E.; Schad, L.,                                                                                                                                                                                   | Intracellular Sodium<br>Changes in Cancer Cells<br>using aMicrocavity Array-<br>Based Bioreactor System<br>andSodium Triple-Quan-<br>tum MR Signal                                            | Processes                                                                                  | 8   | 1267  | 19-<br>Jan       | 10.3390/pr8<br>101267               | Yes                           |
| Leffin, A.; Rosenberg,<br>J.T.; Yuan, X.; Ma, T.;<br>Grant, S.C.; Frydman,<br>L.,                                                                                                                                                                         | Multiparametric classifica-<br>tion of sub-acute ischemic<br>stroke recovery with ultra-<br>fast diffusion, 23Na, and<br>MPIO-labeled stem cell<br>MRI at 21.1 T                              | NMR in Bio-<br>medicine                                                                    | 33  | 2     | e4186            | 10.1002/nb<br>m.4186                | Yes                           |

| Authors                                                                                                                                                                                                | Title                                                                                                                                                                                       | Journal<br>Name                                                                          | Vol | Issue | Pages              | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----|-------|--------------------|--------------------------------------------|-------------------------------|
| Liu, X.; Zhong, G.; Xiao,<br>Z.; Zheng, B.; Zuo, W.;<br>Zhou, K.; Liu, H.; Liang,<br>Z.; Xiang, Y.; Chen, Z.;<br>Ortiz, G.F.; Fu, R.; Yang,<br>Y.,                                                     | Al and Fe-containing Mn-<br>based layered cathode<br>with controlled vacancies<br>for high-rate sodium ion<br>batteries                                                                     | Nano En-<br>ergy                                                                         | 76  |       | 10499<br>7         | 10.1016/j.na<br>noen.2020.1<br>04997       | Yes                           |
| Madsen, R.; Qiao, A.;<br>Sen, J.; Hung, I.; Chen,<br>K.; Gan, Z.; Sen, S.; Yue,<br>Y.,                                                                                                                 | Ultrahigh-field <sup>67</sup> Zn NMR re-<br>veals short-range disorder<br>in zeolitic imidazolate<br>framework glasses                                                                      | Science                                                                                  | 367 |       | 1473-<br>1476      | 10.1126/sci-<br>ence.aaz02<br>51           | Yes                           |
| Martins, V.; Xu, J.; Hung,<br>I.; Gan, Z.; Gervais, C.;<br>Bonhomme, C.; Huang,<br>Y.,                                                                                                                 | <sup>17</sup> O solid-state NMR at ul-<br>trahigh magnetic field of<br>35.2 T: Resolution of in-<br>equivalent oxygen sites in<br>different phases of MOF<br>MIL-53(AI)                     | Magnetic<br>Reso-<br>nance in<br>Chemistry                                               | 0   |       | 0                  | 10.1002/mrc<br>.5122                       | Yes                           |
| Martins, V.; Xu, J.;<br>Wang, X.; Chen, K.;<br>Hung, I.; Gan, Z.;<br>Gervais, C.; Bon-<br>homme, C.; Jiang, S.;<br>Zheng, A.; Lucier, B.;<br>Huang, Y.,                                                | Higher Magnetic Fields,<br>Finer MOF Structural Infor-<br>mation                                                                                                                            | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society                                   | 142 | 35    | 14877<br>1488<br>9 | 10.1021/jacs<br>.0c02810                   | Yes                           |
| Marxsen, S.F.; Häuβler,<br>M.; Mecking, S.; Alamo,<br>R.G.,                                                                                                                                            | lsothermal Step Thickening<br>in a Long-Spaced Aliphatic<br>Polyester                                                                                                                       | Polymer                                                                                  | 191 |       | 12228<br>2         | 10.1016/j.po<br>lymer.2020.1<br>22282      | Yes                           |
| Mayen, L.; Jensen, N.;<br>Laurencin, D.; Marsan,<br>O.; Bonhomme, C.;<br>Gervais, C.; Smith, M.;<br>Coelho, C.; Laurent, G.;<br>Trebosc, J.; Gan, Z.;<br>Chen, K.; Rey, C.;<br>Combes, C.; Soulié, J., | A soft-chemistry approach<br>to the synthesis of amor-<br>phous calcium ortho/pyro-<br>phosphate biomaterials of<br>tunable composition                                                     | Acta Ma-<br>terialia                                                                     | 103 |       | 333-<br>345        | 10.1016/j.ac<br>tbio.2019.12<br>.027       | Yes                           |
| Mentink-Vigier, F.,                                                                                                                                                                                    | Optimizing nitroxide biradi-<br>cals for cross-effect MAS-<br>DNP: the role of g -tensors''''<br>distance                                                                                   | Physical<br>Chemistry<br>Chemical<br>Physics                                             | 22  |       | 3643-<br>3652      | 10.1039/C9<br>CP06201G                     | Yes                           |
| Ngatia, L.; De Oliveira,<br>L.; Betiku, O.; Fu, R.;<br>Moriasi, D.; Steiner, J.;<br>Verse, A.; Taylor, R.,                                                                                             | Relationship of arsenic and<br>chromium availability with<br>carbon functionalgroups,<br>aluminum and iron in Little<br>Washita River Experimental<br>WatershedReservoirs,<br>Oklahoma, USA | Ecotoxicol-<br>ogy and<br>Environ-<br>mental<br>Safety                                   | 207 |       | 11146<br>8         | 10.1016/j.ec<br>oenv.2020.1<br>11468       | Yes                           |
| O'Keefe, C.A.; Motillo,<br>C.; Fabian, L.; Friscic, T.;<br>Schurko, R.W.,                                                                                                                              | NMR-Enhanced Crystallog-<br>raphy Aids Open Metal-Or-<br>ganic Framework Discov-<br>ery Using Solvent-Free Ac-<br>celerated Aging                                                           | Chemistry<br>of Materi-<br>als                                                           | 32  |       | 4273-<br>4281      | 10.1021/acs<br>.chem-<br>mater.0c00<br>894 | Yes                           |
| Paulino, J.; Yi, M.; Hung,<br>I.; Gan, Z.; Wang, X.;<br>Chekmenev, E.Y.; Zhou,<br>H.; Cross, T.A.,                                                                                                     | Functional stability of water<br>wire-carbonyl interactions<br>in an ion channel                                                                                                            | Proceed-<br>ings of the<br>National<br>Academy<br>of<br>Sciences<br>of the USA<br>(PNAS) | 117 | 22    | 11908-<br>11915    | 10.1073/pn<br>as.20010831<br>17            | Yes                           |

#### 2020 MagLab Annual Report - 5. Publications

| Authors                                                                                                                                                                                                   | Title                                                                                                                                                                                                                   | Journal<br>Name                                                                            | Vol  | Issue | Pages               | DOI                                         | Cites<br>NSF<br>Core<br>Grant |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------|-------|---------------------|---------------------------------------------|-------------------------------|
| Pavuluri, K.D.; Rosen-<br>berg, J.T.; Helsper, S.;<br>Bo, S.; McMahon, M.T.,                                                                                                                              | Amplified detection of<br>phosphocreatine and cre-<br>atine after supplementa-<br>tion using CEST MRI at high<br>and ultrahigh magnetic<br>fields                                                                       | Journal of<br>Magnetic<br>Reso-<br>nance                                                   | 313  |       | 10670<br>3          | 10.1016/j.jmr<br>.2020.10670<br>3           | Yes                           |
| Ren, M.; Chen, X.;<br>Sang, Y.; Alamo, R.G.,                                                                                                                                                              | Comparative Effects on<br>Recrystallization of Melt-<br>Memory and Liquid-Liquid<br>Phase Separation in Zieg-<br>ler-Natta and Metallocene<br>Ethylene Copolymers with<br>Bimodal Comonomer<br>Composition Distribution | Industrial<br>and Engi-<br>neering<br>Chemistry<br>Research                                | 59   |       | 19260<br>-1927<br>1 | 10.1021/acs<br>.iecr.0c0364<br>7            | Yes                           |
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| Stirk, A.J.; Wilson, B.H.;<br>O'Keefe, C.A.; Amarne,<br>H.; Zhu, K.; Schurko,<br>R.W.; Loeb, S.J.,                                                                                                        | Applying reticular synthesis<br>to the design of Cu-based<br>MOFs with mechanically in-<br>terlocked linkers                                                                                                            | Nano Re-<br>search                                                                         | 14   | 2     | 417<br>422          | 10.1007/s12<br>274-020-<br>3123-z           | Yes                           |
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| Authors                                                                                                                                                         | Title                                                                                                                                                                                                                   | Journal<br>Name                                        | Vol | Issue | Pages            | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
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| Tran, N.; Mentink-Vigier,<br>F.; Long, J.R.,                                                                                                                    | Dynamic Nuclear Polariza-<br>tion of Biomembrane As-<br>semblies                                                                                                                                                        | Biomole-<br>cules                                      | 10  | 9     | 1246             | 10.3390/bio<br>m10091246                   | Yes                           |
| Venkatesh, A.; Hung, I.;<br>Boteju, K.C.; Sadow,<br>A.D.; Gor'kov, P.L.; Gan,<br>Z.; Rossini, A.J.,                                                             | Suppressing 1H Spin Diffu-<br>sion in Fast MAS Proton De-<br>tected Heteronuclear Cor-<br>relation Solid-State NMR Ex-<br>periments                                                                                     | Solid State<br>Nuclear<br>Magnetic<br>Reso-<br>nance   | 105 |       | 10163<br>6       | 10.1016/j.ssn<br>mr.2019.101<br>636        | Yes                           |
| Venkatesh, A.; Luan, X.;<br>Perras, F.A.; Hung, I.;<br>Huang, W.; Rossini, A.J.,                                                                                | t1-Noise Eliminated Dipolar<br>Heteronuclear Multiple-<br>Quantum Coherence<br>Solid-State NMR Spectros-<br>copy                                                                                                        | Physical<br>Chemistry<br>Chemical<br>Physics           | 22  |       | 20815-<br>20828  | 10.1039/D0<br>CP03511D                     | Yes                           |
| Vugmeyster, L.;<br>Ostrovsky, D.; Fu, R.,                                                                                                                       | Deuteron Quadrupolar<br>Chemical Exchange<br>Saturation Transfer (Q-<br>CEST) Solid-State NMR for<br>Static Powder Samples:<br>Approach and Applica-<br>tions to Amyloid- <b>B Fibrils</b>                              | Chem-<br>PhysChem                                      | 21  |       | 220-<br>231      | 10.1002/cp<br>hc.2019010<br>53             | Yes                           |
| Wang, L.S.; Patel, S.V.;<br>Sanghvi, S.S.; Hu, Y.;<br>Haile, S.M.,                                                                                              | Structure and Properties of<br>Cs7(H4PO4)(H2PO4)8: A<br>New Superprotonic Solid<br>Acid Featuring the Unusual<br>Polycation (H4PO4)+                                                                                    | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society | 142 | 47    | 19992-<br>-20001 | 10.1021/jacs<br>.0c08870                   | No                            |
| Wang, P.; Liu, H.; Patel,<br>S.; Feng, X.; Chien, P.;<br>Wang, Y.; Hu, Y.,                                                                                      | Fast Ion Conduction and Its<br>Origin in Li <sub>6-x</sub> PS <sub>5-x</sub> Br <sub>1+x</sub>                                                                                                                          | Chemistry<br>of Materi-<br>als                         | 32  | 9     | 3833–<br>3840    | 10.1021/acs<br>.chem-<br>mater.9b05<br>331 | Yes                           |
| Wang, Q.; Li, W.; Hung,<br>I.; Mentink-Vigier, F.;<br>Wang, X.; Qi, G.; Wang,<br>X.; Gan, Z.; Xu, J.; Deng,<br>F.,                                              | Mapping the oxygen struc-<br>ture of γ-Al2O3 by high-<br>field solid-state NMR spec-<br>troscopy                                                                                                                        | Nature<br>Communi-<br>cations                          | 11  | 1     | 3620             | 10.1038/s41<br>467-020-<br>17470-4         | Yes                           |
| Wi, S.; Frydman, L.,                                                                                                                                            | An Efficient, Robust New<br>Schemefor Establishing<br>Broadband Homonuclear<br>Correlationsin Biomolecular<br>Solid State NMR                                                                                           | Chem-<br>PhysChem                                      | 21  |       | 12-<br>Jan       | 10.1002/cp<br>hc.2019010<br>71             | Yes                           |
| Wijesekara, A.V.; Ven-<br>katesh, A.; Lampkin,<br>B.J.; VanVeller, B.;<br>Lubach, J.W.;<br>Nagapudi, K.; Hung, I.;<br>Gor'kov, P.L.; Gan, Z.;<br>Rossini, A.J., | Fast Acquisition of Proton-<br>Detected HETCOR Solid-<br>State NMR Spectra of<br>Quadrupolar Nuclei and<br>Rapid Measurement of NH<br>Bond Lengths by Fre-<br>quency Selective HMQC<br>and RESPDOR Pulse Se-<br>quences | Chemistry<br>a Euro-<br>pean Jour-<br>nal              | 26  | 35    | 7881-<br>7888    | 10.1002/che<br>m.20200039<br>0             | Yes                           |
| Wilson, B.H.; Gholami,<br>G.; Zhu, K.; O'Keefe,<br>C.A.; Schurko, R.W.;<br>Loeb, S.J.,                                                                          | Exploring the Dynamics of<br>Zr-Based Metal-organic<br>Frameworks Containing<br>Mechanically Interlocked<br>Molecular Shuttles                                                                                          | Faraday<br>Discussions                                 | 225 |       | 358-<br>370      | 10.1039/D0F<br>D00004C                     | No                            |
| Wilson, B.H.; Vojvodin,<br>C.; Gholami, G.; Ab-<br>dulla, L.M.; O'Keefe,<br>C.A.; Schurko, R.W.;<br>Loeb, S.J.,                                                 | Precise Spatial Arrange-<br>ment and Interaction be-<br>tween Two Different Mobile<br>Components in a Metal-<br>Organic Framework                                                                                       | Chem                                                   | 7   |       | 10-<br>Jan       | 10.1016/j.ch<br>empr.2020.1<br>1.009       | Yes                           |

| Authors                                                                                                                                                                                                                                                                       | Title                                                                                                                                                       | Journal<br>Name                                                                | Vol | Issue | Pages               | DOI                                       | Cites<br>NSF<br>Core<br>Grant |
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| Wu, N.; Chien, P.; Qian,<br>Y.; Li, Y.; Xu, H.;<br>Grundish, N.S.; Xu, B.;<br>Jin, H.; Hu, Y.; Yu, G.;<br>Goodenough, J.B.,                                                                                                                                                   | Enhanced Surface Interac-<br>tions Enable Fast Li+ Con-<br>duction in Oxide/Polymer<br>Composite Electrolyte                                                | An-<br>gewandte<br>Chemie                                                      | 132 |       | 9-Feb               | 10.1002/an<br>ge.2019144<br>78            | Yes                           |
| Xiang, Y.; Zheng, G.;<br>Liang, Z.; Jin, Y.; Liu, X.;<br>Chen, S.; Zhou, K.; Zhu,<br>J.; Lin, M.; He, H.; Wan,<br>J.; Yu, S.; Zhong, G.; Fu,<br>R.; Li, Y.; Yang, Y.,                                                                                                         | Visualizing the growth pro-<br>cess of sodium microstruc-<br>tures in sodium batteries by<br>in-situ <sup>23</sup> Na MRI and NMR<br>spectroscopy           | Nature<br>Nanotech-<br>nology                                                  | 15  |       | 883-<br>890         | 10.1038/s41<br>565-020-<br>0749-7         | Yes                           |
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| Yuan, B.; Hung, I.; Gan,<br>Z.; Sen, S.,                                                                                                                                                                                                                                      | Chemical order in binary<br>Se-Te glasses: Results from<br>high-resolution 2D <sup>77</sup> Se and<br><sup>125</sup> Te MATPASS NMR spec-<br>troscopy       | Journal of<br>Non-Crys-<br>talline Sol-<br>ids                                 | 544 |       | 12021<br>2          | 10.1016/j.jn<br>oncrysol.202<br>0.120212  | Yes                           |
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| Zhang, X.; Marxsen, S.F.;<br>Ortmann, P.; Mecking,<br>S.; Alamo, R.G.,                                                                                                                                                                                                        | Crystallization of Long-<br>Spaced Precision Polyace-<br>tals II: Effect of Polymor-<br>phism on Isothermal Crys-<br>tallization Kinetics                   | Macromol-<br>ecules                                                            | 53  |       | 7899-<br>7913       | 10.1021/acs<br>.macro-<br>mol.0c0144<br>3 | Yes                           |
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| Zuo, W.; Qiu, J.; Liu, X.;<br>Ren, F.; Liu, H.; He, H.;<br>Luo, C.; Li, J.; Ortiz, G.F.;<br>Duan, H.; Liu, J.; Wang,<br>M.; Li, Y.; Fu, R.; Yong,<br>Y.,                                                                                                                      | The stability of P2-layered<br>sodium transition metal ox-<br>ides in ambient atmos-<br>pheres                                                              | Nature<br>Communi-<br>cations                                                  | 11  |       | 3544                | 10.1038/s41<br>467-020-<br>17290-6        | Yes                           |

| Authors                                                                                                        | Title                                                                                                                                  | Journal<br>Name                             | Vol | Issue | Pages         | DOI                    | Cites<br>NSF<br>Core<br>Grant |
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| Fuhr, A.; Yun, H.J.;<br>Crooker, S.; Klimov, V.,                                                                                                                                                                        | Spectroscopic and Mag-<br>neto-Optical Signatures of<br>Cu1+ and Cu2+ Defects in<br>Copper Indium Sulfide<br>Quantum Dots                              | American<br>Chemical<br>Society<br>Nano                                                    | 14   |       | 2212        | 10.1021/acs<br>nano.9b091<br>81          | Yes                           |
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| Hayes, I.M.;<br>Maksimovich, N.;<br>Lopez, G. N.; Chan, M.<br>K.; Ramshaw, B. J.;<br>McDonald, R.;<br>Analytis, J.,                                                                                                     | Superconductivity and<br>quantum criticality linked<br>by the Hall effect in a<br>strange metal                                                        | Nature<br>Physics                                                                          | 2677 | 17    | 5-Jan       | 10.1038/s41<br>567-020-<br>0982-x        | Yes                           |

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| Jin, H.; Janicke, M.;<br>Crooker, S.; Klimov, V.;<br>Goryca, M.M.,                                                                                                                                                                                                                                                                   | Exploiting Functional Impu-<br>rities for Fast and Efficient<br>Incorporation of Manga-<br>nese into Quantum Dots                | Journal of<br>the Ameri-<br>can<br>Chemical<br>Society                                     | 142         |       | 18160           | 10.1021/jacs<br>.0c08510                   | Yes                           |
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| Khan, M. A.; Chang, P.;<br>Ghimire, N.;<br>Bhattacharya, A.;<br>Jiang, J. S.; Singleton,<br>J.; Mitchell, J. F.,                                                                                                                                                                                                                     | Fermi surface topology<br>and nontrivial Berry phase<br>in the flat-band semimetal<br>Pd3Pb                                      | Physical<br>Review B                                                                       | 101         |       | 24511<br>3      | 10.1103/Phy<br>sRevB.101.2<br>45113        | Yes                           |
| Li, J.; Goryca, M.M.; Wil-<br>son, N.; Stier, A.; Xu, X.;<br>Crooker, S.,                                                                                                                                                                                                                                                            | Spontaneous Valley Polari-<br>zation of Interacting Carri-<br>ers in a Monolayer Semi-<br>conductor                              | Physical<br>Review<br>Letters                                                              | 125         |       | 14760<br>2      | 10.1103/Phy<br>sRevLett.125<br>.147602     | Yes                           |
| Lu, J.; Adkins, T.; Dixon,<br>I.R.; Nguyen, D.N.; Han,<br>K.,                                                                                                                                                                                                                                                                        | Nondestructive Testing of<br>High Strength Conductors<br>for High Field Pulsed Mag-<br>nets                                      | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity                             | 30          | 4     | 69004<br>05     | 10.1109/TAS<br>C.2020.2980<br>525          | Yes                           |
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| Authors                                                                                                                                                                                                                                                                                                                                                                              | Title                                                                                                                                                                                       | Journal<br>Name                                                | Vol | Issue | Pages           | DOI                                 | Cites<br>NSF<br>Core<br>Grant |
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| Michel, J.; Nguyen,<br>D.N.; Lucero, J.D.,                                                                                                                                                                                                                                                                                                                                           | Design, Construction, and<br>Operation of New Duplex<br>Magnet at Pulsed Field Fa-<br>cility-NHMFL                                                                                          | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 50010<br>5      | 10.1109/TAS<br>C.2020.2970<br>670   | Yes                           |
| Modic, K.; McDonald,<br>R.; Lai, Y.; Palmstrom,<br>J.C.; Graf, D.E.; Chan,<br>M.K.; Balakirev, F.;<br>Boebinger, G.S.; Betts,<br>J.; Schmidt, M.; Sokolov,<br>D.A.; Moll, P.J.W.;<br>Ramshaw, B.; Shehter,<br>A.,                                                                                                                                                                    | Scale-invariant magnetic<br>anisotropy in RuCl3 at high<br>magnetic fields                                                                                                                  | Nature<br>Physics                                              | 1   |       | 1               | 10.1038/s41<br>567-020-<br>1028-0   | Yes                           |
| Morgan, G.; Jakobsen,<br>V.B.; Trzop, E.; Gavin,<br>L.C.; Dobbelaar, E.;<br>Chikara, S.; Ding, X.N.;<br>Esien, K.; Müller-Bunz,<br>H.; Felton, S.; Zapf, V.;<br>Collet, E.; Carpenter,<br>M.A.,                                                                                                                                                                                      | Stress-induced Domain<br>Wall Motion in a Ferroelas-<br>tic Mn3+ Spin Crossover<br>Complex                                                                                                  | An-<br>gewandte<br>Chemie                                      | 59  | 32    | 13305-<br>13312 | 10.1002/ani<br>e.202003041          | Yes                           |
| Nguyen, D.N.; Vo, T.D.,                                                                                                                                                                                                                                                                                                                                                              | Comprehensive Finite Ele-<br>ment Modeling for Pulsed<br>Magnet Design Using<br>COMSOL and Java                                                                                             | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 49006<br>05     | 10.1109/TAS<br>C.2020.2971<br>935   | Yes                           |
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| Opherden, D.; Nizar, N.;<br>Richardson, K.; Monroe,<br>J.; Turnbull, M.; Polson,<br>M.; Vela, S.; Blackmore,<br>W.; Goddard, P.;<br>Singleton, J.; Choi, E.;<br>Xiao, F.; Williams, R.;<br>Lancaster, T.; Pratt, F.;<br>Blundell, S.; Skourski, Y.;<br>Uhlarz, M.;<br>Ponomaryov, A.;<br>Zvyagin, S.; Wosnitza, J.;<br>Beinitz, M.; Heinmaa, I.;                                     | Open Access Extremely<br>well isolated two-dimen-<br>sional spin-12 antiferro-<br>magnetic Heisenberg lay-<br>ers with a small exchange<br>coupling in the molecular-<br>based magnet CuPOF | Physical<br>Review B                                           | 102 |       | 64431           | 10.1103/Phy<br>sRevB.102.0<br>64431 | Yes                           |

| Authors                                                                                                                                                                                                                                                                                                                                | Title                                                                                                                             | Journal<br>Name                                      | Vol | Issue      | Pages      | DOI                                           | Cites<br>NSF<br>Core<br>Grant |
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| Shornikova, E.; Ya-<br>kovlev, D.; Crooker, S.;<br>Bayer, M.,                                                                                                                                                                                                                                                                          | Negatively Charged Exci-<br>tons in CdSe Nanoplatelets                                                                            | American<br>Chemical<br>Society<br>Nano Let-<br>ters | 20  |            | 1370       | 10.1021/acs<br>.nano-<br>lett.9b04907         | Yes                           |
| Singleton, J.,                                                                                                                                                                                                                                                                                                                         | Temperature scaling be-<br>havior of the linear magne-<br>toresistance observed in<br>high-temperature super-<br>conductors       | Physical<br>Review<br>Materials                      | 4   |            | 61801      | 10.1103/Phy<br>sRevMateri-<br>als.4.061801    | Yes                           |
| Singleton, J.; Schmidt,<br>A.C.; Bailey, C.B.;<br>Wigger, J.M.; Krawczyk,<br>F.,                                                                                                                                                                                                                                                       | Information Carried by<br>Electromagnetic Radiation<br>Launched from Acceler-<br>ated Polarization Currents                       | Physical<br>Review<br>Applied                        | 14  |            | 64046      | 10.1103/Phy<br>sRevAp-<br>plied.14.064<br>046 | Yes                           |
| Walmsley, P.;<br>Aeschlimann, S.;<br>Straquadine, J.A.W.;<br>Giraldo Gallo, P.L.;<br>Riggs, S.C.; Chan, M.K.;<br>McDonald, R.; Fisher,<br>I.R.,                                                                                                                                                                                        | Magnetic breakdown and<br>charge density wave for-<br>mation: A quantum oscilla-<br>tion study of the rare-earth<br>tritellurides | Physical<br>Review B                                 | 102 | 15-<br>Apr | 45150      | 10.1103/Phy<br>sRevB.102.0<br>45150           | Yes                           |
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| Williams, R.C.; Black-<br>more, W.J.; Curley, S.P.;<br>Lees, M.R.; Birnbaum,<br>S.M.; Singleton, J.;<br>Huddart, B.M.; Hicken,<br>T.J.; Lancaster, T.;<br>Blundell, S.J.; Xiao, F.;<br>Ozarowski, A.; Pratt,<br>F.L.; Voneshan, D.J.;<br>Giguchia, Z.; Baines, C.;<br>Schlueter, J.A.; Villa,<br>D.Y.; Manson, J.L.;<br>Goddard, P.A., | Near-ideal molecule-<br>based Haldane spin chain                                                                                  | Physical<br>Review Re-<br>search                     | 2   |            | 13082      | 10.1103/Phy<br>sRevResear<br>ch.2.013082      | Yes                           |
| Willis, X.; Ding, X.N.; Sin-<br>gleton, J.; Balakirev, F.,                                                                                                                                                                                                                                                                             | Cryogenic goniometer for<br>measurements in pulsed<br>magnetic fields fabricated<br>via additive manufacturing<br>technique       | Review of<br>Scientific<br>Instruments               | 91  |            | 36102      | 10.1063/1.5<br>125792                         | Yes                           |

| Authors                                                                                                                                                                                                                                | Title                                                                                                                                | Journal<br>Name                                                | Vol | Issue | Pages      | DOI                                    | Cites<br>NSF<br>Core<br>Grant |
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| Yokosuk, M.O.; Kim,<br>H.S.; Hughey, K.D.; Kim,<br>J.; Stier, A.; O'Neil, K.R.;<br>Crooker, S.; Haule, K.;<br>Vanderbilt, D.;<br>Musfeldt, J.L.,                                                                                       | Nonreciprocal directional<br>dichroism of a chiral mag-<br>net in the visible range                                                  | Nature<br>Partner<br>Journals<br>Quantum<br>Materials<br>(npj) | 5   |       | 20         | 10.1038/s41<br>535-020-<br>0224-6      | Yes                           |
| Yu, J.; Chen, D.; Gu, J.;<br>Chen, J.; Jiang, J.;<br>Zhang, L.; Yu, Y.; Zhang,<br>X.; Zapf, V.; Cheng, H.,                                                                                                                             | Three Jahn-Teller States of<br>Matter in Spin-Crossover<br>System Mn(taa)                                                            | Physical<br>Review<br>Letters                                  | 124 |       | 22720<br>1 | 10.1103/Phy<br>sRevLett.124<br>.227201 | No                            |

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| Bhattarai, K.; Kim, K.L.;<br>Kim, K.; Radcliff, K.; Hu,<br>X.; Im, C.; Painter, T.A.;<br>Dixon, I.R.; Larbalestier,<br>D.C.; Lee, S.G.,                                              | Understanding quench in<br>no-insulation (NI) REBCO<br>magnets through experi-<br>ments and simulations                                                                                | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33  |       | 35002 | 10.1088/136<br>1-<br>6668/ab669<br>9       | Yes                           |
| Francis, A.; Abraimov,<br>D.V.; Viouchkov, Y.L.;<br>Su, Y.; Kametani, F.;<br>Larbalestier, D.C.,                                                                                     | Development of general<br>expressions for the temper-<br>ature and magnetic field<br>dependence of the critical<br>current density in coated<br>conductors with variable<br>properties | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33  | 4     | 44011 | 10.1088/136<br>1-<br>6668/ab73e<br>e       | Yes                           |
| Galstyan, E.; Pratap, R.;<br>Majkic, G.; Kochat, M.;<br>Abraimov, D.V.;<br>Jaroszynski, J.;<br>Selvamanickam, V.,                                                                    | In-field critical current and<br>pinning mechanisms at 4.2<br>K of Zr-added REBCO<br>coated conductors                                                                                 | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33  | 7     | 74007 | 10.1088/136<br>1-<br>6668/ab90c<br>6       | Yes                           |
| Hossain, S.I.; Jiang, J.;<br>Trociewitz, U.P.; Lu, J.;<br>Bosque, E.; Kim, Y.K.;<br>Larbalestier, D.C.;<br>Hellstrom, E.,                                                            | A study on the extent of Ag<br>protrusions in different TiO <sub>2</sub> -<br>coated Bi-2212 wires                                                                                     | IOP Con-<br>ference<br>Series: Ma-<br>terials Sci-<br>ence and<br>Engineer-<br>ing | 756 |       | 12017 | 10.1088/175<br>7-<br>899X/756/1/<br>012017 | Yes                           |

| Authors                                                                                                                                                                         | Title                                                                                                                                                                                           | Journal<br>Name                                                                            | Vol | Issue | Pages      | DOI                                   | Cites<br>NSF<br>Core<br>Grant |
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| Jaroszynski, J.,                                                                                                                                                                | A new no-insulation REBCO magnet of 32 T class                                                                                                                                                  | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                                    | 33  | 8     | 80501      | 10.1088/136<br>1-<br>6668/ab968<br>6  | Yes                           |
| Kametani, F.; Su, Y.;<br>Collantes, Y.; Pak, C.;<br>Tarantini, C.;<br>Larbalestier, D.C.;<br>Hellstrom, E.,                                                                     | Chemically degraded<br>grain boundaries in fine-<br>grain Ba0.6K0.4Fe2As2 pol-<br>ycrystalline bulks                                                                                            | Applied<br>Physics Ex-<br>press                                                            | 13  |       | 11300<br>2 | 10.35848/18<br>82-<br>0786/abbfd<br>f | Yes                           |
| Kang, J.; Kim, J.; Ryan,<br>P.J.; Xie, L.; Guo, L.;<br>Sundahl, C.; Schad, J.;<br>Campbell, N.;<br>Collantes, Y.; Hellstrom,<br>E.; Rzchowski, M.S.;<br>Eom, C.,                | Superconductivity in un-<br>doped BaFe2As2 by tetra-<br>hedral geometry design                                                                                                                  | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA<br>(PNAS) | 117 | 35    | 21170      | 10.1073/pn<br>as.20011231<br>17       | Yes                           |
| Kar, S.; Sai Sandra, J.;<br>Luo, W.;<br>Yerraguravagari, V.;<br>Galstyan, E.;<br>Jaroszynski, J.J.;<br>Abraimov, D.V.; Majkic,<br>G.; Selvamanickam, V.,                        | Progress in scale-up of<br>REBCO STAR wire for<br>canted cosine theta coils<br>and future strategies with<br>enhanced flexibility                                                               | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                                    | 33  | 9     | 94001      | 10.1088/136<br>1-<br>6668/ab9e4<br>1  | Yes                           |
| Kim, K.; Bhattarai, K.;<br>Kim, K.L.; Bai, H.; Dixon,<br>I.R.; Painter, T.A.; Bong,<br>U.; Larbalestier, D.C.;<br>Hahn, S.,                                                     | Design and Performance<br>Estimation of a 20 T 46 mm<br>No-Insulation All-REBCO<br>User Magnet                                                                                                  | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity                             | 30  | 4     | 1–5        | 10.1109/TAS<br>C.2020.2975<br>166     | Yes                           |
| Kim, S.; Larbalestier,<br>D.C.,                                                                                                                                                 | Influence of variable Ca-<br>doping on the critical cur-<br>rent density of low-angle<br>grain boundaries in<br>YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-d</sub>                               | Journal of<br>Applied<br>Physics                                                           | 128 | 10    | 10390<br>5 | 10.1063/5.0<br>016157                 | Yes                           |
| Majkic, G.; Pratap, R.;<br>Paidpilli, M.; Galstyan,<br>E.; Kochat, M.; Goel, C.;<br>Kar, S.; Jaroszynski, J.J.;<br>Abraimov, D.V.;<br>Selvamanickam, V.,                        | In-field critical current per-<br>formance of 4.0 µm thick<br>film REBCO conductor with<br>Hf addition at 4.2 K and<br>fields up to 31.2 T                                                      | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                                    | 33  | 7     | 07LT03     | 10.1088/136<br>1-<br>6668/ab954<br>1  | Yes                           |
| Matras, M.; Jiang, J.;<br>Trociewitz, U.P.;<br>Larbalestier, D.C.;<br>Hellstrom, E.,                                                                                            | Process to densify<br>Bi2Sr2CaCu2O X round<br>wire with overpressure be-<br>fore coil winding and final<br>overpressure heat treat-<br>ment                                                     | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                                    | 33  | 2     | 25010      | 10.1088/136<br>1-<br>6668/ab5ad<br>6  | Yes                           |
| Pak, C.; Su, Y.;<br>Collantes, Y.; Tarantini,<br>C.; Hellstrom, E.;<br>Larbalestier, D.C.;<br>Kametani, F.,                                                                     | Synthesis routes to elimi-<br>nate oxide impurity segre-<br>gation and their influence<br>on intergrain connectivity<br>in K-doped BaFe <sub>2</sub> As <sub>2</sub> poly-<br>crystalline bulks | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                                    | 33  |       | 84202      | 10.1088/136<br>1-<br>6668/aba01<br>a  | Yes                           |
| Pallecchi, I.; Tarantini,<br>C.; Hänisch, J.; Yama-<br>moto, A.,                                                                                                                | Preface to the special issue<br>'Focus on 10 Years of Iron-<br>Based Superconductors                                                                                                            | Supercon-<br>ductor Sci-<br>ence and                                                       | 33  |       | 90301      | 10.1088/136<br>1-                     | No                            |

| Authors                                                                                                                                                                                                                                                                                                                                                                                    | Title                                                                                                                                                                                                                          | Journal<br>Name                                                                    | Vol  | Issue | Pages  | DOI                                         | Cites<br>NSF<br>Core<br>Grant |
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|                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                | Technol-<br>ogy                                                                    |      |       |        | 6668/ab9ad<br>2                             |                               |
| Radcliff, K.J.; Walsh,<br>R.P.; Larbalestier, D.C.;<br>Hahn, S.,                                                                                                                                                                                                                                                                                                                           | The Effect of Reinforce-<br>ment Substrate Alloy Selec-<br>tion on Mechanical Proper-<br>ties of REBCO Coated<br>Conductors                                                                                                    | IOP Con-<br>ference<br>Series: Ma-<br>terials Sci-<br>ence and<br>Engineer-<br>ing | 756  | 1     | 12023  | 10.1088/175<br>7-<br>899X/756/1/<br>012023  | Yes                           |
| Segal, C.; Barth, C.;<br>Falorio, I.; Zurita, A.C.;<br>Ballarino, A.; Chaud, X.;<br>Tarantini, C.; Lee, P.J.;<br>Larbalestier, D.C.,                                                                                                                                                                                                                                                       | Evidence of Kramer extrap-<br>olation inaccuracy for pre-<br>dicting high field Nb <sub>3</sub> Sn<br>properties                                                                                                               | Journal of<br>Physics:<br>Confer-<br>ence Se-<br>ries                              | 1559 |       | 12062  | 10.1088/174<br>2-<br>6596/1559/1<br>/012062 | Yes                           |
| Seo, S.; Noh, H.; Li, N.;<br>Jiang, J.; Tarantini, C.;<br>Shi, R.; Jung, S.G.; Oh,<br>M.J.; Liu, M.; Lee, J.; Gu,<br>G.; Jo, Y.; Park, T.;<br>Hellstrom, E.; Gao, P.;<br>Lee, S.,                                                                                                                                                                                                          | Artificially engineered<br>nanostrain in FeSexTe1-x su-<br>perconductor thin films for<br>supercurrent enhance-<br>ment                                                                                                        | Nature<br>Publishing<br>Group<br>(NPG) Asia<br>Materials                           | 12   |       | 7      | 10.1038/s41<br>427-019-<br>0186-y           | Yes                           |
| Vakaliuk, O.; Werfel, F.;<br>Jaroszynski, J.;<br>Halbedel, B.,                                                                                                                                                                                                                                                                                                                             | Trapped field potential of<br>commercial Y-Ba-Cu-O<br>bulk superconductors de-<br>signed for applications                                                                                                                      | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33   | 9     | 95005  | 10.1088/136<br>1-<br>6668/ab9fc<br>4        | Yes                           |
| van der Laan, D.C.;<br>Weiss, J.D.; Trociewitz,<br>U.P.; Abraimov, D.V.;<br>Francis, A.; Gillman, J.;<br>Davis, D.S.; Kim, Y.K.;<br>Griffin, V.S.; Miller, G.E.;<br>Weijers, H.W.; Cooley,<br>L.D.; Larbalestier, D.C.;<br>Wang, X.R.,                                                                                                                                                     | A CORC® cable insert sole-<br>noid: the first high-temper-<br>ature superconducting in-<br>sert magnet tested at cur-<br>rents exceeding 4 kA in 14<br>T background magnetic<br>field                                          | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33   | 5     | 05LT03 | 10.1088/136<br>1-<br>6668/ab7fb<br>e        | Yes                           |
| Wang, X.; Abraimov,<br>D.V.; Arbelaez, D.; J<br>Bogdanof, T.; Brouwer,<br>L.; Caspi, S.; R<br>Dietderich, D.;<br>DiMarco, J.; Francis, A.;<br>Garcia Fajardo, L.; B<br>Ghiorso, W.; A Gourlay,<br>S.; C Higley, H.;<br>Marchevsky, M.; A<br>Maruszewski, M.; S My-<br>ers, C.; O Prestemon, S.;<br>Shen, T.; Taylor, J.;<br>Teyber, R.; Turqueti, M.;<br>van der Laan, D.; D<br>Weiss, J., | Development and perfor-<br>mance of a 2.9 Tesla di-<br>pole magnet using high-<br>temperature supercon-<br>ducting CORC® wires                                                                                                 | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 34   | 1     | 15012  | 10.1088/136<br>1-<br>6668/abc2a<br>5        | No                            |
| Weiss, J.D.; van der<br>Laan, D.C.; Hazelton,<br>D.; Knoll, A.; Carota, G.;<br>Abraimov, D.V.; Francis,<br>A.; Small, M.A.;<br>Bradford, G.;<br>Jaroszynski, J.J.,                                                                                                                                                                                                                         | Introduction of the next<br>generation of CORC® wires<br>with engineering current<br>density exceeding 650 A<br>mm <sup>-2</sup> at 12 T based on Su-<br>perPower"s ReBCO tapes<br>containing substrates of 25<br>µm thickness | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33   | 4     | 44001  | 10.1088/136<br>1-<br>6668/ab72c<br>6        | Yes                           |

| Authors                                                                                                                                                                                                         | Title                                                                                           | Journal<br>Name                                         | Vol | Issue | Pages      | DOI                                  | Cites<br>NSF<br>Core<br>Grant |
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| Yuan Huang, K.; Shi, Y.;<br>Srpcic, J.; D Ainslie, M.;<br>Kumar Namburi, D.; R<br>Dennis, A.; Zhou, D.;<br>Boll, M.; Filipenko, M.;<br>Jaroszynski, J.; Hell-<br>strom, E.; A Cardwell,<br>D.; Hay Durrell, J., | Composite stacks for relia-<br>ble > 17 T trapped fields in<br>bulk superconductor mag-<br>nets | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy | 33  |       | 10347<br>1 | 10.1088/136<br>1-<br>6668/ab5e1<br>2 | Yes                           |

# Publications generated by facilities: MS & T (36)

| Authors                                                                                                                                                                          | Title                                                                                                                                                                                 | Journal<br>Name                                                                    | Vol | Issue | Pages         | DOI                                                        | Cites<br>NSF<br>Core<br>Grant |
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| Afaneh, T.; Fryer, A.; Xin,<br>Y.; Hyde, R.H.;<br>Kapuruge, N.; Gutiérrez,<br>H.R.,                                                                                              | Large-Area Growth and<br>Stability of Monolayer Gal-<br>lium Monochalcogenides<br>for Optoelectronic Devices                                                                          | American<br>Chemical<br>Society<br>Applied<br>Nano Ma-<br>terials                  | 3   | 8     | 7879-<br>7887 | 10.1021/acs<br>anm.0c0136<br>9                             | Yes                           |
| Bai, H.; Bird, M.D.;<br>Cooley, L.; Dixon, I.R.;<br>Kim, K.L.; Larbalestier,<br>D.C.; Marshall, W.S.;<br>Trociewitz, U.P.; Weijers,<br>H.W.; Abraimov, D.V.;<br>Boebinger, G.S., | The 40 T Superconducting<br>Magnet Project at the Na-<br>tional High Magnetic Field<br>Laboratory                                                                                     | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity                     | 30  | 4     | 5-Jan         | 10.1109/TAS<br>C.2020.2969<br>642                          | Yes                           |
| Bao, S.; Garceau, N.;<br>Guo, W.,                                                                                                                                                | Heat and mass transfer<br>during a sudden loss of<br>vacuum in a liquid helium<br>cooled tube - Part II: Theo-<br>retical modeling                                                    | Interna-<br>tional Jour-<br>nal Heat<br>and Mass<br>Transfer                       | 146 |       | 11888<br>3    | 10.1016/j.ijh<br>eatmas-<br>strans-<br>fer.2019.118<br>883 | Yes                           |
| Bao, S.; Kanai, T.;<br>Zhang, Y.; Cattafesta,<br>L.N.; Guo, W.,                                                                                                                  | Stereoscopic detection of<br>hot spots in superfluid 4He<br>(He II) for accelerator-cav-<br>ity diagnosis                                                                             | Interna-<br>tional Jour-<br>nal Heat<br>and Mass<br>Transfer                       | 161 |       | 12025<br>9    | 10.1016/j.ijh<br>eatmas-<br>strans-<br>fer.2020.120<br>259 | Yes                           |
| Bhattarai, K.; Kim, K.L.;<br>Kim, K.; Radcliff, K.; Hu,<br>X.; Im, C.; Painter, T.A.;<br>Dixon, I.R.; Larbalestier,<br>D.C.; Lee, S.G.,                                          | Understanding quench in<br>no-insulation (NI) REBCO<br>magnets through experi-<br>ments and simulations                                                                               | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33  |       | 35002         | 10.1088/136<br>1-<br>6668/ab669<br>9                       | Yes                           |
| Bonilla, M.; Kolekar, S.;<br>Li, J.F.; Xin, Y.; Coelho,<br>P.M.; Lasek, K.;<br>Zberecki, K.; Lizzit, D.;<br>Tosi, E.; Lacovig, P.;<br>Lizzit, S.; Batzill, M.,                   | Compositional Phase<br>Change of Early Transition<br>Metal Diselenide (VSe <sub>2</sub> and<br>TiSe <sub>2</sub> ) Ultrathin Films by Post-<br>growth Annealing                       | Advanced<br>Materials<br>Interfaces                                                | 7   | 15    | 20004<br>97   | 10.1002/ad<br>mi.20200049<br>7                             | Yes                           |
| Engstrand, T.; Wei, K.;<br>Baumbach, R.; Xin, Y.;<br>Latturner, S.,                                                                                                              | Structural Disorder in Inter-<br>metallic Boride<br>Pr <sub>21</sub> M <sub>16</sub> Te <sub>6</sub> B <sub>30</sub> (M = Mn, Fe):<br>A Transition Metal Cluster<br>and Its Evil Twin | Inorganic<br>Chemistry                                                             | 59  |       | 2484-<br>2494 | 10.1021/acs<br>.inorg-<br>chem.9b03<br>358                 | Yes                           |
| Garceau, N.; Bao, S.;<br>Guo, W.,                                                                                                                                                | Effect of mass flow rate on<br>gas propagation after vac-<br>uum break in a liquid he-<br>lium cooled tube.                                                                           | IOP Con-<br>ference<br>Series: Ma-<br>terials Sci-<br>ence and<br>Engineer-<br>ing | 755 |       | 12112         | 10.1088/175<br>7-<br>899x/755/1/<br>012112                 | Yes                           |

| Authors                                                                                                                               | Title                                                                                                                                                               | Journal<br>Name                                                | Vol | Issue | Pages         | DOI                                    | Cites<br>NSF<br>Core<br>Grant |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----|-------|---------------|----------------------------------------|-------------------------------|
| Guo, W.; Golov, A.,                                                                                                                   | Shape fluctuations and op-<br>tical transition of He*2 ex-<br>cimer tracers in superfluid<br>4He                                                                    | Physical<br>Review B                                           | 101 |       | 64515         | 10.1103/Phy<br>sRevB.101.0<br>64515    | Yes                           |
| Han, K.; Lu, J.; Toplosky,<br>V.; Niu, R.; Goddard,<br>R.E.; Xin, Y.; Walsh, R.;<br>Dixon, I.R.,                                      | Properties of Selected<br>High-Strength Composite<br>Conductors With Different<br>Strengthening Compo-<br>nents                                                     | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 43013<br>05   | 10.1109/TAS<br>C.2020.2981<br>270      | Yes                           |
| Juarez, E.B.; Trillaud, F.;<br>Zermeno, F.; Weijers,<br>H.W.; Bird, M.D.,                                                             | Screening Currents and<br>Hysteresis Losses in the<br>REBCO Insert of the 32 T All-<br>Superconducting Magnet<br>Using T-A Homogenous<br>Model                      | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 5-Jan         | 10.1109/TAS<br>C.2020.2969<br>865      | Yes                           |
| Kanai, T.; Guo, W.;<br>Tsubota, M.; Jin, D.,                                                                                          | Torque and Angular Mo-<br>mentum Transfer in Merg-<br>ing Rotating Bose-Einstein<br>Condensates                                                                     | Physical<br>Review<br>Letters                                  | 124 |       | 10530<br>2    | 10.1103/Phy<br>sRevLett.124<br>.105302 | Yes                           |
| Kim, K.; Bhattarai, K.;<br>Kim, K.L.; Bai, H.; Dixon,<br>I.R.; Painter, T.A.; Bong,<br>U.; Larbalestier, D.C.;<br>Hahn, S.,           | Design and Performance<br>Estimation of a 20 T 46 mm<br>No-Insulation All-REBCO<br>User Magnet                                                                      | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 1–5           | 10.1109/TAS<br>C.2020.2975<br>166      | Yes                           |
| Kolb-Bond, D.;<br>Berrospe-Juarez, E.;<br>Bird, M.D.; Dixon, I.R.;<br>Weijers, H.W.; Trillaud, F.;<br>Zermeno, V.M.R.;<br>Grilli, F., | Computing Strains Due to<br>Screening Currents in<br>REBCO Magnets                                                                                                  | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 5-Jan         | 10.1109/TAS<br>C.2020.2979<br>396      | Yes                           |
| Lasek, K.; Coelho, P.M.;<br>Zberecki, K.; Xin, Y.;<br>Kolekar, S.K.; Li, J.;<br>Batzill, M.,                                          | Molecular Beam Epitaxy of<br>Transition Metal (Ti-, V-, and<br>Cr-) Tellurides: From Mono-<br>layer Ditellurides to Multi-<br>layer Self-Intercalation<br>Compounds | American<br>Chemical<br>Society<br>Nano                        | 14  |       | 8473-<br>8484 | 10.1021/acs<br>nano.0c027<br>12        | Yes                           |
| Lu, J.; Adkins, T.; Dixon,<br>I.R.; Nguyen, D.N.; Han,<br>K.,                                                                         | Nondestructive Testing of<br>High Strength Conductors<br>for High Field Pulsed Mag-<br>nets                                                                         | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 69004<br>05   | 10.1109/TAS<br>C.2020.2980<br>525      | Yes                           |
| Lu, J.; Choi, E.S.; Zhou,<br>H.,                                                                                                      | Erratum: Physical properties<br>of Hastelloy® C-276 at cry-<br>ogenic temperatures [J.<br>Appl. Phys. 103, 064908<br>(2008)]                                        | Journal of<br>Applied<br>Physics                               | 127 |       | 39901         | 10.1063/1.5<br>141940                  | Yes                           |
| Lu, J.; Xin, Y.; Lochner,<br>E.J.; Radcliff, K.; Levitan,<br>J.W.,                                                                    | Contact resistivity due to<br>oxide layers between two<br>REBCO tapes                                                                                               | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy        | 33  | 4     | 45001         | 10.1088/136<br>1-<br>6668/ab714<br>d   | Yes                           |
| Mao, P.; Xin, Y.; Han, K.;<br>liu, Z.; yang, Z.,                                                                                      | Formation of long-period<br>stacking-ordered (LPSO)<br>structures and microhard-<br>ness of as-cast Mg-4.5 Zn6Y<br>alloy                                            | Materials<br>Science<br>and Engi-<br>neering A                 | 777 |       | 13901<br>9    | 10.1016/j.ms<br>ea.2020.139<br>019     | Yes                           |
| Marshall, W.S.; Gavrilin,<br>A.V.; Kolb-Bond, D.J.;<br>Radcliff, K.; Walsh, R.P.,                                                     | Composite Mechanical<br>Properties of Coils Made<br>With Nickel-Alloy Lami-<br>nated Bi-2223 Conductors                                                             | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 4-Jan         | 10.1109/TAS<br>C.2020.2970<br>388      | Yes                           |

| Authors                                                                                                                                                                                                                                                                    | Title                                                                                                                                                                                           | Journal<br>Name                                                                    | Vol | Issue | Pages               | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|-------|---------------------|--------------------------------------------|-------------------------------|
| Neu, J.N.; Graf, D.E.;<br>Wei, K.; Gaiser, A.; Xin,<br>Y.; Lai, Y.; Albrecht-<br>Schmitt, T.E.;<br>Baumbach, R.; Singh,<br>D.J.; Siegrist, T.M.,                                                                                                                           | Superstructures and Super-<br>conductivity Linked with Pd<br>Intercalation in Nb₂Pd <sub>x</sub> Se₅                                                                                            | Chemistry<br>of Materi-<br>als                                                     | 32  | 0     | 8361                | 10.1021/acs<br>.chem-<br>mater.0c02<br>291 | Yes                           |
| Niu, R.; Han, K.; Xiang,<br>Z.; Qiao, L.; Siegrist, T.M.,                                                                                                                                                                                                                  | Ultra-high local plasticity in<br>high-strength nanocompo-<br>sites                                                                                                                             | Journal of<br>Materials<br>Science                                                 | 55  |       | 15183<br>-<br>15198 | 10.1007/s10<br>853-020-<br>05097-1         | Yes                           |
| Pak, C.; Su, Y.;<br>Collantes, Y.; Tarantini,<br>C.; Hellstrom, E.;<br>Larbalestier, D.C.;<br>Kametani, F.,                                                                                                                                                                | Synthesis routes to elimi-<br>nate oxide impurity segre-<br>gation and their influence<br>on intergrain connectivity<br>in K-doped BaFe <sub>2</sub> As <sub>2</sub> poly-<br>crystalline bulks | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy                            | 33  |       | 84202               | 10.1088/136<br>1-<br>6668/aba01<br>a       | Yes                           |
| Radcliff, K.J.; Walsh,<br>R.P.; Larbalestier, D.C.;<br>Hahn, S.,                                                                                                                                                                                                           | The Effect of Reinforce-<br>ment Substrate Alloy Selec-<br>tion on Mechanical Proper-<br>ties of REBCO Coated<br>Conductors                                                                     | IOP Con-<br>ference<br>Series: Ma-<br>terials Sci-<br>ence and<br>Engineer-<br>ing | 756 | 1     | 12023               | 10.1088/175<br>7-<br>899X/756/1/<br>012023 | Yes                           |
| Sanavandi, H.; Bao, S.;<br>Zhang, Y.; Keijzer, R.;<br>Guo, W.; Cattafesta,<br>L.N.,                                                                                                                                                                                        | A cryogenic-helium pipe<br>flow facility with unique<br>double-line molecular tag-<br>ging velocimetry capability                                                                               | Review of<br>Scientific<br>Instruments                                             | 91  | 5     | 53901               | 10.1063/5.0<br>008117                      | Yes                           |
| Sonnenschein, V.; Tsuji,<br>Y.; Kokuryu, S.; Kubo,<br>W.; Suzuki, S.; Tomita, H.;<br>Kiyanagi, Y.; Iguchi, T.;<br>Matsushita, T.; Wada,<br>N.; Kitaguchi, M.;<br>Shimizu, H.M.; Hirota, K.;<br>Shinohara, T.; Hiroi, K.;<br>Hayashida, H.; Guo, W.;<br>Ito, D.; Saito, Y., | An experimental setup for<br>creating and imaging<br>4He2* excimer cluster trac-<br>ers in superfluid helium-4<br>via neutron-3He absorption<br>reaction                                        | Review of<br>Scientific<br>Instruments                                             | 91  | 3     | 33318               | 10.1063/1.5<br>130919                      | No                            |
| Tang, Y.; Bao, S.; Kanai,<br>T.; Guo, W.,                                                                                                                                                                                                                                  | Statistical properties of ho-<br>mogeneous and isotropic<br>turbulence in He II meas-<br>ured via particle tracking<br>velocimetry                                                              | Physical<br>Review Flu-<br>ids                                                     | 5   |       | 84602               | 10.1103/Phy<br>sRevFlu-<br>ids.5.084602    | Yes                           |
| Toth, J.; Bole, S.T.,                                                                                                                                                                                                                                                      | Conceptual Design for a<br>Next Generation Resistive<br>Large Bore Magnet at the<br>NHMFL                                                                                                       | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity                     | 30  | 4     | 4-Jan               | 10.1109/TAS<br>C.2020.2964<br>219          | Yes                           |
| Walsh, R.P.; Radcliff, K.;<br>Lu, J.; Han, K.,                                                                                                                                                                                                                             | The low temperature me-<br>chanical properties of a<br>Nitronic 40 forging                                                                                                                      | IOP Con-<br>ference<br>Series: Ma-<br>terials Sci-<br>ence and<br>Engineer-<br>ing | 756 | 756   | 12001               | 10.1088/175<br>7-<br>899X/756/1/<br>012001 | Yes                           |
| Wen, X.; Bao, S.;<br>McDonald, L.; Pierce,<br>J.; Greene, G.L.; Crow,<br>L.; Tong, X.;<br>Mezzacappa, A.;<br>Glasby, R.; Guo, W.;<br>Fitzsimmons, M.R.,                                                                                                                    | Imaging Fluorescence of<br>He * 2 Excimers Created by<br>Neutron Capture in Liquid<br>Helium II                                                                                                 | Physical<br>Review<br>Letters                                                      | 124 |       | 13450<br>2          | 10.1103/Phy<br>sRevLett.124<br>.134502     | Yes                           |

| Authors                                                                                                                                                | Title                                                                                                                            | Journal<br>Name                                                | Vol | Issue | Pages        | DOI                                    | Cites<br>NSF<br>Core<br>Grant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----|-------|--------------|----------------------------------------|-------------------------------|
| Worku, M.; Tian, Y.;<br>Zhou, C.K.; Lin, H.R.;<br>Chaaban, M.; Xu, L.J.;<br>He, Q.Q.; Beery, D.;<br>Zhou, Y.; Lin, X.S.; Su,<br>Y.F.; Xin, Y.; Ma, B., | Hollow metal halide perov-<br>skite nanocrystals with effi-<br>cient blue emissions                                              | Science<br>Advances                                            | 6   | 17    | eaaz5<br>961 | 10.1126/sci-<br>adv.aaz596<br>1        | Yes                           |
| Xiao, H.; zheng, S.; Xin,<br>Y.; Xu, J.; Han, K.; Li, H.;<br>Zhai, Q.,                                                                                 | Characterization of Micro-<br>structure in High-Hardness<br>Surface Layer of Low-Car-<br>bon Steel                               | Metals                                                         | 10  | 8     | 995          | 10.3390/me<br>†10080995                | Yes                           |
| Yu, H.; Lu, J.,                                                                                                                                        | Superconducting Trans-<br>former for Superconduct-<br>ing Cable Testing up to 45<br>kA                                           | IEEE Trans-<br>actions on<br>Applied<br>Supercon-<br>ductivity | 30  | 4     | 55002<br>04  | 10.1109/TAS<br>C.2020.2972<br>502      | Yes                           |
| Yui, S.; Kobayashi, H.;<br>Tsubota, M.; Guo, W.,                                                                                                       | Fully Coupled Two-Fluid Dy-<br>namics in Superfluid ⁴He:<br>Anomalous Anisotropic Ve-<br>locity Fluctuations in Coun-<br>terflow | Physical<br>Review<br>Letters                                  | 124 |       | 15530<br>1   | 10.1103/Phy<br>sRevLett.124<br>.155301 | Yes                           |
| Zhao, J.; Yu, J .; Han, K.;<br>Zhong, H .; Li, R.; Zhai,<br>Q.,                                                                                        | Effect of Coil Configuration<br>Design on Al Solidified<br>Structure Refinement                                                  | Metals                                                         | 10  | 1     | 53           | 10.3390/me<br>t10010153                | Yes                           |
| Zhu, W.; Sheng, D.N.;<br>Yang, K.,                                                                                                                     | Topological Interface be-<br>tween Pfaffian and Anti-<br>Pfaffian Order in v=5/2<br>Quantum Hall Effect                          | Physical<br>Review<br>Letters                                  | 125 |       | 14680<br>2   | 10.1103/Phy<br>sRevLett.125<br>.146802 | Yes                           |

### Publications generated by facilities: Education at FSU (3)

| Authors                                                                                                    | Title                                                                                                   | Journal<br>Name                                             | Vol | Issue | Pages       | DOI                                | Cites<br>NSF<br>Core<br>Grant |
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| Dhital, C.; Pham, D.;<br>Lawal, T.; Bucholz, C.;<br>Poyraz, A.; Zhang, Q.;<br>Nepal, R.; Jin, R.; Rai, R., | Crystal and magnetic<br>structure of polar oxide<br>HoCrWO6                                             | Journal of<br>Magnetism<br>and Mag-<br>netic Ma-<br>terials | 514 |       | 16721<br>9  | 10.1016/j.jm<br>mm.2020.16<br>7219 | Yes                           |
| Hughes, R.; Schellinger,<br>J.; Billington, B.; Britsch,<br>B.; Santiago, A.,                              | A Summary of Effective<br>Gender Equitable Teach-<br>ing Practices in Informal<br>STEM Education Spaces | Journal of<br>STEM Out-<br>reach                            | 3   | 1     | 9           | 10.15695/jst<br>em/v3i1.16         | Yes                           |
| Hughes, R.; Schellinger,<br>J.; Roberts, K.L.,                                                             | The Role of Recognition in<br>Disciplinary Identity for Girls                                           | Journal of<br>Research<br>on Sci-<br>ence<br>Teaching       | 58  | 3     | 420-<br>455 | 10.1002/tea<br>.21665              | Yes                           |

# Publications generated by facilities: CMT/E (46)

| Authors                                                       | Title                                                                                        | Journal<br>Name               | Vol | Issue | Pages | DOI                                    | Cites<br>NSF<br>Core<br>Grant |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------|-----|-------|-------|----------------------------------------|-------------------------------|
| Bertaina, S.U.; Vezin, H.;<br>De Raedt, H.;<br>Chiorescu, I., | Experimental protection of<br>quantum coherence by us-<br>ing a phase-tunable image<br>drive | Scientific<br>Reports         | 10  | 1     | 21643 | 10.1038/s41<br>598-020-<br>77047-5     | Yes                           |
| Chauhan, P.;<br>Mahmood, F.;                                  | Tunable Magnon Interac-<br>tions in a Ferromagnetic<br>Spin-1 Chain                          | Physical<br>Review<br>Letters | 124 |       | 37203 | 10.1103/Phy<br>sRevLett.124<br>.037203 | Yes                           |

CMT/E

Education

| Authors                                                                                                                                                              | Title                                                                                                                                                                                 | Journal<br>Name                                                | Vol | Issue | Pages         | DOI                                        | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----|-------|---------------|--------------------------------------------|-------------------------------|
| Changlani, H.J.;<br>Koohpayeh, S.M.;<br>Armitage, N.P.,                                                                                                              |                                                                                                                                                                                       |                                                                |     |       |               |                                            | Grant                         |
| Chen, K.; Chappell,<br>G.L.; Zhang, S.; Lan, W.;<br>Besara, T.; Huang, K.;<br>Graf, D.E.; Balicas, L.;<br>Reyes, A.P.; Baumbach,<br>R.,                              | Superconductivity in single crystals of ZrP <sub>1.27</sub> Se <sub>0.73</sub>                                                                                                        | Physical<br>Review B                                           | 102 |       | 14452<br>2    | 10.1103/Phy<br>sRevB.102.1<br>44522        | Yes                           |
| Chen, L.; Yang, K.,                                                                                                                                                  | Construction of a series of<br>new v = 2/5 fractional<br>quantum Hall wave func-<br>tions by conformal field<br>theory                                                                | Physical<br>Review B                                           | 102 |       | 11513<br>2    | 10.1103/Phy<br>sRevB.102.1<br>15132        | Yes                           |
| Christensen, M.H.;<br>Wang, X.; Schattner, Y.;<br>Berg, E.; Fernandes,<br>R.M.,                                                                                      | Modeling Unconventional<br>Superconductivity at the<br>Crossover between Strong<br>and Weak Electronic Inter-<br>actions                                                              | Physical<br>Review<br>Letters                                  | 125 |       | 24700<br>1    | 10.1103/Phy<br>sRevLett.125<br>.247001     | Yes                           |
| Engstrand, T.; Wei, K.;<br>Baumbach, R.; Xin, Y.;<br>Latturner, S.,                                                                                                  | Structural Disorder in Inter-<br>metallic Boride<br>Pr <sub>21</sub> M <sub>16</sub> Te <sub>6</sub> B <sub>30</sub> (M = Mn, Fe):<br>A Transition Metal Cluster<br>and Its Evil Twin | Inorganic<br>Chemistry                                         | 59  |       | 2484-<br>2494 | 10.1021/acs<br>.inorg-<br>chem.9b03<br>358 | Yes                           |
| Gorfien, M.; Wang, H.;<br>Chen, L.; Rahmani, H.;<br>Yu, J.; Zhu, P.; Chen, J.;<br>Wang, X.; Zhao, J.;<br>Cao, J.,                                                    | Nanoscale thermal<br>transport across an<br>GaAs/AlGaAs heterostruc-<br>ture interface                                                                                                | Structural<br>Dynamics                                         | 7   |       | 25101         | 10.1063/1.5<br>129629                      | Yes                           |
| Hassan, N.M.;<br>Thirunavukkuarasu, K.;<br>Lu, Z.; Smirnov, D.;<br>Zhilyaeva, E.I.;<br>Torunova, S.;<br>Lyubovskaya, R.N.;<br>Drichko, N.,                           | Melting of charge order in<br>the low-temperature state<br>of an electronic ferroelec-<br>tric-like system                                                                            | Nature<br>Partner<br>Journals<br>Quantum<br>Materials<br>(npj) | 5   | 1     | 15            | 10.1038/s41<br>535-020-<br>0217-5          | Yes                           |
| Jaroszynski, J.,                                                                                                                                                     | A new no-insulation REBCO magnet of 32 T class                                                                                                                                        | Supercon-<br>ductor Sci-<br>ence and<br>Technol-<br>ogy        | 33  | 8     | 80501         | 10.1088/136<br>1-<br>6668/ab968<br>6       | Yes                           |
| Ju, L.; Wang, L.; Liu, X.;<br>Moon, S.; Ozerov, M.;<br>Lu, Z.; Taniguchi, T.;<br>Watanabe, K.; Mueller,<br>E.; Zhang, F.; Smirnov,<br>D.; Rana, F.; McEuen,<br>P.L., | Unconventional valley-de-<br>pendent optical selection<br>rules and landau level mix-<br>ing in bilayer graphene                                                                      | Nature<br>Communi-<br>cations                                  | 11  | 1     | 2941          | 10.1038/s41<br>467-020-<br>16844-y         | No                            |
| Kang, J.; Vafek, O.,                                                                                                                                                 | Non-Abelian Dirac node<br>braiding and near-degen-<br>eracy of correlated phases<br>at odd integer filling in<br>magic-angle twisted bi-<br>layer graphene                            | Physical<br>Review B                                           | 102 |       | 35161         | 10.1103/Phy<br>sRevB.102.0<br>35161        | Yes                           |
| Lee, K.; Melendrez, R.;<br>Pal, A.; Changlani, H.J.,                                                                                                                 | Exact three-colored quan-<br>tum scars from geometric<br>frustration                                                                                                                  | Physical<br>Review B:<br>Rapid<br>Comm/Let<br>ters             | 101 |       | 24111<br>1    | 10.1103/Phy<br>sRevB.101.2<br>41111        | Yes                           |

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| Lee, S.; Zhou, C.; Neu,<br>J.N.; Beery, D.; Arcidi-<br>acono, A.; Chaaban,<br>M.; Lin, H.; Gaiser, A.;<br>Chen, B.; Albrecht-<br>Schmitt, T.E.; Siegrist,<br>T.M.; Ma, B., | Bulk Assemblies of Lead<br>Bromide Trimer Clusters<br>with Geometry-Dependent<br>Photophysical Properties                         | Chemistry<br>of Materi-<br>als           | 32  | 1     | 374-<br>380     | 10.1021/acs<br>.chem-<br>mater.9b03<br>893 | Yes                           |
| Lesseux, G.G.; Sakai, H.;<br>Hattori, T.; Tokunaga, Y.;<br>Kambe, S.; Kuhns, P.L.;<br>Reyes, A.P.; Thompson,<br>J.D.; Pagluso, P.G.;<br>Urbano, R.R.,                      | Orbitally defined field-in-<br>duced electronic state in a<br>Kondo lattice                                                       | Physical<br>Review B                     | 101 |       | 16511<br>1      | 10.1103/Phy<br>sRevB.101.1<br>65111        | Yes                           |
| Li, S.; Drueke, E.; Porter,<br>Z.; Jin, W.; Lu, Z.;<br>Smirnov, D.; Merlin, R.;<br>Wilson, S.D.; Sun, K.;<br>Zhao, L.,                                                     | Symmetry-Resolved Two-<br>Magnon Excitations in a<br>Strong Spin-Orbit-Coupled<br>Bilayer Antiferromagnet                         | Physical<br>Review<br>Letters            | 125 |       | 87202           | 10.1103/Phy<br>sRevLett.125<br>.087202     | Yes                           |
| Lin, Z.; Li, Z.; Deng, H.;<br>Liu, T.; Shi, G.; Bones-<br>teel, N.E.; Schlottmann,<br>P.U.; Li, Y.; Xiong, P.,                                                             | Giant enhancement of the<br>in-plane critical field for<br>thin Al films via proximity<br>coupling to a topological<br>insulator  | Physical<br>Review B                     | 102 |       | 14451<br>8      | 10.1103/Phy<br>sRevB.102.1<br>44518        | No                            |
| LoCicero, S.A.;<br>Averback, C.M.;<br>Shumnyk, U.; Choi, E.;<br>Talham, D.R.,                                                                                              | Particle Size Effects on the<br>Order-Disorder Phase Tran-<br>sition in<br>[(CH3)2NH2]Mg(HCOO)3                                   | Journal of<br>Physical<br>Chemistry<br>C | 124 | 38    | 21113-<br>21122 | 10.1021/acs<br>.jpcc.0c045<br>05           | Yes                           |
| Lu, J.; Choi, E.S.; Zhou,<br>H.,                                                                                                                                           | Erratum: "Physical proper-<br>ties of Hastelloy® C-276™<br>at cryogenic tempera-<br>tures" [J. Appl. Phys. 103,<br>064908 (2008)] | Journal of<br>Applied<br>Physics         | 127 |       | 39901           | 10.1063/1.5<br>141940                      | Yes                           |
| Moon, B.; Han, G.; Ra-<br>donjic, M.M.; Ji, H.;<br>Dobrosavljevic, V.,                                                                                                     | Quantum critical scaling<br>for finite-temperature Mott-<br>like metal-insulator crosso-<br>ver in few-layered MoS2               | Physical<br>Review B                     | 102 |       | 24542<br>4      | 10.1103/Phy<br>sRevB.102.2<br>45424        | Yes                           |
| Mozaffari, S.; Aryal, N.;<br>Schoenemann, R.U.;<br>Chen, K.; McCandless,<br>G.T.; Chan, J.Y.;<br>Manousakis, E.; Balicas,<br>L.,                                           | Multiple Dirac nodes and<br>symmetry protected Dirac<br>nodal line in orthorhombic<br>a-RhSi                                      | Physical<br>Review B                     | 102 |       | 11513<br>1      | 10.1103/Phy<br>sRevB.102.1<br>15131        | Yes                           |
| Neu, J.N.; Graf, D.E.;<br>Wei, K.; Gaiser, A.; Xin,<br>Y.; Lai, Y.; Albrecht-<br>Schmitt, T.E.;<br>Baumbach, R.; Singh,<br>D.J.; Siegrist, T.M.,                           | Superstructures and Super-<br>conductivity Linked with Pd<br>Intercalation in Nb₂Pd <sub>x</sub> Se₅                              | Chemistry<br>of Materi-<br>als           | 32  | 0     | 8361            | 10.1021/acs<br>.chem-<br>mater.0c02<br>291 | Yes                           |
| Paul, A.; Chung, C.;<br>Birol, T.; Changlani, H.J.,                                                                                                                        | Spin-lattice Coupling and<br>the Emergence of the Tri-<br>merized Phase in the S=1<br>Kagome Antiferromagnet<br>Na2Ti3Cl8         | Physical<br>Review<br>Letters            | 124 |       | 16720<br>3      | 10.1103/Phy<br>sRevLett.124<br>.167203     | Yes                           |
| Ratkovski, D.R.; Balicas,<br>L.; Bangura, A.; Ma-<br>chado, F.; Rezende, S.,                                                                                               | Thermal transport in yttrium<br>iron garnet at very high<br>magnetic fields                                                       | Physical<br>Review B                     | 101 |       | 17444<br>2      | 10.1103/Phy<br>sRevB.101.1<br>74442        | Yes                           |

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| Saubert, S.; Scheie, A.;<br>Duvinage, C.;<br>Kindervater, J.; Zhang,<br>S.; Changlani, H.J.; Xu,<br>G.; Koohpayeh, S.M.;<br>Tchernyshyov, O.;<br>Broholm, C.L.;<br>Pfleiderer, C., | Orientation dependence<br>of the magnetic phase di-<br>agram of Yb <sub>2</sub> Ti <sub>2</sub> O <sub>7</sub>                                   | Physical<br>Review B                                                                       | 101 |       | 17443<br>4      | 10.1103/Phy<br>sRevB.101.1<br>74434      | Yes                           |
| Scheie, A.; Kindervater,<br>J.; Zhang, S.;<br>Changlani, H.J.; Sala,<br>G.; Ehlers, G.; Heine-<br>mann, A.; Tucker, G.S.;<br>Koohpayeh, S.M.;<br>Broholm, C.,                      | Multiphase magnetism in<br>Yb2Ti2O7                                                                                                              | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA<br>(PNAS) | 117 | 44    | 27245-<br>27254 | 10.1073/pn<br>as.20087911<br>17          | Yes                           |
| Sen, S.; Vidhyadhiraja,<br>N.S.; Miranda, E.;<br>Dobrosavljevic, V.;<br>Ku, W.,                                                                                                    | Fragility of the Kondo insu-<br>lating gap against disor-<br>der: Relevance to recent<br>puzzles in topological<br>Kondo insulators              | Physical<br>Review Re-<br>search                                                           | 2   |       | 33370           | 10.1103/Phy<br>sRevResear<br>ch.2.033370 | Yes                           |
| Shao, Y.; Rudenko,<br>A.N.; Hu, J.; Sun, Z.; Zhu,<br>Y.; Moon, S.; Millis, A.J.;<br>Yuan, S.; Lichtenstein,<br>A.I.; Smirnov, D.; Mao,<br>Z.Q.; Katsnelson, M.I.;<br>Basov, D.N.,  | Electronic correlations in nodal-line semimetals                                                                                                 | Nature<br>Physics                                                                          | 16  | 6     | 636-<br>641     | 10.1038/s41<br>567-020-<br>0859-z        | Yes                           |
| Shashkin, A.A.; Melni-<br>kov, M.Y.; Dolgopolov,<br>V.T.; Radonjic, M.M.;<br>Dobrosavljevic, V.;<br>Huang, S.H.; Liu, C.W.;<br>Zhu, A.Y.; Kravchenko,<br>S.V.,                     | Manifestation of strong<br>correlations in transport in<br>ultraclean SiGe/Si/SiGe<br>quantum wells                                              | Physical<br>Review B:<br>Rapid<br>Comm/Let<br>ters                                         | 102 |       | 81119           | 10.1103/Phy<br>sRevB.102.0<br>81119      | Yes                           |
| Shi, Q.; Shih, E.M.;<br>Gustafsson, M.V.;<br>Rhodes, D.A.; Kim, B.;<br>Watanabe, K.;<br>Taniguchi, T.; Papic, Z.;<br>Hone, J.; Dean, C.R.,                                         | Odd- and even-denomina-<br>tor fractional quantum Hall<br>states in monolayer WSe2.                                                              | Nature<br>Nanotech-<br>nology                                                              | 15  |       | 569-<br>573     | 10.1038/s41<br>565-020-<br>0685-6        | Yes                           |
| Shi, Z.; Baity, P.G.;<br>Sasagawa, T.; Popovic,<br>D.,                                                                                                                             | Vortex phase diagram and<br>the normal state of cu-<br>prates with charge and<br>spin orders                                                     | Science<br>Advances                                                                        | 6   |       | eaay8<br>946    | 10.1126/sci-<br>adv.aay894<br>6          | Yes                           |
| Shi, Z.; Baity, P.G.; Terzic,<br>J.; Sasagawa, T.;<br>Popovic, D.,                                                                                                                 | Pair density wave at high<br>magnetic fields in cuprates<br>with charge and spin or-<br>ders                                                     | Nature<br>Communi-<br>cations                                                              | 11  |       | 3323            | 10.1038/s41<br>467-020-<br>17138-z       | Yes                           |
| Suarez-Villagran, M.Y.;<br>Mitsakos, N.; Lee, T.;<br>Dobrosavljevic, V.; Mil-<br>ler, J.H.; Miranda, E.,                                                                           | Two-dimensional disor-<br>dered Mott metal-insulator<br>transition                                                                               | Physical<br>Review B                                                                       | 101 |       | 23511<br>2      | 10.1103/Phy<br>sRevB.101.2<br>35112      | Yes                           |
| Ungor, O.; Phan, H.;<br>Choi, E.; Roth, J.K.;<br>Shatruk, M.,                                                                                                                      | Magnetism and electrical<br>conductivity of molecular<br>semiconductor,<br>[Fe(DMF)4(TCNQ)2](TCNQ)<br>2, with fractionally charged<br>TCNQ units | Journal of<br>Magnetism<br>and Mag-<br>netic Ma-<br>terials                                | 497 |       | 16598<br>4      | 10.1016/j.jm<br>mm.2019.16<br>5984       | Yes                           |

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| Vafek, O.; Kang, J.,                                                                                                                                                                                                   | Renormalization Group<br>Study of Hidden Symmetry<br>in Twisted Bilayer Gra-<br>phene with Coulomb Inter-<br>actions                   | Physical<br>Review<br>Letters                                                              | 125 |       | 25760<br>2      | 10.1103/Phy<br>sRevLett.125<br>.257602 | Yes                           |
| Wang, T.; Li, Z.; Lu, Z.; Li,<br>Y.; Miao, S.; Lian, Z.;<br>Meng, Y.; Blei, M.;<br>Taniguchi, T.;<br>Watanabe, K.; Tongay,<br>S.; Yao, W.; Smirnov, D.;<br>Zhang, C.; Shi, S.,                                         | Observation of Quantized<br>Exciton Energies in Mono-<br>layer WSe2 under a Strong<br>Magnetic Field                                   | Physical<br>Review X                                                                       | 10  |       | 21024           | 10.1103/Phy<br>sRevX.10.02<br>1024     | Yes                           |
| Wang, T.; Miao, S.; Li, Z.;<br>Meng, Y.; Lu, Z.; Lian, Z.;<br>Blei, M.; Taniguchi, T.;<br>Watanabe, K.; Tongay,<br>S.; Smirnov, D.; Shi, S.,                                                                           | Giant Valley-Zeeman Split-<br>ting from Spin-Singlet and<br>Spin-Triplet Interlayer Exci-<br>tons in WSe2/MoSe2 Heter-<br>ostructure   | American<br>Chemical<br>Society<br>Nano Let-<br>ters                                       | 20  | 1     | 694             | 10.1021/acs<br>.nano-<br>lett.9b04528  | Yes                           |
| Wang, X.; Li, J.; Cao, J.,                                                                                                                                                                                             | Coherent phonon genera-<br>tion in laser-heated gold<br>nanofilm                                                                       | Journal of<br>Chemical<br>Physics                                                          | 152 |       | 12470<br>4      | 10.1063/1.5<br>137818                  | Yes                           |
| Wang, X.; Vafek, O.,                                                                                                                                                                                                   | Diagnosis of explicit sym-<br>metry breaking in the tight-<br>binding constructions for<br>symmetry-protected topo-<br>logical systems | Physical<br>Review B                                                                       | 102 |       | 75142           | 10.1103/Phy<br>sRevB.102.0<br>75142    | Yes                           |
| Yang, K.,                                                                                                                                                                                                              | Phase-space quantum me-<br>chanics as a Landau-level<br>problem                                                                        | Physical<br>Review A                                                                       | 102 |       | 12222           | 10.1103/Phy<br>sRevA.102.0<br>12222    | Yes                           |
| Yang, M.; Robert, C.;<br>Lu, Z.; Van Tuan, D.;<br>Smirnov, D.; Marie, X.;<br>Dery, H.,                                                                                                                                 | Exciton valley depolariza-<br>tion in monolayer transi-<br>tion-metal dichalcogeni-<br>des                                             | Physical<br>Review B                                                                       | 101 |       | 11530<br>7      | 10.1103/Phy<br>sRevB.101.1<br>15307    | Yes                           |
| Yu, Y.; Brown, S.; Raghu,<br>S.; Yang, K.,                                                                                                                                                                             | Critical temperature Tc<br>and Pauli limited critical<br>field of Sr2RuO4: Uniaxial<br>strain dependence                               | Physical<br>Review B                                                                       | 102 |       | 14509           | 10.1103/Phy<br>sRevB.102.0<br>14509    | Yes                           |
| Zeuch, D.; Bonesteel,<br>N.E.,                                                                                                                                                                                         | Efficient two-qubit pulse se-<br>quences beyond CNOT                                                                                   | Physical<br>Review B                                                                       | 102 |       | 75311           | 10.1103/Phy<br>sRevB.102.0<br>75311    | Yes                           |
| Zhang, F.; Zheng, W.;<br>Lu, Y.; Pabbi, L.;<br>Fujizawa, K.; Elias, A.L.;<br>Binnion, A.R.;<br>Granzier-Nakajima, T.;<br>Zhang, T.; Lei, Y.; Lin, Z.;<br>Hudson, E.W.; Sinnott,<br>S.B.; Balicas, L.;<br>Terrones, M., | Superconductivity en-<br>hancement in phase-engi-<br>neered molybdenum car-<br>bide/disulfide vertical het-<br>erostructures           | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA<br>(PNAS) | 117 | 33    | 19685-<br>19693 | 10.1073/pn<br>as.20034221<br>17        | Yes                           |
| Zheng, C.; Yang, K.;<br>Wan, X.,                                                                                                                                                                                       | Thouless conductances of<br>a three-dimensional quan-<br>tum Hall system                                                               | Physical<br>Review B                                                                       | 102 |       | 64208           | 10.1103/Phy<br>sRevB.102.0<br>64208    | Yes                           |
| Zheng, W.;<br>Schoenemann, R.U.;<br>Mozaffari, S.; Chiu, Y.C.;<br>Goraum, Z.B.; Aryal, N.;<br>Manousakis, E.; Siegrist,<br>T.M.; Wei, K.; Balicas, L.,                                                                 | Bulk Fermi surfaces of the<br>Dirac type-II semimetallic<br>candidate NiTe <sub>2</sub>                                                | Physical<br>Review B                                                                       | 102 |       | 12510<br>3      | 10.1103/Phy<br>sRevB.102.1<br>25103    | Yes                           |

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| Zhou, C.; Lee, S.; Lin, H.;<br>Neu, J.N.; Chaaban,<br>M.; Xu, L.; Arcidiacono,<br>A.; He, Q.; Worku, M.;<br>Ledbetter, L.; Lin, X.;<br>Schlueter, J.A.; Siegrist,<br>T.M.; Ma, B., | Bulk Assembly of Multicom-<br>ponent Zero-Dimensional<br>Metal Halides with Dual<br>Emission | American<br>Chemical<br>Society<br>Materials<br>Letters | 2   | 4     | 376-<br>380 | 10.1021/acs<br>materi-<br>alslett.0c000<br>11 | Yes                           |

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| Abadi, M.; Owens, J.D.;<br>Liu, X.; Them, T.; Cui, X.;<br>Heavens, N.; Soreghan,<br>G.,                                                                                                                                                      | Atmospheric dust stimu-<br>lated marine primary<br>productivity during Earth's<br>penultimate icehouse                                                                                                           | Geology                                                                                    | 48    | 3     | 247<br>251      | 10.1130/G4<br>6977.1                      | No                            |
| Abshire, M.L.; Owens,<br>J.D.; Cofrancesco, J.;<br>Inthom, M.; Riedinger,<br>N.,                                                                                                                                                             | Geochemical Signatures<br>for Redepositional Environ-<br>ments: The Namibia Conti-<br>nental Margin                                                                                                              | Marine<br>Geology                                                                          | 429   |       | 10631<br>6      | 10.1016/j.m<br>ar-<br>geo.2020.10<br>6316 | Yes                           |
| Bowman, C.N.;<br>Lindskog, A.; Kozik, N.;<br>Richbourg, C.; Owens,<br>J.D.; Young, S.A.,                                                                                                                                                     | Integrated sedimentary, bi-<br>otic, and paleoredox dy-<br>namics from multiple locali-<br>ties in southern Laurentia<br>during the late Silurian<br>(Ludfordian) extinction<br>event                            | Palaeoge-<br>ography,<br>Palaeocli-<br>matology,<br>Palaeoe-<br>cology                     | 553   |       | 10979<br>9      | 10.1016/j.pa<br>laeo.2020.1<br>09799      | Yes                           |
| Bryant, R.N.; Jones, C.;<br>Raven, M.R.; Owens,<br>J.D.; Fike, D.A.,                                                                                                                                                                         | Shifting modes of iron sul-<br>fidization at the onset of<br>OAE-2 drive regional shifts<br>in pyrite δ34S records                                                                                               | Chemical<br>Geology                                                                        | 553   |       | 11980<br>8      | 10.1016/j.ch<br>emgeo.202<br>0.119808     | Yes                           |
| Bundy, R.M.; Tagliabue,<br>A.; Hawco, N.J.;<br>Morton, P.; Twining, B.S.;<br>Hatta, M.; Noble, A.E.;<br>Cape, M.R.; John, S.G.;<br>Cullen, J.T.; Saito, M.A.,                                                                                | Elevated sources of cobalt<br>in the Arctic Ocean                                                                                                                                                                | Journal of<br>Geophysi-<br>cal Re-<br>search Bio-<br>geosci-<br>ences                      | 17    | 19    | 4745<br>4767    | 10.5194/bg-<br>17-4745-<br>2020           | Yes                           |
| Fan, H.; Nielsen, S.;<br>Owens, J.D.; Auro, M.;<br>Shu, Y.; Hardisty, D.;<br>Horner, T.; Bowman,<br>C.N.; Young, S.A.; Wen,<br>H.,                                                                                                           | Constraining oceanic oxy-<br>genation during the Shu-<br>ram excursion in South<br>China using thallium iso-<br>topes                                                                                            | Geobiol-<br>ogy                                                                            | 18    | 3     | 348<br>365      | 10.1111/gbi.<br>12379                     | Yes                           |
| Gong, Y.; Wang, Y.Q.;<br>Wang, Y.; Mao, F.; Bai,<br>B.; Wang, H.; Qian, L.;<br>Jin, X.; Wang, X.; Meng,<br>J.,                                                                                                                               | Dietary adaptations and<br>paleoecology of Lophialet-<br>idae (Mammalia: Tapiroi-<br>dea) from the Eocene of<br>the Erlian Basin, China:<br>Combined evidence from<br>mesowear and stable iso-<br>tope analyses. | Palaeon-<br>tology                                                                         | 63    | 4     | 547-<br>564     | 10.1111/pal<br>a.12471                    | Yes                           |
| Hawkings, J.R.;<br>Skidmore, M.L.;<br>Wadham, J.L.; Priscu,<br>J.C.; Morton, P.L.;<br>Hatton, J.E.; Gardner,<br>C.B.; Kohler, T.J.; Stibal,<br>M.; Bagshaw, E.A.;<br>Steigmeyer, A.; Barker,<br>J.; Dore, J.E.; Lyons,<br>W.B.; Tranter, M.; | Enhanced trace element<br>mobilization by Earth's ice<br>sheets                                                                                                                                                  | Proceed-<br>ings of the<br>National<br>Academy<br>of Sci-<br>ences of<br>the USA<br>(PNAS) | 117   | 50    | 31648-<br>31659 | 10.1073/pn<br>as.20143781<br>17           | Yes                           |

| Authors                                                                                                                                                                                 | Title                                                                                                                                                                                                                 | Journal<br>Name                                                        | Vol | Issue | Pages        | DOI                                     | Cites<br>NSF<br>Core<br>Grant |
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| Spencer, R.G.M.; SALSA<br>Science Team, .,                                                                                                                                              |                                                                                                                                                                                                                       |                                                                        |     |       |              |                                         |                               |
| Jensen, L.T.; Morton,<br>P.L.; Twining, B.S.; Heller,<br>M.I.; Hatta, M.;<br>Measures, C.I.; John,<br>S.G.; Zhang, R.;<br>Pinedo-Gonzalez, P.;<br>Sherrell, R.M.;<br>Fitzsimmons, J.N., | A comparison of marine Fe<br>and Mn cycling: US GE-<br>OTRACES GN01 Western<br>Arctic case study                                                                                                                      | Geo-<br>chimica et<br>Cosmo-<br>chimica<br>Acta                        | 288 |       | 138<br>160   | 10.1016/j.gc<br>a.2020.08.00<br>6       | Yes                           |
| Ostrander, C.M.;<br>Owens, J.D.; Nielsen,<br>S.G.; Lyons, T.W.; Shu,<br>Y.; Chen, X.; Sperling,<br>E.A.; Jiang, G.;<br>Johnston, D.T.; Sahoo,<br>S.K.; Anbar, A.D.,                     | Thallium isotope ratios in<br>shales from South China<br>and northwestern Canada<br>suggest widespread O2<br>accumulation in marine<br>bottom waters was an un-<br>common occurrence dur-<br>ing the Ediacaran Period | Chemical<br>Geology                                                    | 557 |       | 11985<br>6   | 10.1016/j.ch<br>emgeo.202<br>0.119856   | Yes                           |
| Wang, J.; Zhou, H.;<br>Salters, V.J.; Dick, H.J.B.;<br>Standish, J.J.; Wang, C.,                                                                                                        | Trace element and iso-<br>topic evidence for recy-<br>cled lithosphere at basalts<br>from 48°E to 53°E, South-<br>west Indian Ridge                                                                                   | Journal of<br>Petrology                                                | 61  |       | 0            | 10.1093/pe-<br>trol-<br>ogy/egaa0<br>68 | Yes                           |
| Willig, M.; Stracke, A.;<br>Beier, C.; Salters, V.J.,                                                                                                                                   | Constraints on mantle evo-<br>lution from Ce-Nd-Hf iso-<br>tope systematics                                                                                                                                           | Geo-<br>chimica et<br>Cosmo-<br>chimica<br>Acta                        | 272 |       | 36-53        | 10.1016/j.gc<br>a.2019.12.02<br>9       | Yes                           |
| Wu, F.; Owens, J.D.;<br>Scholz, F.; Huang, L.; Li,<br>S.; Riedinger, N.;<br>Peterson, L.; German,<br>C.; Nielsen, S.,                                                                   | Sedimentary vanadium iso-<br>tope signatures in low oxy-<br>gen marine conditions                                                                                                                                     | Geo-<br>chimica et<br>Cosmo-<br>chimica<br>Acta                        | 284 |       | 134-<br>155  | 10.1016/j.gc<br>a.2020.06.01<br>3       | No                            |
| Wu, X.; Zhang, L.; Hu, B.<br>X.; Wang, Y.; Xu, Z.,                                                                                                                                      | Isotopic and hydrochemi-<br>cal evidence for the salin-<br>ity origin in the coastal aq-<br>uifers of the Pearl River<br>Delta, Guangzhou, China.                                                                     | Journal of<br>Contami-<br>nant Hy-<br>drology                          | 235 |       | 10373<br>2   | 10.1016/j.jc<br>onhyd.2020.<br>103732   | Yes                           |
| Yang, S.; Humayun, M.;<br>Salters, V.J.,                                                                                                                                                | Elemental constraints on<br>the amount of recycled<br>crust in the generation of<br>mid-ocean ridge basalts<br>(MORB)                                                                                                 | Science<br>Advances                                                    | 6   | 26    | eaba<br>2923 | 10.1126/sci-<br>adv.aba292<br>3         | Yes                           |
| Young, S.A.; Benayoun,<br>E.; Kozik, N.; Hints, O.;<br>Martma, T.; Bergström,<br>S.T.; Owens, J.D.,                                                                                     | Marine redox variability<br>from Baltica during extinc-<br>tion events in the latest Or-<br>dovicianearly Silurian                                                                                                    | Palaeoge-<br>ography,<br>Palaeocli-<br>matology,<br>Palaeoe-<br>cology | 554 |       | 10979<br>2   | 10.1016/j.pa<br>laeo.2020.1<br>09792    | Yes                           |

## Publications generated by facilities: MBI at UF<sup>1</sup> (37)

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| Authors                                                                                                                                                                                                                                                                                          | Title                                                                                                                                                             | Journal<br>Name                                             | Vol | Issue | Pages         | DOI                                      | Cites<br>NSF<br>Core<br>Grant |
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| Barnard, A.M.;<br>Willcocks, R.J.; Triplett,<br>W.T.; Forbes, S.C.;<br>Daniels, M.J.;<br>Chakraborty, S.; Lott,<br>D.J.; Senesac, C.R.;<br>Finanger, E.L.;<br>Harrington, A.T.;<br>Tennekoon, G.; Arora,<br>H.; Wang, D.J.;<br>Sweeney, H.L.; Rooney,<br>W.D.; Walter, G.A.;<br>Vandenborne, K., | MR biomarkers predict clin-<br>ical function in Duchenne<br>muscular dystrophy                                                                                    | Neurology                                                   | 94  | 9     | e897-<br>e909 | 10.1212/WN<br>L.000000000<br>0009012     | No                            |
| Bikson, M.; et all                                                                                                                                                                                                                                                                               | Guidelines for TMS/tES clini-<br>cal services and research<br>through the COVID-19<br>pandemic                                                                    | Brain Stim-<br>ulation                                      | 13  | 4     | 1124-<br>1149 | 10.1016/j.brs<br>.2020.05.010            | No                            |
| Bogoian, H.R.; King, T.Z.;<br>Turner, J.A.; Semmel,<br>E.S.; Dotson, V.M.,                                                                                                                                                                                                                       | Linking depressive symp-<br>tom dimensions to cerebel-<br>lar subregion volumes in<br>later life                                                                  | Transla-<br>tional Psy-<br>chiatry                          | 10  | 1     | 18            | 10.1038/s41<br>398-020-<br>00883-6       | Yes                           |
| Boissoneault, J.; Penza,<br>C.W.; George, S.Z.;<br>Robinson, M.E.; Bishop,<br>M.D.,                                                                                                                                                                                                              | Comparison of brain struc-<br>ture between pain-suscep-<br>tible and asymptomatic in-<br>dividuals following experi-<br>mental induction of low<br>back pain      | Spine Jour-<br>nal                                          | 20  | 2     | 292-<br>299   | 10.1016/j.spi<br>nee.2019.08<br>.015     | Yes                           |
| Boissoneault, J.; Sevel,<br>L.; Stennett, B.;<br>Alappattu, M.; Bishop,<br>M.; Robinson, M.,                                                                                                                                                                                                     | Regional increases in brain<br>signal variability are associ-<br>ated with pain intensity re-<br>ductions following re-<br>peated eccentric exercise<br>bouts     | European<br>Journal of<br>Pain                              | 24  | 4     | e1532         | 10.1002/ejp.<br>1532                     | Yes                           |
| Boissoneault, J.;<br>Stennett, B.; Robinson,<br>M.E.,                                                                                                                                                                                                                                            | Acute alcohol intake alters<br>resting state functional<br>connectivity of nucleus ac-<br>cumbens with pain-related<br>corticolimbic structures                   | Drug and<br>Alcohol<br>Depend-<br>ence                      | 207 |       | 10781<br>1    | 10.1016/j.dr<br>ugalcdep.2<br>019.107811 | No                            |
| Bril, F.; Barb, D.;<br>Lomonaco, R.; Lai, J.;<br>Cusi, K.,                                                                                                                                                                                                                                       | Change in hepatic fat<br>content measured by MRI<br>does not predict treat-<br>ment-induced histological<br>improvement of steato-<br>hepatitis                   | Journal of<br>Hepatol-<br>ogy                               | 72  | 3     | 401<br>410    | 10.1016/j.jh<br>ep.2019.09.<br>018       | No                            |
| Bril, F.; McPhaul, M.J.;<br>Caulfield, M.P.; Clark,<br>V.C.; Soldevilla-Pico, C.;<br>Firpi-Morell, R.J.; Lai,<br>J.P.; Shiffman, D.;<br>Rowland, C.M.; Cusi, K.,                                                                                                                                 | Performance of Plasma Bi-<br>omarkers and Diagnostic<br>Panels for Nonalcoholic<br>Steatohepatitis and Ad-<br>vanced Fibrosis in Patients<br>With Type 2 Diabetes | Diabetes<br>Care                                            | 43  | 2     | 290<br>297    | 10.2337/dc1<br>9-1071                    | No                            |
| Britton, M.; Porges, E.;<br>Bryant, V.; Cohen, R.,                                                                                                                                                                                                                                               | Neuroimaging and Cogni-<br>tive Evidence for Com-<br>bined HIV-Alcohol Effects<br>on the Central Nervous Sys-<br>tem: A Review                                    | Alcoholism<br>Clinical<br>and Exper-<br>imental<br>Research |     |       | 14530         | 10.1111/ac<br>er.14530                   | No                            |

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| Chen, Q.Y.; Luo, D.;<br>Seabra, G.M.; Luesch,<br>H.,                                                                                                                                                                                                                                                              | Ahp-Cyclodepsipeptides<br>as tunable inhibitors of hu-<br>man neutrophil elastase<br>and kallikrein 7: Total syn-<br>thesis of tutuilamide A, ser-<br>ine protease selectivity<br>profile and comparison<br>with lyngbyastatin 7 | Bioorganic<br>and Me-<br>dicinal<br>Chemistry | 28   | 23    | 11575<br>6   | 10.1016/j.b<br>mc.2020.11<br>5756             | No                            |
| Clark, D.J.; Manini, T.M.;<br>Ferris, D.P.; Hass, C.J.;<br>Brumback, B.A.; Cruz-<br>Almeida, Y.; Pahor, M.;<br>Reuter-Lorenz, P.A.;<br>Seidler, R.D.,                                                                                                                                                             | Multimodal imaging of<br>brain activity to investigate<br>walking and mobility de-<br>cline in older adults (mind<br>in motion study): Hypothe-<br>sis, theory, and methods                                                      | Frontiers in<br>Aging<br>Neurosci-<br>ence    | 11   |       | 358          | 10.3389/fna<br>gi.2019.0035<br>8              | No                            |
| Diaz-Manera, J.; Walter,<br>G.A.; Straub, V.,                                                                                                                                                                                                                                                                     | Skeletal muscle magnetic<br>resonance imaging in<br>Pompe disease                                                                                                                                                                | Muscle<br>and Nerve                           | ePub |       | 11-<br>Jan   | 10.1002/mu<br>s.27099                         | No                            |
| Forbes, S.C.; Arora, H.;<br>Willcocks, R.J.; Triplett,<br>W.T.; Rooney, W.D.;<br>Barnard, A.M.; Alabasi,<br>U.; Wang, D.J.; Lott,<br>D.J.; Senesac, C.R.;<br>Harrington, A.T.;<br>Finanger, E.L.;<br>Tennekoon, G.I.;<br>Brandsema, J.; Daniels,<br>M.J.; Sweeney, H.L.;<br>Walter, G.A.;<br>Vandenborne, K.H.E., | Upper and Lower Extremi-<br>ties in Duchenne Muscular<br>Dystrophy Evaluated with<br>Quantitative MRI and Pro-<br>ton MR Spectroscopy in a<br>Multicenter Cohort                                                                 | Radiology                                     | 295  | 3     | 616-<br>625  | 10.1148/ra-<br>diol.2020192<br>210            | Yes                           |
| Gullett, J.M.; O'Shea,<br>A.; Lamb, D.G.; Porges,<br>E.C.; O'Shea, D.M.;<br>Pasternak, O.; Cohen,<br>R.A.; Woods, A.J.,                                                                                                                                                                                           | The Association of White<br>Matter Free Water with<br>Cognition in Older Adults                                                                                                                                                  | Neu-<br>rolmage                               | 219  |       | 11704<br>0   | 10.1016/j.ne<br>uroimage.2<br>020.117040      | No                            |
| Hausman, H.K.; O'Shea,<br>A.; Kraft, J.N.;<br>Boutzoukas, E.M.;<br>Evangelista, N.D.; Van<br>Etten, E.J.; Bharadwaj,<br>P.K.; Smith, S.G.; Porges,<br>E.; Hishaw, G.A.; Wu, S.;<br>DeKosky, S.; Alexander,<br>G.E.; Marsiske, M.;<br>Cohen, R.; Woods, A.J.,                                                      | The Role of Resting-State<br>Network Functional Con-<br>nectivity in Cognitive Ag-<br>ing                                                                                                                                        | Frontiers in<br>Aging<br>Neurosci-<br>ence    | 12   |       | 177          | 10.3389/fna<br>gi.2020.0017<br>7              | No                            |
| Judge, S.M.; Deyhle,<br>M.R.; Neyroud, D.;<br>Nosacka, R.L.; D'Lugos,<br>A.C.; Cameron, M.E.;<br>Vohra, R.S.; Smuder,<br>A.J.; Roberts, B.M.;<br>Callaway, C.S.;<br>Underwood, P.W.;<br>Chrzanowski, S.M.;<br>Batra, A.; Murphy, M.E.;<br>Heaven, J.D.; Walter,                                                   | MEF2c-Dependent Down-<br>regulation of Myocilin Me-<br>diates Cancer-Induced<br>Muscle Wasting and Asso-<br>ciates with Cachexia in Pa-<br>tients with Cancer                                                                    | Cancer<br>Research                            | 80   | 9     | 1861<br>1874 | 10.1158/000<br>8-<br>5472.CAN-<br>19-1558     | No                            |

| Authors                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Title                                                                                                                            | Journal<br>Name                            | Vol          | Issue | Pages       | DOI                              | Cites<br>NSF<br>Core<br>Grant |
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| G.A.; Trevino, J.G.;<br>Judge, A.R.,                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                  |                                            |              |       |             |                                  | Grant                         |
| Kraft, J.N.; O'Shea, A.;<br>Albizu, A.; Evangelista,<br>N.D.; Hausman, H.K.;<br>Boutzoukas, E.; Nissim,<br>N.R.; Van Etten, E.J.;<br>Bharadwaj, P.K.; Song,<br>H.; Smith, S.G.; Porges,<br>E.; DeKosky, S.; Hishaw,<br>G.A.; Wu, S.; Marsiske,<br>M.; Cohen, R.;<br>Alexander, G.E.;<br>Woods, A.J.,                                                                                                                                                             | Structural Neural Correlates<br>of Double Decision Perfor-<br>mance in Older Adults                                              | Frontiers in<br>Aging<br>Neurosci-<br>ence | 12           |       | 278         | 10.3389/fna<br>gi.2020.0027<br>8 | No                            |
| Lins-Austin, B.; Patel, S.;<br>Mietzsch, M.; Brooke,<br>D.; Bennett, A.;<br>Venkatakrishnan, B.;<br>Van Vliet, K.; Smith,<br>A.N.; Long, J.R.;<br>McKenna, R.; Potter,<br>M.; Byrne, B.; Boye, S.L.;<br>Bothner, B.; Heilbronn,<br>R.; Agbandje-<br>McKenna, M.,                                                                                                                                                                                                 | Adeno-associated virus<br>(AAV) Capsid stability and<br>liposome remodeling dur-<br>ing Endo/Lysosomal pH<br>trafficking         | Viruses                                    | 12           | 6     | 668         | 10.3390/v12<br>060668            | No                            |
| Lott, D.; Taivassalo, T.;<br>Cooke, K.; Park, H.;<br>Moslemi, Z.; Batra, A.;<br>Forbes, S.C.; Byrne, B.;<br>Walter, G.A.;<br>Vandenborne, K.H.E.,                                                                                                                                                                                                                                                                                                                | Safety, feasibility, and effi-<br>cacy of strengthening ex-<br>ercise in Duchenne muscu-<br>lar dystrophy                        | Muscle<br>and Nerve                        |              |       | 27137       | 10.1002/mu<br>s.27137            | Yes                           |
| Makwana, B.; Tart-<br>Zelvin, A.; Xu, X.M.;<br>Gunstad, J.J.; Cote,<br>D.M.; Poppas, A.;<br>Cohen, R.A.; Sweet,<br>L.H.,                                                                                                                                                                                                                                                                                                                                         | Cerebrovascular Perfusion<br>among Older Adults with<br>and Without Cardiovascu-<br>lar Disease                                  | Journal of<br>Neuroim-<br>aging            | 30           | 6     | 851-<br>856 | 10.1111/jon.<br>12757            | No                            |
| A.F.; Miller, M.B.; Nair,<br>N.; Rathinakumar, H.;<br>Davenport, M.; Berry,<br>J.R.; McGovney, K.;<br>Staud, R.; Berry, R.;<br>Robinson, M.,                                                                                                                                                                                                                                                                                                                     | Effect of cognitive behav-<br>ioral therapy on sleep and<br>opioid medication use in<br>adults with fibromyalgia<br>and insomnia | Journal of<br>Sleep Re-<br>search          | 29           | 6     | e1302<br>0  | 10.1111/jsr.1<br>3020            | No                            |
| Meyerspeer, M.;<br>Boesch, C.; Cameron,<br>D.; Dezortova, M.;<br>Forbes, S.C.;<br>Heerschap, A.;<br>Jeneson, J.A.L.; Kan,<br>H.M.E.; Kent, J.; Layec,<br>G.; Prompers, J.J.;<br>Reyngoudt, H.; Sleigh,<br>A.; Valkovic, L.; Kemp,<br>G.J.; Baligand, C.;<br>Carlier, P.G.; Chatel, B.;<br>Damon, B.; Heskamp,<br>L.; Hajek, M.; Jooijmans,<br>M.; Krssak, M.;<br>Reichenbach, J.;<br>Schmid, A.; Slade, J.;<br>Vandenborne, K.H.E.;<br>Walter, G.A.; Willis, D., | <sup>31</sup> P magnetic resonance<br>spectroscopy in skeletal<br>muscle: Experts' consensus<br>recommendations                  | NMR in Bio-<br>medicine                    | Spe-<br>cial |       | 22-<br>Jan  | 10.1002/nb<br>m.4246             | No                            |

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| Povazan, M.; et all                                                                                                                                                                                                                                                                                                                                                       | Comparison of multivendor<br>single-voxel MR spectros-<br>copy data acquired in<br>healthy brain at 26 sites                                                            | Radiology                                         | 295  | 1     | 171-<br>180        | 10.1148/ra-<br>diol.2020191<br>037  | No                            |
| Quattrone, A.; Antonini,<br>A.; Vaillancourt, D.;<br>Seppi, K.; Ceravolo, R.;<br>Strafella, A.; Morelli, M.;<br>Nigro, S.; Vescio, B.;<br>Bianco, M.; Vasta, R.;<br>Arcuri, P.; Weis, L.;<br>Fiorenzato, E.; Biundo,<br>R.; Burciu, R.; Krismer, F.;<br>McFarland, N.; Mueller,<br>C.; Gizewski, E.;<br>Cosottini, M.; Del Prete,<br>E.; Mazzucchi, S.;<br>Quattrone, A., | A New MRI Measure to<br>Early Differentiate Progres-<br>sive Supranuclear Palsy<br>From De Novo Parkinson''s<br>Disease in Clinical Practice:<br>An International Study | Movement<br>Disorders                             | ePub |       | 10-<br>Jan         | 10.1002/md<br>s.28364               | No                            |
| Rooney, W.D.; Berlow,<br>Y.A.; Triplett, W.T.;<br>Forbes, S.C.; Willcocks,<br>R.J.; Wang, D.J.; Arpan,<br>I.; Arora, H.; Senesac,<br>C.; Lott, D.J.;<br>Tennekoon, G.; Finkel,<br>R.; Russman, B.S.;<br>Finanger, E.L.;<br>Chakraborty, S.;<br>O'Brien, E.; Moloney, B.;<br>Barnard, A.; Sweeney,<br>H.L.; Daniels, M.J.; Wal-<br>ter, G.A.;<br>Vandenborne, K.H.E.,      | Modeling disease trajec-<br>tory in Duchenne muscular<br>dystrophy                                                                                                      | Restorative<br>Neurology<br>and Neu-<br>roscience | 94   | 15    | e1622<br><br>e1633 | 10.1212/WN<br>L.00000000<br>0009244 | No                            |
| Salazar, A.P.; Hupfeld,<br>K.E.; Lee, J.K.; Beltran,<br>N.E.; Kofman, I.S.; De<br>Dios, Y.E.; Mulder, E.;<br>Bloomberg, J.J.;<br>Mulavara, A.P.; Seidler,<br>R.D.,                                                                                                                                                                                                        | Neural Working Memory<br>Changes During a Space-<br>flight Analog With Elevated<br>Carbon Dioxide: A Pilot<br>Study                                                     | Frontiers in<br>Systems<br>Neurosci-<br>ence      | 14   |       | 48                 | 10.3389/fnsy<br>s.2020.00048        | No                            |
| Saleh, M.G.; Wang, M.;<br>Mikkelsen, M.; Hui,<br>S.C.N.; Oeltzschner, G.;<br>Boissoneault, J.;<br>Stennett, B.; Edden,<br>R.A.E.; Porges, E.C.,                                                                                                                                                                                                                           | Simultaneous edited MRS<br>of GABA, glutathione, and<br>ethanol                                                                                                         | NMR in Bio-<br>medicine                           | 33   | 4     | e4227              | 10.1002/nb<br>m.4227                | Yes                           |
| Sambuco, N.; Bradley,<br>M.M.; Herring, D.R.;<br>Lang, P.J.,                                                                                                                                                                                                                                                                                                              | Common circuit or para-<br>digm shift? The functional<br>brain in emotional scene                                                                                       | Psycho-<br>physiology                             | 57   | 4     | e1352<br>2         | 10.1111/psy<br>p.13522              | Yes                           |

| Authors                                                                                                                                                                  | Title                                                                                                                                                                                   | Journal<br>Name                                             | Vol  | Issue | Pages         | DOI                                    | Cites<br>NSF<br>Core<br>Grant |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------|-------|---------------|----------------------------------------|-------------------------------|
|                                                                                                                                                                          | perception and emotional<br>imagery                                                                                                                                                     |                                                             |      |       |               |                                        |                               |
| Sevel, L.; Boissoneault,<br>J.; Alappattu, M.J.;<br>Bishop, M.D.; Robinson,<br>M.E.,                                                                                     | Training Endogenous Pain<br>Modulation: A Preliminary<br>Investigation of Neural Ad-<br>aptation Following Re-<br>peated Exposure to Clini-<br>cally-Relevant Pain                      | Brain Im-<br>aging and<br>Behavior                          | 14   | 3     | 881-<br>896   | 10.1007/s11<br>682-018-<br>0033-8      | No                            |
| Sevel, L.; Stennett, B.;<br>Schneider, V.; Bush, N.;<br>Nixon, S.J.; Robinson,<br>M.; Boissoneault, J.,                                                                  | Acute Alcohol Intake Pro-<br>duces Widespread De-<br>creases in Cortical Resting<br>Signal Variability in Healthy<br>Social Drinkers                                                    | Alcoholism<br>Clinical<br>and Exper-<br>imental<br>Research | 44   | 7     | 1410-<br>1419 | 10.1111/ac<br>er.14381                 | No                            |
| Terry, E.; Tanner, J.;<br>Cardoso, J.; Sibille, K.;<br>Lai, S.; Deshpande, H.;<br>Deutsch, G.; Goodin,<br>B.; Bradley, L.; Price,<br>C.C.; Fillingim, R.B.;<br>Team, U., | Associations of pain<br>catastrophizing with pain-<br>related brain structure in in-<br>dividuals with or at risk for<br>knee osteoarthritis: Socio-<br>demographic considera-<br>tions | Brain Im-<br>aging and<br>Behavior                          | ePub |       | 9-Jan         | 10.1007/s11<br>682-020-<br>00372-w     | No                            |
| Thompson, P.M.; et all                                                                                                                                                   | ENIGMA and global neuro-<br>science: A decade of<br>large-scale studies of the<br>brain in health and disease<br>across more than 40 coun-<br>tries                                     | Transla-<br>tional Psy-<br>chiatry                          | 10   | 1     | 28-<br>Jan    | 10.1038/s41<br>398-020-<br>0705-1      | No                            |
| Yacoubi, B.;<br>Casamento-Moran, A.;<br>Burciu, R.G.;<br>Subramony, S.H.;<br>Vaillancourt, D.E.;<br>Christou, E.A.,                                                      | Temporal invariance in<br>SCA6 is related to smaller<br>cerebellar lobule VI and<br>greater disease severity                                                                            | Journal of<br>Neurosci-<br>ence Re-<br>search               | 40   | 8     | 1722-<br>1731 | 10.1523/JNE<br>UROSCI.153<br>2-19.2019 | No                            |

# Publications generated by facilities: UF Physics (9)

UF Physics

| Authors                                                                                                           | Title                                                                                                                                                      | Journal<br>Name                               | Vol | Issue | Pages        | DOI                                     | Cites<br>NSF<br>Core<br>Grant |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----|-------|--------------|-----------------------------------------|-------------------------------|
| Du, Y.; Behera, R.;<br>Maligal-Ganesh, R.;<br>Chen, M.; Chekmenev,<br>E.; Huang, W.; Bowers,<br>C.,               | Cyclopropane Hydrogena-<br>tion vs Isomerization over Pt<br>and PtSn Intermetallic Na-<br>noparticle Catalysts: A Par-<br>ahydrogen Spin-Labeling<br>Study | Journal of<br>Physical<br>Chemistry<br>C      | 124 | 15    | 8304<br>8309 | 10.1021/acs<br>.jpcc.0c024<br>93        | Yes                           |
| Du, Y.; Zhou, R.; Ferrer,<br>M.; Chen, M.; Graham,<br>J.; Malphurs, B.; Labbe,<br>G.; Huang, W.; Bowers,<br>C.,   | An Inexpensive Apparatus<br>for up to 97% Continuous-<br>Flow Parahydrogen Enrich-<br>ment Using Liquid Helium                                             | Journal of<br>Magnetic<br>Reso-<br>nance      | 321 |       | 10686<br>9   | 10.1016/j.jmr<br>.2020.10686<br>9       | Yes                           |
| Elmslie, T.A.;<br>VanGennep, D.; Bi, W.;<br>Lai, Y.; Weir, S.T.; Vohra,<br>Y.K.; Baumbach, R.E.;<br>Hamlin, J.J., | Pressure-induced suppres-<br>sion of ferromagnetism in<br>CePd <sub>2</sub> P <sub>2</sub>                                                                 | Physical<br>Review B                          | 102 |       | 12514<br>6   | 10.1103/Phy<br>sRevB.102.1<br>25146     | Yes                           |
| Huan, C.; Adams, J.;<br>Lewkowitz, M.;<br>Masuhara, N.;<br>Candela, D.; Sullivan,<br>N.S.,                        | NMR Studies of the Dynam-<br>ics of 1D 3He in 4He Plated<br>MCM-41                                                                                         | Journal of<br>Low Tem-<br>perature<br>Physics | 201 |       | 146          | 10.1007/s10<br>909-020-<br>02358-w      | Yes                           |
| Huan, C.; Hamida, J.A.;<br>Sullivan, N.S.,                                                                        | NMR studies of the dynam-<br>ics of HD adsorbed in<br>MCM-41                                                                                               | Mi-<br>croporous                              | 294 |       | 10992<br>1   | 10.1016/j.mi<br>cromeso.20<br>19.109921 | Yes                           |

| Authors                                                                                                                                                        | Title                                                                                                                                         | Journal<br>Name                  | Vol | Issue | Pages        | DOI                                      | Cites<br>NSF<br>Core<br>Grant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----|-------|--------------|------------------------------------------|-------------------------------|
|                                                                                                                                                                |                                                                                                                                               | and Meso-<br>porous<br>Materials |     |       |              |                                          |                               |
| Pajerowski, D.M.;<br>Manson, J.L.; Herbrych,<br>J.; Bendix, J.;<br>Podlesnyak, A.A.; Cain,<br>J.M.; Meisel, M.W.,                                              | Inelastic neutron scattering<br>study of the anisotropic S =<br>1 spin chain [Ni(HF <sub>2</sub> )(3-<br>Clpyridine)4]BF4                     | Physical<br>Review B             | 101 |       | 94431        | 10.1103/Phy<br>sRevB.101.0<br>94431      | Yes                           |
| Pei, Y.; Chen, M.;<br>Zhong, X.; Zhao, T.;<br>Ferrer, M.;<br>Maligal-Ganesh, R.;<br>Ma, T.; Zhang, B.; Qi, Z.;<br>Zhou, L.; Bowers, C.; Liu,<br>C.; Huang, W., | Pairwise semi-hydrogena-<br>tion of alkyne to cis-alkene<br>on platinum-tin intermetal-<br>lic compounds                                      | Nanoscale<br>Research<br>Letters | 12  | 15    | 8519<br>8524 | 10.1039/D0<br>NR00920B                   | Yes                           |
| Romer, A.T.; Maier, T.A.;<br>Kreisel, A.; Eremin, I.;<br>Hirschfeld, P.J.;<br>Andersen, B.M.,                                                                  | Pairing in the two-dimen-<br>sional Hubbard model from<br>weak to strong coupling                                                             | Physical<br>Review Re-<br>search | 2   |       | 13108        | 10.1103/Phy<br>sRevResear<br>ch.2.013108 | No                            |
| Song, B.; Choi, D.; Xin,<br>Y.; Bowers, C.R.;<br>Hagelin-Weaver, H.,                                                                                           | Ultra-Low Loading Pt/CeO2<br>Catalysts: Ceria Facet Ef-<br>fect Affords Improved Pair-<br>wise Selectivity for Parahy-<br>drogen Enhanced NMR | An-<br>gewandte<br>Chemie        |     |       |              | 10.1002/ani<br>e.202012469               | Yes                           |

# Books, Chapters, Reviews and Other One-Time Publications (5)

| Authors                                                                                                     | Title                                                                                                                                    | Facility                         |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Bird, M.D.,                                                                                                 | Ultra-High Field Solenoids and Axion Detection                                                                                           | MS & T                           |
| Pradhan, N.R.; Thantirige, R.; Patil, P.D.;<br>McGill, S.A.; and Talapatra, S.,                             | Chapter 6: Electronic and optoelectronic prop-<br>erties of the heterostructure devices composed<br>of two-dimensional layered materials | DC Field Facility                |
| Pradhan, Nihar R.; Thantirige, Rukshan;<br>Patil; Prasanna D.;McGill; Stephen A. and<br>Tallapatra, Saikat, | Electronic and optoelectronic properties of the<br>heterostructure devices composed of two-di-<br>mensional layered materials            | DC Field Facility                |
| Singleton, J.,                                                                                              | Nineteenth Century Small Organ Design on the<br>Other Side of the Pond                                                                   | Pulsed Field Facility<br>at LANL |
| Sitther, V.; Tabatabai, B.; Fathabad, S.G.;<br>Gichuki, S.; Chen, H. and Arumanayagam,<br>C.S.,             | Cyanobacteria as a Biofuel Source: Advances and Applications                                                                             | ICR Facility                     |

# Patents & Other Products (3)

| Authors                                | Title                                                                                                               | Facility                            |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Bowers, C.R.; Zhao, W.,                | Methods and systems for producing, using, and<br>administering hyperpolarized fluids (US Patent<br>App. 16/753,875) | AMRIS Facility at UF,<br>UF Physics |
| Chang, NB.; Wanielista, M.P.,          | Iron Fillings-based Green Environmental Media<br>for Nutrient Removal and Methods of Use                            | ICR Facility                        |
| Pradhan, Nihar and McGill, Stephen A., | Phase Modulators Based On Ambipolar Field-Effect Transistors, US Patent 10,854,740                                  | DC Field Facility                   |

#### Internet Disseminations (19)

| Authors                       | Title                                                                                           | Facility                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Cheggour, N. and Marks, E.L., | On the Need for Protocols and Standard Proce-<br>dures for Studying Ic(strain) in Bi-2212 Wires | MS & T, Applied Su-<br>perconductivity<br>Center |

| Authors                                                                                                                                                                                                                                                                                                                                                                                     | Title                                                                                                                                            | Facility                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Grissonnanche G.; Fang Y.; Legros A.; Ver-<br>ret S.; Laliberté F.; Collignon C.; Zhou J.;<br>Graf D.; Goddard P.; Taillefer L.; Ramshaw<br>B.J.,                                                                                                                                                                                                                                           | Measurement of the Planckian scattering rate                                                                                                     | DC Field Facility,<br>CMT/E, MS & T                           |
| Grockowiak D.; Ahart M.; Helm T.; Coniglio<br>W.A.; Kumar R.; Somayazulu M.; Meng Y.;<br>Oliff M.; Williams V.; Ashcroft N.W.; Hemley<br>R.J.; Tozer S.W.,                                                                                                                                                                                                                                  | Hot Hydride Superconductivity above 550 K                                                                                                        | DC Field Facility,<br>CMT/E                                   |
| Haley, S.C.; Maniv, E.; Cookmeyer, T.;<br>Maksimovic, N.; Parker, D.E.; John, C.;<br>Doyle, S.; Weber, S.F.; Neaton, J.B.; Single-<br>ton, J.; Analytis, J.G.,                                                                                                                                                                                                                              | Half-magnetization plateau and the origin of threefold symmetry breaking in an electrically-switchable triangular antiferromagnet                | Pulsed Field Facility<br>at LANL                              |
| Khan, M.A.; Chang, P.; Ghimire, N.; Bretz-<br>Sullivan, T.M.; Bhattacharya, A.; Jiang, J.S.;<br>Singleton, J.; Mitchell, J.F.,                                                                                                                                                                                                                                                              | Fermi surface topology and non-trivial Berry phase in the flat-band semimetal Pd3Pb                                                              | Pulsed Field Facility<br>at LANL                              |
| Liu X.; Wang Z.; Watanabe K.; Taniguchi T.;<br>Vafek O.; Li J.I.A.,                                                                                                                                                                                                                                                                                                                         | Tuning electron correlation in magic-angle<br>twisted bilayer graphene using Coulomb screen-<br>ing                                              | CMT/E                                                         |
| Liu, C.; Humbert, V.F.C.; Bretz-Sullivan, T.M.;<br>Wang, G.; Hong, D.; Wrobel, F.; Zhang, J.;<br>Hoffman, J.D.; Pearson, J.E.; Jiang, J.S.;<br>Chang, C.; Suslov, A.; Mason, N.; Norman,<br>M.R. and Bhattacharya, A.,                                                                                                                                                                      | Observation of an antiferromagnetic quantum critical point in high-purity LaNiO3                                                                 | DC Field Facility                                             |
| Maksimovic, N.; Hayes, I.M.; Nagarajan,<br>V.; Koshelev, A.E.; Singleton, J.; Lee, Y.;<br>Schenkel, T.; Analytis, J.G,                                                                                                                                                                                                                                                                      | Magnetoresistance scaling, disorder, `hot spots'<br>and the origin of T-linear resistivity in<br>BaFe2(As1-xPx)2                                 | Pulsed Field Facility<br>at LANL                              |
| Modic K.A.; McDonald R.D.; Ruff J.P.C.;<br>Bachmann M.D.; Lai Y.; Palmstrom J.C.;<br>Graf D.; Chan M.; Balakirev F.F.; Betts J.B.;<br>Boebinger G.S.; Schmidt M.; Sokolov D.A.;<br>Moll P.J.W.; Ramshaw B.J.; Shekhter A.,                                                                                                                                                                  | Scale-Invariance of a Spin Liquid in High Mag-<br>netic Fields                                                                                   | DC Field Facility,<br>Pulsed Field Facility<br>at LANL, CMT/E |
| Opherden, D.; Nizar, N.; Richardson, K.;<br>Monroe, J.C.; Turnbull, M.M.; Polson, M.;<br>Vela, S.; Blackmore, W.J.; Goddard, P.A.;<br>Singleton, J.; Choi, E.S.; Xiao, F.; Williams,<br>R.C.; Lancaster, T.; Pratt, F.L.; Blundell, S.J.;<br>Skourski, Y.; Uhlarz, M.; Ponomaryov, A.N.;<br>Zvyagin, S.A.; Wosnitza, J.; Baenitz, M.;<br>Heinmaa.I.; Stern, R.; Kühne, H.; Landee,<br>C.P., | Extremely well-isolated 2D spin-1/2 antiferromag-<br>netic Heisenberg layers with small exchange<br>coupling in the molecular-based magnet CuPOF | Pulsed Field Facility<br>at LANL                              |
| Post, K.W.; Legros, A.; Rickel, D.G.; Single-<br>ton, J.; McDonald, R.D.; He, X.; Bozovic, I.;<br>Xu, X.; Shi, X.; Armitage, N.P.; Crooker, S.A.,                                                                                                                                                                                                                                           | Observation of cyclotron resonance and meas-<br>urement of the hole mass in optimally-doped<br>La2-xSrxCuO4                                      | Pulsed Field Facility<br>at LANL                              |
| Qiu, R.L.J.; Liu, CW.; Woods, A.J.; Serafin,<br>A.; Xia, JS.; Pfeiffer, L.N.; West, K.W. and<br>Gao, X.P.A.,                                                                                                                                                                                                                                                                                | Incipient Formation of the Reentrant Insulating<br>Phase in a Dilute 2D Hole System with Strong In-<br>teractions                                | UF Physics                                                    |
| Sarkar T.; Poniatowski N.R.; Higgins J.S.;<br>Mandal P.R.; Chan M.K.; Greene R.L.,                                                                                                                                                                                                                                                                                                          | Strange Metallic Transport in the Antiferromag-<br>netic Regime of Electron Doped Cuprates                                                       | Pulsed Field Facility<br>at LANL                              |
| Schepkin, V.D.,                                                                                                                                                                                                                                                                                                                                                                             | Analytical tool for in vivo magnetic resonance signals                                                                                           | NMR Facility                                                  |
| Singleton, J.; Schmidt, A.; Bailey, C,; Wig-<br>ger, J. and Krawczyk, F.,                                                                                                                                                                                                                                                                                                                   | Information carried by electromagnetic radia-<br>tion launched from accelerated polarization<br>currents                                         | Pulsed Field Facility<br>at LANL                              |
| Sun D.; Minkov V.S.; Mozaffari S.; Chariton<br>S.; Prakapenka V.B.; Eremets M.I.; Balicas<br>L.; Balakirev F.F.,                                                                                                                                                                                                                                                                            | High-temperature superconductivity on the verge of a structural instability in lanthanum superhydride                                            | Pulsed Field Facility<br>at LANL, CMT/E                       |
| Sun, D.; Naud, M.F.; Nguyen, D.N.; Betts,<br>J.B.; Singleton, J. and Balakirev, F.F.,                                                                                                                                                                                                                                                                                                       | Composite Pressure Cell for Pulsed Magnets                                                                                                       | Pulsed Field Facility<br>at LANL                              |
| Wang X.; Cao J.; Lu Z.; Cohen A.; Kitadai<br>H.; Li T.; Wilson M.; Lui C.H.; Smirnov D.;<br>Sharifzadeh S.; Ling X.,                                                                                                                                                                                                                                                                        | Spin-Induced Linear Polarization of Excitonic<br>Emission in Antiferromagnetic van der Waals<br>Crystals                                         | DC Field Facility,<br>CMT/E                                   |

| Authors                                                                                                                                                                                                                                   | Title                                                                                                                      | Facility                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Xiao, F.; Blackmore, W.J.; Huddart, B.M.;<br>Gomilek, M.; Hicken, T.J.; Baines, C.; Baker,<br>P.J.; Pratt, F.L.; Blundell, S.J.; Lu, H., Single-<br>ton, J.; Gawryluk, D.; Turnbull, M.M.;<br>Krämer, K.W.; Goddard, P.A.; Lancaster, T., | Magnetic order and disorder in a quasi-two-di-<br>mensional quantum Heisenberg antiferromagnet<br>with randomized exchange | Pulsed Field Facility<br>at LANL |

#### Awards (9)

| Authors          | Title                                                                                                                                | Facility                         |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Balicas, L.      | Divisional Associate Editor for Physical Review Letters                                                                              | DC Field Facility, CMT/E         |
| Chen, H.         | The Dr. Martin Luther King Jr. Distinguished Service<br>Award                                                                        | ICR Facility                     |
| Jaime, M.        | Fellow, American Association for the Advancement of Science (AAAS)                                                                   | Pulsed Field Facility at LANL    |
| Jaime, M.        | Vice-Chair, GMAG Topical Group, American Physical<br>Society                                                                         | Pulsed Field Facility at LANL    |
| Larbalestier, D. | Fellow of the Royal Academy of Engineering                                                                                           | Applied Superconductivity Center |
| Niles, S.        | 2020 FSU Analytical Chemistry Graduate Student Award                                                                                 | ICR Facility                     |
| Popovic, D.      | AAAS, Member of the Electorate Nominating Commit-<br>tee of the Section on Physics                                                   | DC Field Facility, CMT/E         |
| Popovic, D.      | Full Member, Sigma Xi, The Scientific Research Honor So-<br>ciety                                                                    | DC Field Facility, CMT/E         |
| Zapf, V.S.       | Subject area lead, Quantum Spin Liquids, "Quantum Sci-<br>ence Center" Department of Energy Quantum infor-<br>mation Sciences center | Pulsed Field Facility at LANL    |

# Grants (12)

| Authors                                                                | Title                                                                                                                                                                                       | Facility                      |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Dean, D., Zapf, V.S.<br>and others                                     | Quantum Science Center                                                                                                                                                                      | Pulsed Field Facility at LANL |
| Helsper, S.                                                            | Investigation into hMSC-derived therapy in ischemic stroke at<br>high field MR imaging and spectroscopy                                                                                     | NMR Facility                  |
| Hill, S.                                                               | U.SIreland R&D Partnership: Molecular Magnetoelectric Materi-<br>als                                                                                                                        | EMR Facility                  |
| McKenna, A.M.                                                          | Ultrahigh-Resolution Fourier-Transform Ion Cyclotron Resonance<br>Mass Spectrometry for Fingerprinting, Source Tracking, and Allo-<br>cation of Per- and Polyfluoroalkyl Substances (PFASs) | ICR Facility                  |
| Park, W. K. and<br>Greene, L. H.                                       | Electron tunneling spectroscopy of the novel pairing state in the<br>1-1-5 heavy fermions and possible topological Kondo insulator<br>YbB12                                                 | CMT/E                         |
| Park, W. K.                                                            | Electron Tunneling Spectroscopy under High Magnetic Fields                                                                                                                                  | DC Field Facility             |
| Sachs, J. and<br>Atwood, A.                                            | Collaborative Research: Response of the Tropical Pacific to the<br>Abrupt Climate Change Event 8,200 Years Ago                                                                              | Geochemistry Facility         |
| Schurko, R.W.                                                          | Solid-State Nuclear Magnetic Resonance (NMR) Spectroscopy<br>of Unreceptive Nuclei from Across the Periodic Table                                                                           | NMR Facility                  |
| Shatruk, M. and Hill,<br>S.                                            | Spin-State Switching and Conductivity in Metal Complexes with<br>Non-Innocent Ligands                                                                                                       | EMR Facility                  |
| Tang, Y., Chen., H.<br>and Chen, G.                                    | Selenium recovery from wastewater based on exclusively extra-<br>cellular selenium nanoparticles production                                                                                 | ICR Facility                  |
| Williams, H.N., Chen,<br>H., Stukel, M., Kranz,<br>S. and Abdullah, A. | Excellence in Research Collaborative Proposal: Impact of Multi-<br>ple Micropredators on Marine Bacterial Communities and their<br>Prey Lysis Products                                      | ICR Facility                  |
| Xu, J. and Gan, Z.                                                     | Methodology of High-Field Solid-State NMR and Its Applications<br>in Heterogeneous Catalysis                                                                                                | NMR Facility                  |

| Authors                      | Title                                                                                                                             | Facility             | University | Department                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------|------------|------------------------------------------|
| Behnke, Megan                | Dissolved Organic Matter Sources in<br>Glacierized Watersheds Delineated<br>Through Compositional and Carbon<br>Isotopic Modeling | ICR Facility         | FSU        | Earth, Ocean &<br>Atmospheric<br>Science |
| Conti, Carl                  | ssNMR Methods for Elucidating Struc-<br>ture-Property Relationships in Plas-<br>monic Semiconductor Nanocrystals                  | NMR Facility         | FSU        | Chemistry & Bio-<br>chemistry            |
| Crawford-Goss, Ian<br>Taylor | Superconductivity in cerium contain-<br>ing high entropy alloys                                                                   | DC Field Facility    | FSU        | Physics                                  |
| Dragone, Richard<br>Joseph   | Effects of Aging on Risky Decision Mak-<br>ing and Brain Functional Connectivity<br>in a Rat Model                                | AMRIS Facility at UF | UF         | Neuroscience                             |
| Li, Wenbo                    | Insights ilnto Organic Matter Sources in<br>Glacier Environments                                                                  | ICR Facility         | FSU        | Earth, Ocean &<br>Atmospheric<br>Science |
| Macy, Juan                   | Unconventional Anomalous Hall Effect<br>and Anomalous Nernst Effect in<br>Fe3GeTe2 and Fe5GeTe2                                   | CMT/E                | FSU        | Physics                                  |
| Mejia Marin, Juan<br>Jose    | Ferromagnetism in the hexagonal<br>cage-like compounds:<br>Sm6(Mo,W)4Al43                                                         | DC Field Facility    | FSU        | Physics                                  |
| Peng, Qingqing               | Solution NMR Studies on the C Terminus<br>of Adhesin P1 from Streptococcus<br>mutans                                              | AMRIS Facility at UF | UF         | Biochemistry<br>and Molecular<br>Biology |
| Polk, Rebecca                | The Effect of Oxytocin on Mentalizing<br>in Aging: A Brain-Behavior Analysis                                                      | AMRIS Facility at UF | UF         | Psychology                               |
| Rogers, Jennifer             | Changes to Modern and Aged Dis-<br>solved Organic Matter Inputs into the<br>Kolyma River                                          | ICR Facility         | FSU        | Earth, Ocean &<br>Atmospheric<br>Science |
| Turner, Sean                 | Hemispheric Contributions to Cognition<br>in Epilepsy                                                                             | AMRIS Facility at UF | UF         | Clinical and<br>Health Psychol-<br>ogy   |

# M.S. Degrees (local) (11)

# M.S. Degrees (external) (9)

| Authors          | Title                                                                                                                                                       | Facility                              | University                           | Department                         |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------|------------------------------------|
| Arreola, Jenette | Transthyretin Amyloidosis: Prote-<br>olytic cleavage accelerates<br>G53A TTR misfolding and aggre-<br>gation                                                | NMR Facility                          | East Carolina University             | Chemistry                          |
| Coffey, Nicole   | Controls on the Chemical Com-<br>position of the Surface Micro-<br>layer of Delaware Bay                                                                    | ICR Facility                          | University of Delaware               | Earth,<br>Ocean, &<br>Environment  |
| Dwivedi, Anand   | Nuclear Magnetic Resonance<br>under Extreme Conditions                                                                                                      | DC Field<br>Facility,<br>NMR Facility | University of Wisconsin<br>Milwaukee | Physics                            |
| Gan, Josephine   | Investigation of the Electronic<br>Structures of Heterobimetallic<br>Mn/Fe Oxidases: Computa-<br>tional study on the R2-like Lig-<br>and Binding Oxidases   | EMR Facility                          | The Ohio State University            | Chemistry<br>and Bio-<br>chemistry |
| Gan, Yunqiao     | Investigation of the Electronic<br>Structures of Heterobimetallic<br>Mn/Fe Oxidases: A Computa-<br>tional Study on the R2-like Lig-<br>and Binding Oxidases | EMR Facility                          | The Ohio State University            | Chemistry<br>and Bio-<br>chemistry |
| Mazur, Agnieszka | Cobalt(II) coordination com-<br>pounds in the construction of<br>molecular magnetic materials.                                                              | DC Field<br>Facility                  | University of Wroclaw                | Faculty of<br>Chemistry            |

| Authors                 | Title                                                                                                                                                                           | Facility                              | University                             | Department                         |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------|------------------------------------|
| Ruiz Zamora, Evelin     | Deshidratación-deciclización<br>de tetrahidrofurano para la<br>producción de 1,3-butadieno<br>como materia prima de bio-<br>neumáticos, usando zeolitas<br>spp como catalizador | NMR Facility                          | Autonomous University<br>of Nuevo León | Facultad de<br>Ciencia<br>Químicas |
| Widener, Chelsea        | Spectroscopic Studies of Metal<br>Complexes with Large Mag-<br>netic Anisotropy                                                                                                 | DC Field<br>Facility, EMR<br>Facility | University of Tennessee                | Chemistry                          |
| Wijesekara,<br>Anuradha | Improved characterization of<br>pure and formulated active<br>pharmaceutical ingredients by<br>fast magic angle spinning solid-<br>state NMR spectroscopy                       | NMR Facility                          | lowa State University                  | Chemistry                          |

#### Ph.D. Degrees (local) (26)

| Authors           | Title                                                                                                                                                            | Facility                    | University | Department                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------|---------------------------------------|
| Ahmed, Nur        | Isotope analysis and groundwater<br>modeling for advanced understand-<br>ing of lake water and groundwater<br>mixing through lake sinkholes in north<br>Florida. | Geochemistry<br>Facility    | FSU        | EOAS & NHMFL                          |
| Amin, Manish      | Advancements in Diffusion<br>Weighted Imaging Acquisition and<br>Analysis                                                                                        | AMRIS Facility at<br>UF     | UF         | Physics                               |
| Banan, Guita      | Development of a Multiband Mag-<br>netic Resonance Electrical Imped-<br>ance Tomography Technique                                                                | AMRIS Facility at<br>UF     | UF         | Physics                               |
| Barry, Kevin      | The Highly Anisotropic Phase Dia-<br>gram of Ho2Ti2O7: Bulk Single Crys-<br>tals and Thin Films                                                                  | DC Field Facility,<br>CMT/E | FSU        | Physics                               |
| Berens, Samuel J  | Fundamental understanding of diffu-<br>sion properties in membranes and<br>molecular sieves by high field diffu-<br>sion NMR                                     | AMRIS Facility at<br>UF     | UF         | Chemical<br>Engineering<br>Department |
| Во, Ке            | Neural Mechanism of Affective<br>Scene Perception                                                                                                                | AMRIS Facility at<br>UF     | UF         | Biomedical<br>Engineering             |
| Chiu, Yu Che      | De Haas-van Alphen and Magneto-<br>Transport properties on Topological<br>Nodal line semimetals ZXT (X = Si, Fe;<br>M = Se, Te)                                  | CMT/E                       | FSU        | Physics                               |
| Das Gupta, Sayak  | Polynuclear cerium/manganese/oxo<br>clusters: synthetic, structural, and<br>magnetic studies                                                                     | EMR Facility                | UF         | Chemistry                             |
| Ellis, Matthew    | Understanding magnetic and opti-<br>cal properties of lanthanide-doped<br>oxide nanospinels and heterometal-<br>lic formate metal-organic frame-<br>works        | DC Field Facility           | FSU        | Chemistry and<br>Biochemistry         |
| Frazier, Ian      | UF Restricted Data. Title unavailable<br>until 2022. Topic: neuroimaging<br>(fMRI)                                                                               | AMRIS Facility at<br>UF     | UF         | Psychology                            |
| Henderson, Alyssa | Geomtric Frustration in Magnetic Sys-<br>tems: A Path to Quantum Materials                                                                                       | CMT/E                       | FSU        | Physics                               |
| Hertz, Mary       | Explorations in metal flux synthesis:<br>From layered materials to f-block<br>chemistry                                                                          | DC Field Facility           | FSU        | Chemistry                             |
| Hicks, Alan       | On the Application of Molecular Dy-<br>namics Simulations To The Study of<br>Intrinsically Disordered Proteins                                                   | NMR Facility                | FSU        | Physics                               |

| Authors                   | Title                                                                                                                                                      | Facility                    | University | Department                                 |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------|--------------------------------------------|
| Lu, Zhengguang            | Magneto-spectroscopy of excitons<br>in two dimensional semiconductors                                                                                      | DC Field Facility,<br>CMT/E | FSU        | Physics                                    |
| Marbey, Jonathan          | Investigation of molecule-based magnetic materials via EPR spectros-<br>copy                                                                               | EMR Facility                | FSU        | Physics,<br>Informatics and<br>Mathematics |
| Mendoza, Luis             | Pairing and Pair Breaking in Bilayer<br>Composite Fermion Metals                                                                                           | CMT/E                       | FSU        | Physics                                    |
| Meyyappan,<br>Sreenivasan | Neuronal Mechanisms of Spatial and<br>Feature Attention Control                                                                                            | AMRIS Facility at<br>UF     | UF         | Biomedical<br>Engineering                  |
| Niles, Sydney             | Fourier-Transform Ion Cyclotron Reso-<br>nance Mass Spectrometry (FT-ICR<br>MS) For Characterization of Oxygen-<br>ated Fossil Fuels in the Environment    | ICR Facility                | FSU        | Department of<br>Chemistry                 |
| Potter, Wesley            | Synthesis of actinide materials: Metal flux and supercritical reactions                                                                                    | DC Field Facility           | FSU        | Chemistry                                  |
| Putman, Jonathan          | Chromatographic Methods and<br>Characterization Techniques for Pe-<br>troleum Products                                                                     | ICR Facility                | FSU        | Chemistry                                  |
| Siva Kumar, Shruti        | Identifying Early Markers of Subclini-<br>cal Cardiac and Pulmonary Radia-<br>tion Toxicity in Breast Cancer                                               | AMRIS Facility at<br>UF     | UF         | Biomedical<br>Engineering                  |
| Thompson, Christie        | Magnetic Anisotropy and Noncollin-<br>ear Spin Textures in CoV2O4 Thin<br>Films                                                                            | DC Field Facility,<br>CMT/E | FSU        | Materials<br>Science and<br>Engineering    |
| Tran, Trang Theresa       | Investigating Polymorphism-Induced<br>Conformational Changes in HIV-1<br>Protease by Pulsed Electron Para-<br>magnetic Resonance and Molecular<br>Dynamics | AMRIS Facility at<br>UF     | UF         | Chemistry                                  |
| Wang, Wei En              | Neural Dynamics of Pain and Motor<br>Function in Chronic Musculoskeletal<br>Pain                                                                           | AMRIS Facility at<br>UF     | UF         | Applied<br>Physiology and<br>Kinesiology   |
| Zhang, Chuck              | Characterization of Functional Pro-<br>teins for Drug Research                                                                                             | AMRIS Facility at<br>UF     | UF         | Medicinal<br>Chemistry                     |
| Zheng, Jin                | Solid-State NMR Studies of Li-Ion<br>Transport in Composite Electrolytes<br>and Lithiation Mechanisms of Or-<br>ganic Electrodes                           | NMR Facility                | FSU        | Chemistry and<br>Biochemistry              |

# Ph.D. Degrees (external) (59)

| Authors                | Title                                                                                                                                                                                               | Facility                            | University                                  | Department                              |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------|-----------------------------------------|
| Ajaero,<br>Chukwuemeka | Molecular Characterization Of The<br>Fate And Kinetics Of Oil Sand Pro-<br>cess-Affected Water (OSPW) Naph-<br>thenic Acid Fraction Compounds<br>(NAFCs) In Constructed Wetland<br>Treatment System | ICR Facility                        | University of Regina,<br>Regina, SK, Canada | Environmental<br>Systems<br>Engineering |
| Bachmann, Maja         | Manipulating Anisotropic Transport<br>and Superconductivity by Focused<br>Ion Beam Microstructuring                                                                                                 | Pulsed Field<br>Facility at<br>LANL | University of St. An-<br>drews              | Physics                                 |
| Bader, Samuel          | GaN-on-AIN as a platform for high-<br>voltage complementary electron-<br>ics                                                                                                                        | DC Field<br>Facility                | Cornell University                          | Applied Physics                         |
| Burch, Ashlyn          | Photoexcitiation Dynamics in Opti-<br>mally Doped LSCO Thin Films Under<br>Applied Magnetic Field                                                                                                   | DC Field<br>Facility                | University of Alabama<br>at Birmingham      | Physics                                 |
| Celestine, Michael     | Synthesis, Characterization, and Ki-<br>netics Studies of New Cobalt Com-<br>plexesfor the Production of H <sub>2</sub> in<br>Acidic Media                                                          | EMR Facility                        | Old Dominion Univer-<br>sity                | Chemistry and<br>Biochemistry           |

| Authors                   | Title                                                                                                                                                                             | Facility                                                     | University                                   | Department                                            |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------|
| Celik, Dogan              | ynthesis, Characterization, and Ki-<br>netics Studies of New Cobalt Com-<br>plexesfor the Production of H2 in<br>Acidic Media                                                     | EMR Facility                                                 | Old Dominion Univer-<br>sity                 | Chemistry and<br>Biochemistry                         |
| Chakarawet,<br>Khetpakorn | Magnetic Direct Exchange and<br>Heavy Atom Effects on Slow Mag-<br>netic Relaxation in Transition Metal<br>Single-Molecule Magnets                                                | EMR Facility                                                 | University of Califor-<br>nia, Berkeley      | College of<br>Chemistry                               |
| Chen, Lu                  | Study of Thermal and Magnetic<br>Properties in Strongly Correlated<br>Materials                                                                                                   | DC Field<br>Facility,<br>Pulsed Field<br>Facility at<br>LANL | University of Michigan                       | Department of<br>Physics                              |
| Chuang, Ya-Wen            | Exploring Magnetism in Van der<br>Waals 2D Materials and Hetero-<br>structures                                                                                                    | DC Field<br>Facility                                         | Penn State University                        | Physics                                               |
| Cui, Zheng                | Co-Hydrothermal Liquefaction of<br>Wastewater Treatment Microalgae<br>and Bio-Crude Oil Catalytic Up-<br>grading to Produce Biofuels                                              | ICR Facility                                                 | New Mexico State<br>University               | Chemical and<br>Materials<br>Engineering              |
| Devlin, Kasey             | Structure, Magnetism, and Thermo-<br>electric Properties of Solid-Solution<br>Zintl Phases                                                                                        | DC Field<br>Facility                                         | University of California<br>Davis            | Chemistry<br>Department                               |
| Du, Jia-Hua               | Solid-State NMR Studies of Defects on MgO                                                                                                                                         | NMR Facility                                                 | Nanjing University                           | School of<br>Chemistry and<br>Chemical<br>Engineering |
| Dzsaber, Sami             | The Weyl-Kondo semimetal<br>Ce3Bi4Pd3                                                                                                                                             | Pulsed Field<br>Facility at<br>LANL                          | Vienna University of<br>Technology (TU Wien) | Physics                                               |
| Elinburg, Jessica         | Synthesis, Characterization, and<br>Reactivity of Sn and V=O Perfluoro-<br>pinacolate Complexes and Mag-<br>netic Properties of a Mn6 Cluster<br>Supported by Perfluoropinacolate | EMR Facility                                                 | Boston University                            | Chemistry                                             |
| Emmanouilidou, Eve        | Search for topological semimetal<br>and topological superconductor<br>candidates                                                                                                  | DC Field<br>Facility                                         | university of california,<br>los angeles     | Physics and<br>Astronomy                              |
| Fan, Shiyu                | Spectroscopy of multiferroic super-<br>lattices                                                                                                                                   | DC Field<br>Facility                                         | University of Tennes-<br>see                 | Physics                                               |
| Garg, Uma                 | Effects of Intercalation and de-in-<br>tercalation in Layered Materials:<br>from Topological Insulators to Bat-<br>tery Cathodes                                                  | DC Field<br>Facility                                         | University of Wisconsin<br>Milwaukee         | Physics                                               |
| Girod, Clément            | Chaleur spécifique à basse tempé-<br>rature dans l'état normal des cu-<br>prates supraconducteurs                                                                                 | DC Field<br>Facility                                         | Universite de Sher-<br>brooke                | Physics                                               |
| Gould, Colin<br>Alexander | Design and Synthesis of High-Perfor-<br>mance Lanthanide-Based Single-<br>Molecule Magnets                                                                                        | EMR Facility                                                 | University of Califor-<br>nia, Berkeley      | College of<br>Chemistry                               |
| Harrison, Andrew          | Self-Assembled Metal Nanoparti-<br>cle/Polymer Nanocomposites as<br>Nanoreactors for One-Pot Reac-<br>tions                                                                       | NMR Facility                                                 | Virginia Common-<br>wealth University        | Chemical and<br>Life Science<br>Engineering           |
| Hemsworth,<br>Nicholas    | Exfoliation and Magnetotransport<br>of Two-Dimensional Black Phospho-<br>rus and Antimony                                                                                         | DC Field<br>Facility                                         | McGill University                            | Electrical and<br>Computer<br>Engineering             |
| Hossain, Md<br>Shafayat   | Spontaneous ferromagnetism in two-dimensional electron systems                                                                                                                    | DC Field<br>Facility                                         | Princeton University                         | Electrical<br>Engineering                             |
| Huang, Silu               | Electrical, Magnetic, and Thermal<br>Properties of Semimetallic XMnPn2<br>(X = Ba, Eu, Pn = Sb, Bi)                                                                               | DC Field<br>Facility                                         | Louisiana State Uni-<br>versity              | Physics and<br>Astronomy                              |

| Authors                       | Title                                                                                                                                                          | Facility                                                     | University                                             | Department                                 |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------|
| Jakobsen, Vibe Boel           | Preparation of New Molecular<br>Magnetic Materials                                                                                                             | Pulsed Field<br>Facility at<br>LANL                          | University College<br>Dublin                           | School of<br>Chemistry                     |
| Kealhofer, David              | Topological surface states in cad-<br>mium arsenide (001) thin films                                                                                           | DC Field<br>Facility                                         | University of Califor-<br>nia, Santa Barbara           | Physics                                    |
| Kisgeropoulos, Effie          | From Structure to Function: Utilizing<br>the Biophysical Toolbox to Interro-<br>gate a Novel Class of Mn/Fe Pro-<br>teins                                      | EMR Facility                                                 | The Ohio State Univer-<br>sity                         | Chemistry and<br>Biochemistry              |
| Kochat, Mehdi                 | Study of Flux Pinning in Thick Film<br>REBCO Coated Conductors over a<br>Wide Range of Magnetic Fields<br>and Temperatures                                     | DC Field<br>Facility                                         | University of Houston                                  | Mechanical<br>Engineering                  |
| Kudisch, Bryan                | New directions in the ultrafast spec-<br>troscopy of organic chromophores                                                                                      | DC Field<br>Facility                                         | Princeton University                                   | Chemistry                                  |
| Letourneau, Maria             | Dissolved Organic Matter Dynam-<br>ics in Coastal Aquatic Systems                                                                                              | ICR Facility                                                 | University of Georgia                                  | Marine Sciences                            |
| Li, Yanan                     | Lattice and Charge Order in Bi-<br>based Topological Insulators                                                                                                | DC Field<br>Facility,<br>NMR Facility                        | University of Wisconsin<br>Milwaukee                   | Physics                                    |
| Maillard, Julien              | Chemical Composition of the Ti-<br>tan's Haze by Ion Mobility Coupled<br>to High Résolution Mass Spectrom-<br>etry                                             | ICR Facility                                                 | Versailles Saint-<br>Quentin-en-Yvelines<br>University | LATMOS                                     |
| Makhankova,<br>Valeriya,      | Heterometallic compounds based<br>on 3d-metals with N-, O-donor lig-<br>ands: synthetic approaches, crystal<br>structure, properties. (Habilitation<br>Thesis) | EMR Facility                                                 | Taras Shevchenko<br>National University of<br>Kyiv     | Chemistry                                  |
| Meyer, Sven                   | Introduction of quasi-multilayer<br>pulsed laser deposition for en-<br>hanced superconducting proper-<br>ties of Ba(Fe0.92Co0.08)2As2 thin<br>lms              | DC Field<br>Facility                                         | Karlsruhe Institute of<br>Technology                   | Institute for<br>Technical<br>Physics      |
| Moulian, Remi                 | Characterization of Metal Species<br>of Asphaltenes and Their Interac-<br>tions in Heavy Oil Cuts Applied to<br>Hydrodemetallation                             | ICR Facility                                                 | Université de Pau et<br>des Pays de l'Adour            | IPREM                                      |
| Palmstrom,<br>Johanna         | Elastoresistance of iron based superconductors                                                                                                                 | DC Field<br>Facility,<br>Pulsed Field<br>Facility at<br>LANL | Stanford                                               | Applied Physics                            |
| Plyuta, Nataliya              | Coordination compounds based<br>on 3d-metals with multidentate N-<br>or N,O-donor ligands: synthesis,<br>structure and properties.                             | EMR Facility                                                 | Taras Shevchenko<br>National University of<br>Kyiv     | Chemistry                                  |
| Ratkovski, Danilo             | Measurements of the thermal con-<br>ductivity in YIG at low temperatures<br>and high magnetic fields                                                           | DC Field<br>Facility                                         | Universidade Federal<br>de Pernambuco                  | Physics                                    |
| Rodriguez-<br>Cardona, Bianca | Carbon and Nitrogen Dynamics in<br>Fluvial Systems Across Biomes                                                                                               | ICR Facility                                                 | University of New<br>Hampshire                         | Earth and<br>Environmental<br>Sciences     |
| Rosenberg, Elliott            | Multipolar Order and Fluctuations<br>in TmAg2 and YbRu2Ge2                                                                                                     | DC Field<br>Facility                                         | Stanford                                               | Applied Physics                            |
| Schaffer, Leah V              | Integrated Proteomic Strategies for<br>Proteoform Discovery                                                                                                    | ICR Facility                                                 | University of<br>Wisconsin-Madison                     | Chemistry                                  |
| Schmidt, Andrea               | Theoretical and Experimental Stud-<br>ies of the Emission of Electromag-<br>netic Radiation by Superluminal Po-<br>larization Currents                         | Pulsed Field<br>Facility at<br>LANL                          | University of New<br>Mexico                            | Electrical and<br>Computing<br>Engineering |

| Authors                       | Title                                                                                                                                                                                          | Facility                                                     | University                                 | Department                                                                                           |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------|
| Shen, Bin                     | Studies of pressure-induced quan-<br>tum phase transitions                                                                                                                                     | DC Field<br>Facility                                         | Zhejiang University                        | Physics                                                                                              |
| Shen, Jiahui                  | Solid-state 170 NMR studies of glu-<br>cose and development of 170<br>NMR as a new probe of glucose<br>metabolism in HeLa cancer cells                                                         | NMR Facility                                                 | Queen's University                         | Chemistry                                                                                            |
| Shen, Li                      | 170 Solid-State NMR Studies of the<br>Surface Structure of Zirconia and<br>Alumina Nanomaterials                                                                                               | NMR Facility                                                 | Nanjing University                         | School of<br>Chemistry and<br>Chemical<br>Engineering                                                |
| Shih, En-Min                  | Low-Temperature Transport Study<br>of Transition Metal Dichalcogenide<br>Heterostructures                                                                                                      | DC Field<br>Facility                                         | Columbia University                        | Physics                                                                                              |
| Siegried, Peter<br>Eilbacher  | Uniaxial Strain Dependence of Re-<br>sistivity and Electronic Transport<br>with Non-Trivial Spin Textures in<br>Magnetic Materials                                                             | DC Field<br>Facility                                         | Univ of Colorado -<br>Boulder              | Physics                                                                                              |
| Straquadine,<br>Joshua        | Evolution of the Charge Density<br>Wave State in the Rare Earth Tritel-<br>lurides under uniaxial stress and Dis-<br>order                                                                     | Pulsed Field<br>Facility at<br>LANL                          | Stanford                                   | Applied Physics                                                                                      |
| Telford, Evan                 | Magnetotransport Studies of Corre-<br>lated Electronic Phases in Van der<br>Waals Materials                                                                                                    | DC Field<br>Facility                                         | Columbia University                        | Physics                                                                                              |
| Thorarinsdottir,<br>Agnes Eva | Control of Electronic Spin in the De-<br>sign of Transition Metal-Based Biore-<br>sponsive Magnetic Resonance Im-<br>aging Probes and Metal-Organic<br>Magnets                                 | AMRIS<br>Facility at<br>UF                                   | Northwestern Univer-<br>sity               | Chemistry                                                                                            |
| Vakaliuk, Oleksii             | Novel Lorentz Force Velocimetry<br>system based on bulk high-temper-<br>ature superconductors                                                                                                  | DC Field<br>Facility                                         | Technische Universität<br>Ilmenau          | Institute for<br>Material<br>Engineering<br>and Institute for<br>Micro- and<br>Nano-<br>technologies |
| Venkatesh, Amrit              | Opening up the periodic table for<br>solid-state NMR spectroscopy with<br>fast magic angle spinning and pro-<br>ton detection                                                                  | NMR Facility                                                 | Iowa State University                      | Chemistry                                                                                            |
| Wan, Fang                     | Chemical Doping and Supercon-<br>ducting Phase Formation in Mag-<br>nesium Diboride                                                                                                            | DC Field<br>Facility                                         | The Ohio State<br>University               | Materials<br>Science                                                                                 |
| Wang, Yangyang                | Structure and Dynamics of Trypto-<br>phan Synthase Intermediates Via<br>NMR-Crystallography                                                                                                    | NMR Facility                                                 | University of California<br>- Riverside    | Chemistry                                                                                            |
| Witwicki, Maciej              | Explanation of the molecular prop-<br>erties and reactivity of the oxygen,<br>oxygen-nitrogen and phosphorus<br>radicals - EPR spectroscopy and<br>molecular modeling (Habilitation<br>Thesis) | EMR Facility                                                 | Wroclaw University                         | Chemistry                                                                                            |
| Wu, Fan                       | Studies of electronic correlations,<br>magnetism and topology in rare-<br>earth pnictides                                                                                                      | Pulsed Field<br>Facility at<br>LANL                          | Zhejiang University                        | Department of<br>Physics                                                                             |
| Ye, Linda                     | Topology and Correlation in Ka-<br>gome Lattice Metals                                                                                                                                         | DC Field<br>Facility,<br>Pulsed Field<br>Facility at<br>LANL | Massachusetts Insti-<br>tute of Technology | Physics                                                                                              |

| Authors         | Title                                                                                                                               | Facility             | University                                      | Department                              |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------|-----------------------------------------|
| Zhange, Yongjun | Exploration of new magnetic quan-<br>tum critical materials                                                                         | DC Field<br>Facility | Zhejiang University                             | Physics                                 |
| Zhao, Xinglin   | Activation and conversion of light<br>alkane over Gallium modified ZSM-<br>5 zeolites as studied by solid state<br>NMR spectroscopy | NMR Facility         | University of Chinese<br>Academy of<br>Sciences | Chemistry                               |
| Zhu, Weidi      | Rheology and Relaxation in As-Se<br>Glass-forming Liquids                                                                           | NMR Facility         | University of<br>California, Davis              | Materials<br>Science and<br>Engineering |

# Appendix 1 - Personnel

#### 2020 MagLab Leadership

| First Name  | Last Name    | Position Title                              | Department                    |
|-------------|--------------|---------------------------------------------|-------------------------------|
| Ernesto     | Bosque       | Research Faculty I                          | ASC                           |
| Lance       | Cooley       | Professor                                   | ASC                           |
| David       | Larbalestier | Professor                                   | ASC                           |
| Lucio       | Frydman      | Professor                                   | CIMAR                         |
| Christopher | Hendrickson  | Research Faculty III                        | CIMAR                         |
| Alan        | Marshall     | Professor                                   | CIMAR                         |
| Robert      | Schurko      | Professor                                   | CIMAR                         |
| Lloyd       | Engel        | Research Faculty III                        | Condensed Matter Science      |
| Stephen     | Hill         | Professor                                   | Condensed Matter Science      |
| Timothy     | Murphy       | Research Faculty III                        | Condensed Matter Science      |
| Scott       | Hannahs      | Research Faculty III                        | DC Instrumentation            |
| Gregory     | Boebinger    | Professor                                   | Director's Office             |
| Jeffrey     | Braunwart    | Assistant Director, Science & Research      | Director's Office             |
| Roxanne     | Hughes       | Research Faculty II                         | Director's Office             |
| Eric        | Palm         | Research Faculty III                        | Director's Office             |
| Bettina     | Roberson     | Assistant Director, Administrative Services | Director's Office             |
| Kristin     | Roberts      | Director of Public Affairs                  | Director's Office             |
| Michael     | Rabin        | Research Faculty III                        | LANL                          |
| Mark        | Bird         | Research Faculty III                        | Magnet Science & Technology   |
| Debra       | Booth        | Business Systems Director                   | Management and Administration |
| Eric        | Clark        | Assistant Director, Technology Services     | Management and Administration |
| Laura       | Greene       | Professor                                   | Management and Administration |
| Peter       | Jensen       | Network Administrator                       | Management and Administration |
| John        | Kynoch       | Assistant Director                          | Management and Administration |
| David       | Lunger       | Director, Project Management                | Management and Administration |
| Judy        | McEachern    | Assistant Director, Business Systems        | Management and Administration |
| Tiffany     | Ritter       | Assistant Director, UBA Program             | Management and Administration |
| Joanna      | Long         | Professor                                   | UF                            |
| Mark        | Meisel       | Professor                                   | UF                            |

### Applied Superconductivity Center

| First Name | Last Name | Position Title            | Department |
|------------|-----------|---------------------------|------------|
| Connie     | Linville  | Administrative Specialist | ASC        |
| Fumitake   | Kametani  | Assistant Professor       | ASC        |
| Natalie    | Arnett    | Associate Professor       | ASC        |

ASC

Leadership

| First Name  | Last Name  | Position Title                       | Department |
|-------------|------------|--------------------------------------|------------|
| Sastry      | Pamidi     | Associate Professor                  | ASC        |
| Felicia     | Rogers     | Coordinator, Administrative Services | ASC        |
| Shah        | Alam       | Graduate Research Assistant          | ASC        |
| Shaon       | Barua      | Graduate Research Assistant          | ASC        |
| Santosh     | Chetri     | Graduate Research Assistant          | ASC        |
| Jonathan    | Cooper     | Graduate Research Assistant          | ASC        |
| Kadisha     | Culpepper  | Graduate Research Assistant          | ASC        |
| Ashleigh    | Francis    | Graduate Research Assistant          | ASC        |
| S           | Imam       | Graduate Research Assistant          | ASC        |
| Andre       | Juliao     | Graduate Research Assistant          | ASC        |
| D'Andra     | Мохеу      | Graduate Research Assistant          | ASC        |
| Abiola      | Oloye      | Graduate Research Assistant          | ASC        |
| Yavuz       | Oz         | Graduate Research Assistant          | ASC        |
| Nawaraj     | Paudel     | Graduate Research Assistant          | ASC        |
| Virginia    | Phifer     | Graduate Research Assistant          | ASC        |
| Michael     | Small      | Graduate Research Assistant          | ASC        |
| Patrick     | Murphy     | Laboratory Assistant / Technician    | ASC        |
| Ryker       | Mullinix   | Laboratory Assistant / Technician 2  | ASC        |
| Emma        | Martin     | Laboratory Assistant II              | ASC        |
| Anatolii    | Polyanskii | Magneto Optical Research Specialist  | ASC        |
| Kayla       | Hancock    | Office Assistant                     | ASC        |
| Daniel      | Davis      | Postdoctoral Associate               | ASC        |
| Xinbo       | Hu         | Postdoctoral Associate               | ASC        |
| Chongin     | pak        | Postdoctoral Associate               | ASC        |
| Christopher | Segal      | Postdoctoral Associate               | ASC        |
| Wenura      | Withanage  | Postdoctoral Associate               | ASC        |
| Seungyong   | Hahn       | Professor                            | ASC        |
| Eric        | Hellstrom  | Professor                            | ASC        |
| Audra       | Barnes     | Research Assistant                   | ASC        |
| Griffin     | Bradford   | Research Assistant                   | ASC        |
| Evan        | Miller     | Research Assistant                   | ASC        |
| Brian       | Vail       | Research Assistant                   | ASC        |
| Charles     | English    | Research Engineer                    | ASC        |
| James       | Gillman    | Research Engineer                    | ASC        |
| Youngjae    | Kim        | Research Faculty I                   | ASC        |
| Najib       | Cheggour   | Research Faculty II                  | ASC        |
| Chiara      | Tarantini  | Research Faculty II                  | ASC        |
| Dmytro      | Abraimov   | Research Faculty III                 | ASC        |
| Jianyi      | Jiang      | Research Faculty III                 | ASC        |
| Peter       | Lee        | Research Faculty III                 | ASC        |

| First Name | Last Name    | Position Title                 | Department |
|------------|--------------|--------------------------------|------------|
| Ulf        | Trociewitz   | Research Faculty III           | ASC        |
| Van        | Griffin      | Sr. Research Associate         | ASC        |
| Jozef      | Kvitkovic    | Sr. Research Associate         | ASC        |
| William    | Starch       | Sr. Research Associate         | ASC        |
| Kwangmin   | Kim          | Visiting Associate In Research | ASC        |
| Kwang      | Lok          | Visiting Associate In Research | ASC        |
| Shreyas    | Balachandran | Visiting Research Faculty I    | ASC        |

# CIMAR

CIMAR

| First Name | Last Name   | Position Title                    | Department |
|------------|-------------|-----------------------------------|------------|
| Rufina     | Alamo       | Professor                         | CIMAR      |
| Adam       | Altenhof    | Graduate Research Assistant       | CIMAR      |
| Lissa      | Anderson    | Research Faculty I                | CIMAR      |
| Jacob      | Athey       | Undergrad Research Assistant      | CIMAR      |
| Frederick  | Bagdasarian | Graduate Research Assistant       | CIMAR      |
| Heather    | Barnes      | Program Assistant                 | CIMAR      |
| Daniel     | Barzycki    | Graduate Research Assistant       | CIMAR      |
| Jamini     | Bhagu       | Graduate Research Assistant       | CIMAR      |
| Gregory    | Blakney     | Research Faculty II               | CIMAR      |
| Ashley     | Blue        | Technical/Research Designer       | CIMAR      |
| Shefik     | Bowen       | Graduate Research Assistant       | CIMAR      |
| Charles    | Brenner     | Undergraduate Research Assistant  | CIMAR      |
| William    | Brey        | Research Faculty III              | CIMAR      |
| David      | Butcher     | Postdoctoral Associate            | CIMAR      |
| Martha     | Chacon      | Research Faculty I                | CIMAR      |
| Kuizhi     | Chen        | Postdoctoral Associate            | CIMAR      |
| Yudan      | Chen        | Postdoctoral Associate            | CIMAR      |
| Huan       | Chen        | Research Faculty I                | CIMAR      |
| Timothy    | Cross       | Visiting Scientist/Researcher     | CIMAR      |
| Lauren     | Daley       | Undergraduate Research Assistant  | CIMAR      |
| Cameron    | Davis       | Laboratory Assistant / Technician | CIMAR      |
| Michael    | Deck        | Graduate Research Assistant       | CIMAR      |
| Amari      | DeLeon      | Undergraduate Research Assistant  | CIMAR      |
| Mary       | Desilets    | Administrative Support Assistant  | CIMAR      |
| Richard    | Desilets    | Technical/Research Designer       | CIMAR      |
| Zachary    | Dowdell     | Graduate Research Assistant       | CIMAR      |
| Carl       | Fleischer   | Graduate Student                  | CIMAR      |
| Joseph     | Frye        | Graduate Research Assistant       | CIMAR      |
| Riqiang    | Fu          | Research Faculty III              | CIMAR      |
| Zhehong    | Gan         | Research Faculty III              | CIMAR      |

| First Name | Last Name        | Position Title                   | Department |
|------------|------------------|----------------------------------|------------|
| Taylor     | Glattke          | Graduate Research Assistant      | CIMAR      |
| Blaine     | Gordon           | Graduate Research Assistant      | CIMAR      |
| Peter      | Gor'kov          | Sr. Research Associate           | CIMAR      |
| Mackenzie  | Graham           | Undergraduate Research Assistant | CIMAR      |
| Samuel     | Grant            | Associate Professor              | CIMAR      |
| Daniel     | Hallinan         | Assistant Professor              | CIMAR      |
| Julia      | Hartzog          | Undergraduate Student            | CIMAR      |
| Shannon    | Helsper          | Graduate Research Assistant      | CIMAR      |
| David      | Hike             | Graduate Research Assistant      | CIMAR      |
| Samuel     | Holder           | Graduate Research Assistant      | CIMAR      |
| Sean       | Holmes           | Postdoctoral Associate           | CIMAR      |
| Yan-Yan    | Hυ               | Assistant Professor              | CIMAR      |
| Ivan       | Hung             | Associate In Research            | CIMAR      |
| Krista     | Jemmott          | Program Associate                | CIMAR      |
| Taylor     | Johnston         | Graduate Research Assistant      | CIMAR      |
| James      | Kimball          | Graduate Research Assistant      | CIMAR      |
| Jason      | Kitchen          | NMR Engineer                     | CIMAR      |
| Yuan       | Lin              | Graduate Research Assistant      | CIMAR      |
| llya       | Litvak           | Associate In Research            | CIMAR      |
| Наоуи      | Liu              | Graduate Research Assistant      | CIMAR      |
| Jie        | Lu               | Research Assistant               | CIMAR      |
| Wenping    | Мао              | Visiting Assistant In Research   | CIMAR      |
| Amy        | McKenna          | Research Faculty III             | CIMAR      |
| Frederic   | Mentink-Vigier   | Research Faculty II              | CIMAR      |
| Yimin      | Miao             | Postdoctoral Associate           | CIMAR      |
| Anna       | Mills            | Graduate Research Assistant      | CIMAR      |
| Hadi       | Mohammadigoushki | Assistant Professor              | CIMAR      |
| Kimberly   | Mozolic          | Sr. Administrative Specialist    | CIMAR      |
| Sydney     | Niles            | Graduate Research Assistant      | CIMAR      |
| Melaine    | Oliveira         | Postdoctoral Associate           | CIMAR      |
| Sawankumar | Patel            | Graduate Research Assistant      | CIMAR      |
| Austin     | Peach            | Graduate Research Assistant      | CIMAR      |
| Zeljka     | Popovic          | Graduate Research Assistant      | CIMAR      |
| Jonathan   | Putman           | Graduate Research Assistant      | CIMAR      |
| Anna       | Pyayt            | Associate Professor              | CIMAR      |
| Huajun     | Qin              | Associate in Research            | CIMAR      |
| John       | Quinn            | Research Engineer                | CIMAR      |
| Steven     | Ranner           | Research Engineer                | CIMAR      |
| Kiaura     | Reed             | Undergraduate Research Assistant | CIMAR      |
| Ralm       | Ricarte          | Assistant Professor              | CIMAR      |

| First Name | Last Name     | Position Title                   | Department |
|------------|---------------|----------------------------------|------------|
| Dayna      | Richter       | Graduate Research Assistant      | CIMAR      |
| Ryan       | Rodgers       | Research Faculty III             | CIMAR      |
| Alyssa     | Rose          | Graduate Research Assistant      | CIMAR      |
| Victor     | Schepkin      | Research Faculty II              | CIMAR      |
| Faith      | Scott         | Postdoctoral Associate           | CIMAR      |
| Micah      | Silverman     | Undergraduate Research Assistant | CIMAR      |
| Robert     | Silvers       | Assistant Professor              | CIMAR      |
| Robert     | Smith         | Graduate Student                 | CIMAR      |
| Karl       | Smith         | Postdoctoral Associate           | CIMAR      |
| Murari     | Soundararajan | Postdoctoral Associate           | CIMAR      |
| Jeremy     | Thomas        | Graduate Research Assistant      | CIMAR      |
| Cameron    | Vojvodin      | Graduate Research Assistant      | CIMAR      |
| Pengbo     | Wang          | Graduate Research Assistant      | CIMAR      |
| Nicolena   | Weaver        | Undergraduate Student            | CIMAR      |
| Chad       | Weisbrod      | Research Faculty I               | CIMAR      |
| Sungsool   | Wi            | Research Faculty II              | CIMAR      |
| Xuegang    | Yuan          | Postdoctoral Associate           | CIMAR      |
| Rongfu     | Zhang         | Postdoctoral Associate           | CIMAR      |

### Condensed Matter Science

CMS

| First Name  | Last Name         | Position Title                 | Department               |
|-------------|-------------------|--------------------------------|--------------------------|
| Aisha       | Qureshi           | Administrative Assistant       | Condensed Matter Science |
| Abigail     | Centers           | Application Developer/Designer | Condensed Matter Science |
| Jamel       | Ali               | Assistant Professor            | Condensed Matter Science |
| Christianne | Beekman           | Assistant Professor            | Condensed Matter Science |
| Hitesh      | Changlani         | Assistant Professor            | Condensed Matter Science |
| Hanwei      | Gao               | Assistant Professor            | Condensed Matter Science |
| Stephen     | Hennigar          | Assistant Professor            | Condensed Matter Science |
| Chen        | Huang             | Assistant Professor            | Condensed Matter Science |
| Mainak      | Mookherjee        | Assistant Professor            | Condensed Matter Science |
| Guangxin    | Ni                | Assistant Professor            | Condensed Matter Science |
| Lea         | Nienhaus          | Assistant Professor            | Condensed Matter Science |
| William     | Oates             | Assistant Professor            | Condensed Matter Science |
| Mykhailo    | Shatruk           | Assistant Professor            | Condensed Matter Science |
| Sebastian   | Stoian            | Assistant Professor            | Condensed Matter Science |
| Komalavalli | Thirunavukkuarasu | Assistant Professor            | Condensed Matter Science |
| Zhibin      | Υυ                | Assistant Professor            | Condensed Matter Science |
| Changchun   | Zeng              | Assistant Professor            | Condensed Matter Science |
| Alexey      | Kovalev           | Associate in Research          | Condensed Matter Science |
| Petru       | Andrei            | Associate Professor            | Condensed Matter Science |

| First Name  | Last Name     | Position Title              | Department               |
|-------------|---------------|-----------------------------|--------------------------|
| Biwu        | Ма            | Associate Professor         | Condensed Matter Science |
| Tanya       | Peres         | Associate Professor         | Condensed Matter Science |
| Subramanian | Ramakrishnan  | Associate Professor         | Condensed Matter Science |
| Oskar       | Vafek         | Associate Professor         | Condensed Matter Science |
| Mei         | Zhang         | Associate Professor         | Condensed Matter Science |
| Md.         | Alamgir       | Graduate Research Assistant | Condensed Matter Science |
| Kevin       | Barry         | Graduate Research Assistant | Condensed Matter Science |
| Alexander   | Bieber        | Graduate Research Assistant | Condensed Matter Science |
| Nicole      | Burnett       | Graduate Research Assistant | Condensed Matter Science |
| Greta       | Chappell      | Graduate Research Assistant | Condensed Matter Science |
| Josiah      | Cochran       | Graduate Research Assistant | Condensed Matter Science |
| Melissa     | Davis         | Graduate Research Assistant | Condensed Matter Science |
| Haoyun      | Deng          | Graduate Research Assistant | Condensed Matter Science |
| Liyu        | Dong          | Graduate Research Assistant | Condensed Matter Science |
| Paul        | Eugenio       | Graduate Research Assistant | Condensed Matter Science |
| Aubrey      | Farrell       | Graduate Research Assistant | Condensed Matter Science |
| KEKE        | FENG          | Graduate Research Assistant | Condensed Matter Science |
| Giovanni    | Franco-Rivera | Graduate Research Assistant | Condensed Matter Science |
| Matthew     | Freeman       | Graduate Research Assistant | Condensed Matter Science |
| Jorge       | Galeano       | Graduate Research Assistant | Condensed Matter Science |
| Carlos      | Garcia        | Graduate Research Assistant | Condensed Matter Science |
| Tyler       | Gregory       | Graduate Research Assistant | Condensed Matter Science |
| Brittany    | Grimm         | Graduate Research Assistant | Condensed Matter Science |
| Clemente    | Guzman        | Graduate Research Assistant | Condensed Matter Science |
| Roneisha    | Haney         | Graduate Research Assistant | Condensed Matter Science |
| Wai-Ga      | Но            | Graduate Research Assistant | Condensed Matter Science |
| Jade        | Holleman      | Graduate Research Assistant | Condensed Matter Science |
| Claire      | Jolowsky      | Graduate Research Assistant | Condensed Matter Science |
| Mehmet      | Kaplan        | Graduate Research Assistant | Condensed Matter Science |
| Aikaterini  | Katafygi      | Graduate Research Assistant | Condensed Matter Science |
| Pak         | Ki            | Graduate Research Assistant | Condensed Matter Science |
| Sangsoo     | Kim           | Graduate Research Assistant | Condensed Matter Science |
| Sanath      | Kumar         | Graduate Research Assistant | Condensed Matter Science |
| Haoran      | Li            | Graduate Research Assistant | Condensed Matter Science |
| Mengtian    | Liu           | Graduate Research Assistant | Condensed Matter Science |
| Juan        | Масу          | Graduate Research Assistant | Condensed Matter Science |
| Pengsu      | Мао           | Graduate Research Assistant | Condensed Matter Science |
| Masoud      | Mardani       | Graduate Research Assistant | Condensed Matter Science |
| Lingrui     | Mei           | Graduate Research Assistant | Condensed Matter Science |
| Ronald      | Melendrez     | Graduate Research Assistant | Condensed Matter Science |

| First Name   | Last Name    | Position Title              | Department               |
|--------------|--------------|-----------------------------|--------------------------|
| Katelyn      | Miller       | Graduate Research Assistant | Condensed Matter Science |
| Alex         | Moon         | Graduate Research Assistant | Condensed Matter Science |
| Seongphill   | Moon         | Graduate Research Assistant | Condensed Matter Science |
| William      | Nelson       | Graduate Research Assistant | Condensed Matter Science |
| Jennifer     | Neu          | Graduate Research Assistant | Condensed Matter Science |
| Diana        | Odhiambo     | Graduate Research Assistant | Condensed Matter Science |
| Olatunde     | Oladehin     | Graduate Research Assistant | Condensed Matter Science |
| Abiodun      | Oluwalowo    | Graduate Research Assistant | Condensed Matter Science |
| Ankit        | Patel        | Graduate Research Assistant | Condensed Matter Science |
| Bal          | Pokharel     | Graduate Research Assistant | Condensed Matter Science |
| Marquese     | Pollard      | Graduate Research Assistant | Condensed Matter Science |
| Теј          | Poudel       | Graduate Research Assistant | Condensed Matter Science |
| David        | Quashie      | Graduate Research Assistant | Condensed Matter Science |
| Breigh       | Renner       | Graduate Research Assistant | Condensed Matter Science |
| Laylah       | Roberts      | Graduate Research Assistant | Condensed Matter Science |
| Alexander    | Roubos       | Graduate Research Assistant | Condensed Matter Science |
| Benny        | Schundelmier | Graduate Research Assistant | Condensed Matter Science |
| Annie        | Scutte       | Graduate Research Assistant | Condensed Matter Science |
| Prakash      | Sharma       | Graduate Research Assistant | Condensed Matter Science |
| Lily         | Stanley      | Graduate Research Assistant | Condensed Matter Science |
| Robert       | Stewart      | Graduate Research Assistant | Condensed Matter Science |
| Yuting       | Tan          | Graduate Research Assistant | Condensed Matter Science |
| Christie     | Thompson     | Graduate Research Assistant | Condensed Matter Science |
| Okten        | Ungor        | Graduate Research Assistant | Condensed Matter Science |
| Manoj        | Vinayaka     | Graduate Research Assistant | Condensed Matter Science |
| Matthew      | Wadsworth    | Graduate Research Assistant | Condensed Matter Science |
| Ruojun       | Wang         | Graduate Research Assistant | Condensed Matter Science |
| Yuxin        | Wang         | Graduate Research Assistant | Condensed Matter Science |
| Biwen        | Zhang        | Graduate Research Assistant | Condensed Matter Science |
| Wenkai       | Zheng        | Graduate Research Assistant | Condensed Matter Science |
| Arshad       | Javed        | Grants Compliance Analyst   | Condensed Matter Science |
| Abhisek      | Basu         | Postdoctoral Associate      | Condensed Matter Science |
| Prateek      | Benhal       | Postdoctoral Associate      | Condensed Matter Science |
| Anish        | Bhardwaj     | Postdoctoral Associate      | Condensed Matter Science |
| Nhat         | Bui          | Postdoctoral Associate      | Condensed Matter Science |
| Brian        | Casas        | Postdoctoral Associate      | Condensed Matter Science |
| Shantanu     | Chakraborty  | Postdoctoral Associate      | Condensed Matter Science |
| Ravichandran | Honnavally   | Postdoctoral Associate      | Condensed Matter Science |
| Yuxuan       | Jiang        | Postdoctoral Associate      | Condensed Matter Science |
| Manjodh      | Kaur         | Postdoctoral Associate      | Condensed Matter Science |

| First Name | Last Name        | Position Title         | Department               |
|------------|------------------|------------------------|--------------------------|
| Soojeong   | Kim              | Postdoctoral Associate | Condensed Matter Science |
| Krishnendu | Kundu            | Postdoctoral Associate | Condensed Matter Science |
| Kyungmin   | Lee              | Postdoctoral Associate | Condensed Matter Science |
| Daphne     | Lubert-Perquel   | Postdoctoral Associate | Condensed Matter Science |
| Jonathan   | Marbey           | Postdoctoral Associate | Condensed Matter Science |
| Shirin     | Mozaffari        | Postdoctoral Associate | Condensed Matter Science |
| Vincent    | Obiozo           | Postdoctoral Associate | Condensed Matter Science |
| Jeongmin   | Park             | Postdoctoral Associate | Condensed Matter Science |
| Shivani    | Sharma           | Postdoctoral Associate | Condensed Matter Science |
| Jasminka   | Terzic           | Postdoctoral Associate | Condensed Matter Science |
| Kwok       | Wai              | Postdoctoral Associate | Condensed Matter Science |
| Χίαογυ     | Wang             | Postdoctoral Associate | Condensed Matter Science |
| Youcheng   | Wang             | Postdoctoral Associate | Condensed Matter Science |
| Li         | Xiang            | Postdoctoral Associate | Condensed Matter Science |
| Thomas     | Albrecht-Schmitt | Professor              | Condensed Matter Science |
| Nicholas   | Bonesteel        | Professor              | Condensed Matter Science |
| Jianming   | Сао              | Professor              | Condensed Matter Science |
| Irinel     | Chiorescu        | Professor              | Condensed Matter Science |
| Naresh     | Dalal            | Professor              | Condensed Matter Science |
| Vladimir   | Dobrosavljevic   | Professor              | Condensed Matter Science |
| Piotr      | Fajer            | Professor              | Condensed Matter Science |
| Jin        | Gyu              | Professor              | Condensed Matter Science |
| Efstratios | Manousakis       | Professor              | Condensed Matter Science |
| Pedro      | Schlottmann      | Professor              | Condensed Matter Science |
| Theo       | Siegrist         | Professor              | Condensed Matter Science |
| Kun        | Yang             | Professor              | Condensed Matter Science |
| Renee      | Luallen          | Program Coordinator    | Condensed Matter Science |
| Sergio     | Arana            | Research Assistant     | Condensed Matter Science |
| Caleb      | Betts            | Research Assistant     | Condensed Matter Science |
| Lucas      | Braga            | Research Assistant     | Condensed Matter Science |
| Casey      | Cargill          | Research Assistant     | Condensed Matter Science |
| Michael    | Cho              | Research Assistant     | Condensed Matter Science |
| Matthew    | DeJong           | Research Assistant     | Condensed Matter Science |
| Nathaniel  | Falb             | Research Assistant     | Condensed Matter Science |
| David      | Gordon           | Research Assistant     | Condensed Matter Science |
| Saliya     | Grandison        | Research Assistant     | Condensed Matter Science |
| Bobby      | Haney            | Research Assistant     | Condensed Matter Science |
| Darnell    | Houck            | Research Assistant     | Condensed Matter Science |
| Jeremy     | Jack             | Research Assistant     | Condensed Matter Science |
| John       | Jacke            | Research Assistant     | Condensed Matter Science |

| First Name | Last Name      | Position Title       | Department               |
|------------|----------------|----------------------|--------------------------|
| Sean       | Jackson        | Research Assistant   | Condensed Matter Science |
| Eliana     | Karr           | Research Assistant   | Condensed Matter Science |
| Shannon    | Kelley         | Research Assistant   | Condensed Matter Science |
| Jason      | Kuszynski      | Research Assistant   | Condensed Matter Science |
| Ashlyn     | Langford       | Research Assistant   | Condensed Matter Science |
| Maria      | Laura          | Research Assistant   | Condensed Matter Science |
| Meghan     | Leger          | Research Assistant   | Condensed Matter Science |
| Peter      | McGoron        | Research Assistant   | Condensed Matter Science |
| Elizabeth  | Meinert-Spyker | Research Assistant   | Condensed Matter Science |
| Bianca     | Mitchell       | Research Assistant   | Condensed Matter Science |
| Paige      | Nielsen        | Research Assistant   | Condensed Matter Science |
| Luis       | Saucedo        | Research Assistant   | Condensed Matter Science |
| Madison    | Sayles         | Research Assistant   | Condensed Matter Science |
| Christina  | Schiffert      | Research Assistant   | Condensed Matter Science |
| Sofia      | Torino         | Research Assistant   | Condensed Matter Science |
| Qi         | Wang           | Research Assistant   | Condensed Matter Science |
| Ту         | Wilson         | Research Assistant   | Condensed Matter Science |
| John       | Wise           | Research Assistant   | Condensed Matter Science |
| Michael    | Υυ             | Research Assistant   | Condensed Matter Science |
| Bianca     | Trociewitz     | Research Engineer    | Condensed Matter Science |
| Shalinee   | Chikara        | Research Faculty I   | Condensed Matter Science |
| Elizabeth  | Green          | Research Faculty I   | Condensed Matter Science |
| Lin        | Jiao           | Research Faculty I   | Condensed Matter Science |
| Mykhaylo   | Ozerov         | Research Faculty I   | Condensed Matter Science |
| Arkady     | Shehter        | Research Faculty I   | Condensed Matter Science |
| Julia      | Smith          | Research Faculty I   | Condensed Matter Science |
| Кауа       | Wei            | Research Faculty I   | Condensed Matter Science |
| Alimamy    | Bangura        | Research Faculty II  | Condensed Matter Science |
| Ryan       | Baumbach       | Research Faculty II  | Condensed Matter Science |
| William    | Coniglio       | Research Faculty II  | Condensed Matter Science |
| David      | Graf           | Research Faculty II  | Condensed Matter Science |
| Wan        | Куџ            | Research Faculty II  | Condensed Matter Science |
| Eric       | Lochner        | Research Faculty II  | Condensed Matter Science |
| Likai      | Song           | Research Faculty II  | Condensed Matter Science |
| Luis       | Balicas        | Research Faculty III | Condensed Matter Science |
| Jan        | Jaroszynski    | Research Faculty III | Condensed Matter Science |
| Jerzy      | Krzystek       | Research Faculty III | Condensed Matter Science |
| Stephen    | McGill         | Research Faculty III | Condensed Matter Science |
| Andrzej    | Ozarowski      | Research Faculty III | Condensed Matter Science |
| Dragana    | Popovic        | Research Faculty III | Condensed Matter Science |

| First Name | Last Name | Position Title                | Department               |
|------------|-----------|-------------------------------|--------------------------|
| Arneil     | Reyes     | Research Faculty III          | Condensed Matter Science |
| Eun        | Sang      | Research Faculty III          | Condensed Matter Science |
| Dmitry     | Smirnov   | Research Faculty III          | Condensed Matter Science |
| Alexey     | Suslov    | Research Faculty III          | Condensed Matter Science |
| Stanley    | Tozer     | Research Faculty III          | Condensed Matter Science |
| Johan      | van       | Research Faculty III          | Condensed Matter Science |
| Jason      | Parness   | Technician                    | Condensed Matter Science |
| Thierry    | Dubroca   | Visiting Research Faculty I   | Condensed Matter Science |
| Nihar      | Pradhan   | Visiting Research Faculty I   | Condensed Matter Science |
| Haidong    | Zhou      | Visiting Research Faculty I   | Condensed Matter Science |
| John       | Schlueter | Visiting Scientist/Researcher | Condensed Matter Science |

#### DC Instrumentation

DC Instrumentation

| First Name | Last Name  | Position Title                          | Department         |
|------------|------------|-----------------------------------------|--------------------|
| Harsha     | Ravindra   | Associate in Research                   | DC Instrumentation |
| Karl       | Schoder    | Associate in Research                   | DC Instrumentation |
| Dionne     | Soto       | Associate in Research                   | DC Instrumentation |
| Michael    | Steurer    | Associate in Research                   | DC Instrumentation |
| Heinrich   | Boenig     | Engineer                                | DC Instrumentation |
| James      | Powell     | Research Engineer                       | DC Instrumentation |
| Eric       | Stiers     | Research Engineer                       | DC Instrumentation |
| Vaughan    | Williams   | Research Engineer                       | DC Instrumentation |
| Mark       | Vanderlaan | Research Engineer, Cryogenic Operations | DC Instrumentation |
| Yanjun     | Shi        | Research Faculty I                      | DC Instrumentation |
| Bobby      | Pullum     | Scientific & Research Technician        | DC Instrumentation |
| Troy       | Brumm      | Scientific Research Specialist          | DC Instrumentation |
| Bryon      | Dalton     | Scientific Research Specialist          | DC Instrumentation |
| Larry      | Gordon     | Scientific Research Specialist          | DC Instrumentation |
| Glover     | Jones      | Scientific Research Specialist          | DC Instrumentation |
| Scott      | Maier      | Scientific Research Specialist          | DC Instrumentation |
| Daniel     | McIntosh   | Scientific Research Specialist          | DC Instrumentation |
| Robert     | Nowell     | Scientific Research Specialist          | DC Instrumentation |
| Edward     | Rubes      | Scientific Research Specialist          | DC Instrumentation |
| Dmitry     | Semenov    | Scientific Research Specialist          | DC Instrumentation |
| Sujana     | Sri        | Scientific Research Specialist          | DC Instrumentation |
| Robert     | Carrier    | Technical/Research Designer             | DC Instrumentation |
| Daniel     | Freeman    | Technical/Research Designer             | DC Instrumentation |
| Michael    | Hicks      | Technical/Research Designer             | DC Instrumentation |
| Morgan     | Oliff      | Technical/Research Designer             | DC Instrumentation |
| Joel       | Piotrowski | Technical/Research Designer             | DC Instrumentation |

| First Name  | Last Name | Position Title               | Department         |
|-------------|-----------|------------------------------|--------------------|
| Christopher | Thomas    | Technical/Research Designer  | DC Instrumentation |
| Jesus       | Torres    | Technical/Research Designer  | DC Instrumentation |
| William     | Brehm     | Technician/Research Designer | DC Instrumentation |
| David       | Sloan     | Technician/Research Designer | DC Instrumentation |

### **Director's Office**

Director's Office

| First Name  | Last Name   | Position Title                                                            | Department        |
|-------------|-------------|---------------------------------------------------------------------------|-------------------|
| Sarah       | Whitman     | Animal Lab Tech                                                           | Director's Office |
| Nilubon     | Tabtimtong  | Application Developer Designer                                            | Director's Office |
| Charles     | Coshatt     | Assistant Animal Lab Tech                                                 | Director's Office |
| Marvin      | Woods       | Assistant Director of Research Support                                    | Director's Office |
| Laymon      | Gray        | Assistant Director Safety & Security                                      | Director's Office |
| Jaime       | White-James | Assistant Director, Laboratory Animal<br>Resources                        | Director's Office |
| Crystal     | Brown       | Assistant Lab Animal tech                                                 | Director's Office |
| Christopher | Garye       | Assistant Lab Animal Tech                                                 | Director's Office |
| Ashley      | Gray        | Assistant Biological Safety Officer                                       | Director's Office |
| Benjamin    | Arline      | Assistant Chemical Safety Officer                                         | Director's Office |
| Andrew      | Davis       | Assistant Chemical Safety Officer                                         | Director's Office |
| Richard     | Le          | Biological Safety Officer                                                 | Director's Office |
| Neely       | Lewis       | Building Code Inspector                                                   | Director's Office |
| Tom         | Deckert     | Building Code, Assistant Director<br>Environmental Health & Safety Campus | Director's Office |
| Kari        | Roberts     | Business Analyst                                                          | Director's Office |
| Renee       | Murray      | Chemical Safety Officer                                                   | Director's Office |
| Christian   | Strickland  | Chemical Safety Technician                                                | Director's Office |
| Murray      | Gibson      | Clerk                                                                     | Director's Office |
| Kurt        | Hodges      | Coordinator, Animal Welfare Compliance                                    | Director's Office |
| Johnathan   | Parker      | Critical Systems                                                          | Director's Office |
| Stephen     | Dyal        | Critical Systems Technician                                               | Director's Office |
| Thomas      | Williams    | Critical Systems Technician                                               | Director's Office |
| William     | Hill        | Director of LAR                                                           | Director's Office |
| Thomas      | Jacobson    | Director, EH&S FSU                                                        | Director's Office |
| Dwayne      | Mahony      | EHS Building Inspector                                                    | Director's Office |
| Curt        | Rogers      | EHS Fire Tech                                                             | Director's Office |
| Matthew     | Maleszewski | EHS Technician                                                            | Director's Office |
| Sam         | Sevor       | Fire Safety Coordinator                                                   | Director's Office |
| Michael     | Bryan       | Fire Safety Tech                                                          | Director's Office |
| Thomas      | Brasher     | Fire Systems Technician                                                   | Director's Office |
| Matt        | Howell      | Fire Systems Technician                                                   | Director's Office |
| Corey       | Furbee      | Fire Tech                                                                 | Director's Office |

| First Name   | Last Name    | Position Title                      | Department        |
|--------------|--------------|-------------------------------------|-------------------|
| Morgan       | White        | Fire-Plans Examiner/Inspector       | Director's Office |
| Raymond      | Allen        | FSU Fire Tech                       | Director's Office |
| Darren       | Dime         | FSU Fire Tech                       | Director's Office |
| Mark         | Klawinski    | Industrial Hygienist                | Director's Office |
| Jason        | Marconnet    | Industrial Hygienist                | Director's Office |
| Alfie        | Brown        | Industrial Safety & Health Eng.     | Director's Office |
| Christopher  | Rodman       | Industrial Safety & Health Eng.     | Director's Office |
| Seyedehsahar | Mohammadi    | Industrial Safety Hygienist         | Director's Office |
| Jason        | Nipper       | Lab Animal Technologist             | Director's Office |
| Matthieu     | Dumont       | Licensing Manager                   | Director's Office |
| Caroline     | McNiel       | Media Specialist                    | Director's Office |
| Glenda       | Herrera-Gray | Occ. Health & Safety Specialist     | Director's Office |
| Lou          | Plansoen     | Occ. Health & Safety Specialist     | Director's Office |
| Carlos       | Villa        | Outreach Coordinator                | Director's Office |
| Jennifer     | Schellinger  | Postdoctoral Associate              | Director's Office |
| Colleen      | Davis        | Program Coordinator                 | Director's Office |
| Kristen      | Coyne        | Program Manager                     | Director's Office |
| Anke         | Toth         | Program Manager                     | Director's Office |
| Laurie       | Whetstone    | Quality Control Program Coordinator | Director's Office |
| Jason        | Johnson      | Radiation Safety Officer            | Director's Office |
| Debin        | Hammons      | Receptionist                        | Director's Office |
| Yusuf        | Qureshi      | Receptionist                        | Director's Office |
| Ekaterina    | Semenova     | Receptionist                        | Director's Office |
| Albert       | Migliori     | Research Faculty III                | Director's Office |
| Lezlee       | Richerson    | Sr. Administrative Specialist       | Director's Office |
| Alyssa       | Troy         | Undergraduate Research Intern       | Director's Office |
| Stephen      | Bilenky      | Videographer                        | Director's Office |
| Norman       | Anderson     | VP Research                         | Director's Office |

# Management and Administration

| First Name | Last Name | Position Title                   | Department                    |
|------------|-----------|----------------------------------|-------------------------------|
| Darian     | Davis     | AC Technician                    | Management and Administration |
| Daniel     | Price     | AC Technician                    | Management and Administration |
| Marsha     | Jones     | Accounting Assistant             | Management and Administration |
| Angelena   | Lang      | Accounting Assistant             | Management and Administration |
| Shauna     | Walsh     | Accounting Specialist            | Management and Administration |
| Karen      | Joiner    | Admin Support Assistant          | Management and Administration |
| Whitney    | Brown     | Administrative Specialist        | Management and Administration |
| Dorothy    | Gray      | Administrative Specialist        | Management and Administration |
| Holly      | Stafford  | Administrative Support Assistant | Management and Administration |

| First Name | Last Name  | Position Title                           | Department                    |
|------------|------------|------------------------------------------|-------------------------------|
| Damaris    | Cobb       | Asset Management Specialist              | Management and Administration |
| Karol      | Bickett    | Budget Analyst                           | Management and Administration |
| Walter     | Lee        | Budget Analyst                           | Management and Administration |
| William    | Barker     | Campus Service Assistant                 | Management and Administration |
| Scott      | Hermance   | Campus Service Assistant                 | Management and Administration |
| Catalina   | Torres     | Clerk                                    | Management and Administration |
| Cary       | Winkler    | Controls / Alarm Systems<br>Technician   | Management and Administration |
| Harry      | Dickie     | Custodial Supervisor                     | Management and Administration |
| Keri       | McDaniel   | Energy Specialist                        | Management and Administration |
| Aaron      | Young      | Engineer Technician                      | Management and Administration |
| Marshall   | Wood       | Facilities Electrical Supervisor         | Management and Administration |
| Sean       | Coyne      | Facilities Engineer                      | Management and Administration |
| Kevin      | Gamble     | Facilities Superintendent                | Management and Administration |
| Clyde      | Rea        | FSU MRD Affiliate                        | Management and Administration |
| Jay        | Luedecke   | FSU project manager                      | Management and Administration |
| Shengzhi   | Zhang      | Graduate Research Assistant              | Management and Administration |
| Rodney     | Shreve     | Industrial Engineer                      | Management and Administration |
| Austin     | Stafford   | Intern                                   | Management and Administration |
| Rob        | Allen      | ITS Technician                           | Management and Administration |
| Jackie     | Bucheck    | Lab Program and Air Resources<br>Manager | Management and Administration |
| Marcela    | Castano    | Maintenance Engineer                     | Management and Administration |
| Micheal    | Ivester    | Maintenance Mechanic                     | Management and Administration |
| Steve      | Johnson    | Maintenance Mechanic                     | Management and Administration |
| Don        | Pagel      | Maintenance Mechanic                     | Management and Administration |
| Robert     | Perkins    | Maintenance Mechanic                     | Management and Administration |
| Billy      | Phinazee   | Maintenance Mechanic                     | Management and Administration |
| Anderson   | Poole      | Maintenance Mechanic                     | Management and Administration |
| Daniel     | Preston    | Maintenance Mechanic                     | Management and Administration |
| Ryan       | Porter     | Maintenance Supervisor                   | Management and Administration |
| Raymond    | Cone       | Mechanical Assistant                     | Management and Administration |
| John       | Childs     | Media Specialist (Graphic Artist)        | Management and Administration |
| Kevin      | John       | Media Specialist (Graphic Artist)        | Management and Administration |
| Richard    | Ludlow     | Media Specialist (Graphic Artist)        | Management and Administration |
| Becky      | Price      | Network Architect                        | Management and Administration |
| Monroe     | Walker     | Network Specialist                       | Management and Administration |
| Miranda    | Hacker     | Office Administrator                     | Management and Administration |
| Andrew     | Sapronetti | Office Administrator                     | Management and Administration |
| Judeth     | Jean       | Office Assistant                         | Management and Administration |
| Tra        | Hunter     | Plant Engineer                           | Management and Administration |
| William    | Enfinger   | Plumber                                  | Management and Administration |

| First Name  | Last Name | Position Title                   | Department                    |
|-------------|-----------|----------------------------------|-------------------------------|
| Ronald      | Wallace   | Plumber                          | Management and Administration |
| Philip      | Hill      | Program Associate                | Management and Administration |
| Kenneth     | Braverman | Research Assistant               | Management and Administration |
| Ermal       | Liko      | Scientific & Research Technician | Management and Administration |
| Dustin      | Stevens   | Scientific & Research Technician | Management and Administration |
| Christopher | Oxendine  | Scientific & Research Technician | Management and Administration |
| Russ        | Cooper    | Senior Electrician FSU Campus    | Management and Administration |
| Jacqueline  | Kornegay  | Senior Financial Specialist      | Management and Administration |
| Matthew     | Kirschner | Systems Programmer               | Management and Administration |
| Andrew      | Rettig    | Technical Support Analyst        | Management and Administration |
| Cristina    | Alonso    | Technology Specialist            | Management and Administration |
| James       | Berhalter | Technology Specialist            | Management and Administration |
| Sarita      | Finn      | Technology Specialist            | Management and Administration |
| Dustin      | Szelong   | Technology Specialist            | Management and Administration |
| Lindsay     | Grooms    | UBA Associate Director           | Management and Administration |
| Sarah       | Childers  | UBA Business Associate           | Management and Administration |
| Stacy       | Slavichak | Water Resources Manager          | Management and Administration |
| David       | Hahn      | Web Application Developer        | Management and Administration |
| Duncan      | Proctor   | Web Designer/Programmer          | Management and Administration |

# Magnet Science & Technology

MS&T

| First Name | Last Name | Position Title              | Department                  |
|------------|-----------|-----------------------------|-----------------------------|
| Doris      | Geohagan  | Accounting Specialist       | Magnet Science & Technology |
| Rebekah    | Sweat     | Assistant Professor         | Magnet Science & Technology |
| Rongmei    | Niu       | Associate In Research       | Magnet Science & Technology |
| Nathaniel  | Garceau   | Graduate Research Assistant | Magnet Science & Technology |
| Mikai      | Hulse     | Graduate Research Assistant | Magnet Science & Technology |
| Toshiaki   | Kanai     | Graduate Research Assistant | Magnet Science & Technology |
| Sarajeen   | Saima     | Graduate Research Assistant | Magnet Science & Technology |
| Hamid      | Sanavandi | Graduate Research Assistant | Magnet Science & Technology |
| Nissi      | Supriya   | Graduate Research Assistant | Magnet Science & Technology |
| Sisi       | Wang      | Graduate Research Assistant | Magnet Science & Technology |
| Atousa     | Mehrani   | Graphic Artist              | Magnet Science & Technology |
| Jiang      | Li        | Microscopist                | Magnet Science & Technology |
| Matthew    | Lundblad  | Microscopist                | Magnet Science & Technology |
| Omar       | Taleb     | Microscopist                | Magnet Science & Technology |
| Shiran     | Bao       | Postdoctoral Associate      | Magnet Science & Technology |
| Yuan       | Tang      | Postdoctoral Associate      | Magnet Science & Technology |
| Peng       | Xu        | Postdoctoral Associate      | Magnet Science & Technology |
| Hui        | Yu        | Postdoctoral Associate      | Magnet Science & Technology |

| First Name  | Last Name  | Position Title                 | Department                  |
|-------------|------------|--------------------------------|-----------------------------|
| Wei         | Guo        | Professor                      | Magnet Science & Technology |
| James       | Maddox     | Program Associate              | Magnet Science & Technology |
| Kyle        | Buchholz   | Research Assistant             | Magnet Science & Technology |
| Salem       | Fa         | Research Assistant             | Magnet Science & Technology |
| Kikelomo    | ljagbemi   | Research Assistant             | Magnet Science & Technology |
| William     | Markiewicz | Research Assistant             | Magnet Science & Technology |
| Carl        | Windham    | Research Assistant             | Magnet Science & Technology |
| Todd        | Adkins     | Research Engineer              | Magnet Science & Technology |
| Scott       | Bole       | Research Engineer              | Magnet Science & Technology |
| Kurtis      | Cantrell   | Research Engineer              | Magnet Science & Technology |
| Justin      | Deterding  | Research Engineer              | Magnet Science & Technology |
| Scott       | Gundlach   | Research Engineer              | Magnet Science & Technology |
| Brent       | Jarvis     | Research Engineer              | Magnet Science & Technology |
| Dylan       | Kolb-Bond  | Research Engineer              | Magnet Science & Technology |
| Jeremy      | Levitan    | Research Engineer              | Magnet Science & Technology |
| Emsley      | Marks      | Research Engineer              | Magnet Science & Technology |
| George      | Miller     | Research Engineer              | Magnet Science & Technology |
| James       | O'Reilly   | Research Engineer              | Magnet Science & Technology |
| Christopher | Ray        | Research Engineer              | Magnet Science & Technology |
| Donald      | Richardson | Research Engineer              | Magnet Science & Technology |
| Robert      | Stanton    | Research Engineer              | Magnet Science & Technology |
| Adam        | Voran      | Research Engineer              | Magnet Science & Technology |
| James       | White      | Research Engineer              | Magnet Science & Technology |
| Bertram     | Green      | Research Faculty I             | Magnet Science & Technology |
| Hongyu      | Bai        | Research Faculty II            | Magnet Science & Technology |
| lain        | Dixon      | Research Faculty III           | Magnet Science & Technology |
| Andrey      | Gavrilin   | Research Faculty III           | Magnet Science & Technology |
| Ке          | Han        | Research Faculty III           | Magnet Science & Technology |
| Jun         | Lu         | Research Faculty III           | Magnet Science & Technology |
| Jack        | Toth       | Research Faculty III           | Magnet Science & Technology |
| Yan         | Xin        | Research Faculty III           | Magnet Science & Technology |
| Robert      | Goddard    | Scientific Research Specialist | Magnet Science & Technology |
| Vince       | Toplosky   | Scientific Research Specialist | Magnet Science & Technology |
| William     | Marshall   | Sr. Research Associate         | Magnet Science & Technology |
| Thomas      | Painter    | Sr. Research Associate         | Magnet Science & Technology |
| Robert      | Walsh      | Sr. Research Associate         | Magnet Science & Technology |
| Sheryl      | Zavion     | Sr. Research Associate         | Magnet Science & Technology |
| Erick       | Arroyo     | Technical Research Designer    | Magnet Science & Technology |
| Randy       | Helms      | Technical Research/Designer    | Magnet Science & Technology |
| Joseph      | Lucia      | Technical/Research Designer    | Magnet Science & Technology |

|   | First Name | Last Name | Position Title                | Department                  |
|---|------------|-----------|-------------------------------|-----------------------------|
| Ī | Steven     | Van       | Visiting Research Faculty     | Magnet Science & Technology |
| Ī | Yang       | Zhang     | Visiting Research Faculty III | Magnet Science & Technology |
| Ī | Greg       | Erickson  | Visiting Scientist/Researcher | Magnet Science & Technology |
|   | Al         | Zeller    | Visiting Scientist/Researcher | Magnet Science & Technology |

LANL

#### Los Alamos National Laboratory

| First Name | Last Name   | Position Title                      | Department |
|------------|-------------|-------------------------------------|------------|
| Amanda     | Valdez      | Administrative Assistant            | LANL       |
| Jeff       | Martin      | Controls Specialist                 | LANL       |
| Dave       | Sattler     | Designer                            | LANL       |
| Jing       | Li          | Director Postdoc Fellow             | LANL       |
| Andrea     | Schmidt     | Graduate Research Assistant         | LANL       |
| Josiah     | Srock       | Operations Technician               | LANL       |
| Junho      | Choi        | Postdoctoral Associate              | LANL       |
| Mateusz    | Goryca      | Postdoctoral Associate              | LANL       |
| Daniel     | Jackson     | Postdoctoral Associate              | LANL       |
| Satya      | Kushwaha    | Postdoctoral Associate              | LANL       |
| You        | Lai         | Postdoctoral Associate              | LANL       |
| Minseong   | Lee         | Postdoctoral Associate              | LANL       |
| Johanna    | Palmstrom   | Postdoctoral Associate              | LANL       |
| Kirk       | Post        | Postdoctoral Associate              | LANL       |
| Rico       | Schoenemann | Postdoctoral Associate              | LANL       |
| Dan        | Sun         | Postdoctoral Associate              | LANL       |
| Katherine  | Schreiber   | Postdoctoral Researcher             | LANL       |
| Julie      | Gallegos    | Program Administrator               | LANL       |
| Billy      | Vigil       | Research & Development Technologist | LANL       |
| Serena     | Birnbaum    | Research Assistant                  | LANL       |
| Ashish     | Bhardwaj    | Research Faculty I                  | LANL       |
| Mun        | Keat        | Research Faculty II                 | LANL       |
| Laurel     | Winter      | Research Faculty II                 | LANL       |
| Fedor      | Balakirev   | Research Faculty III                | LANL       |
| Scott      | Crooker     | Research Faculty III                | LANL       |
| Neil       | Harrison    | Research Faculty III                | LANL       |
| Mark       | Hinrichs    | Research Faculty III                | LANL       |
| Marcelo    | Jaime       | Research Faculty III                | LANL       |
| Boris      | Maiorov     | Research Faculty III                | LANL       |
| Ross       | McDonald    | Research Faculty III                | LANL       |
| Doan       | Nguyen      | Research Faculty III                | LANL       |
| Dwight     | Rickel      | Research Faculty III                | LANL       |
| John       | Singleton   | Research Faculty III                | LANL       |

| First Name  | Last Name | Position Title        | Department |  |
|-------------|-----------|-----------------------|------------|--|
| Vivien      | Zapf      | Research Faculty III  | LANL       |  |
| Jason       | Lucero    | Research Technician   | LANL       |  |
| Darrell     | Roybal    | Research Technician   | LANL       |  |
| Hazuki      | Teshima   | Research Technician   | LANL       |  |
| Marcos      | Vigil     | Research Technician   | LANL       |  |
| Michael     | Gordon    | Research Technologist | LANL       |  |
| James       | Michel    | Research Technologist | LANL       |  |
| Scott       | Betts     | Technician            | LANL       |  |
| Thomas      | Kline     | Technologist          | LANL       |  |
| Christopher | Cordova   | Undergraduate Student | LANL       |  |

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#### University of Florida

| First Name  | Last Name  | Position Title                         | Department |  |  |
|-------------|------------|----------------------------------------|------------|--|--|
| Shane       | Chatfield  | 3 T Tech                               | UF         |  |  |
| Rebecca     | Butcher    | Assistant Professor                    | UF         |  |  |
| Yousong     | Ding       | Assistant Professor                    | UF         |  |  |
| Matthew     | Eddy       | Assistant Professor                    | UF         |  |  |
| Marcelo     | Febo       | Assistant Professor                    | UF         |  |  |
| Sean        | Forbes     | Assistant Professor                    | UF         |  |  |
| Dominique   | Laroche    | Assistant Professor                    | UF         |  |  |
| Leslie      | Murray     | Assistant Professor                    | UF         |  |  |
| John        | Forder     | Associate Professor                    | UF         |  |  |
| James       | Hamlin     | Associate Professor                    | UF         |  |  |
| Chalermchai | Khemtong   | Associate Professor                    | UF         |  |  |
| Matthew     | Merritt    | Associate Professor                    | UF         |  |  |
| Tammy       | Nicholson  | Certified Radiology Technology Manager | UF         |  |  |
| James       | Collins    | Core Research Facility Manager         | UF         |  |  |
| Anil        | Mehta      | Core Research Facility Manager         | UF         |  |  |
| Jens        | Rosenberg  | Core Research Facility Manager         | UF         |  |  |
| Joshua      | Slade      | Engineering Technician                 | UF         |  |  |
| Alexander   | Donald     | Graduate Research Assistant            | UF         |  |  |
| Judith      | Steadman   | MRI Technologist                       | UF         |  |  |
| Christi     | Swiers     | MRI Technologist                       | UF         |  |  |
| Denise      | Mesa       | NHMFL Administrative Assistant         | UF         |  |  |
| Cynthia     | Sager      | Office Manager                         | UF         |  |  |
| Andrew      | Woods      | Postdoctoral Associate                 | UF         |  |  |
| Alexander   | Angerhofer | Professor                              | UF         |  |  |
| Amlan       | Biswas     | Professor                              | UF         |  |  |
| Stephen     | Blackband  | Professor                              | UF         |  |  |
| Clifford    | Bowers     | Professor                              | UF         |  |  |

| First Name Last Name |              | Position Title                                  | Department |  |  |
|----------------------|--------------|-------------------------------------------------|------------|--|--|
| George               | Christou     | Professor                                       | UF         |  |  |
| Gail                 | Fanucci      | Professor                                       | UF         |  |  |
| Jeffrey              | Fitzsimmons  | Professor                                       | UF         |  |  |
| Stephen              | Hagen        | Professor                                       | UF         |  |  |
| Arthur               | Hebard       | Professor                                       | UF         |  |  |
| Selman               | Hershfield   | Professor                                       | UF         |  |  |
| Peter                | Hirschfeld   | Professor                                       | UF         |  |  |
| Gary                 | lhas         | Professor                                       | UF         |  |  |
| Kevin                | Ingersent    | Professor                                       | UF         |  |  |
| Pradeep              | Kumar        | Professor                                       | UF         |  |  |
| Song                 | Lai          | Professor                                       | UF         |  |  |
| Yoonseok             | Lee          | Professor                                       | UF         |  |  |
| Hendrik              | Luesch       | Professor                                       | UF         |  |  |
| Thomas               | Mareci       | Professor                                       | UF         |  |  |
| Dmitrii              | Maslov       | Professor                                       | UF         |  |  |
| Khandker             | Muttalib     | Professor                                       | UF         |  |  |
| Наі                  | Ping         | Professor                                       | UF         |  |  |
| Andrew               | Rinzler      | Professor                                       | UF         |  |  |
| Christopher          | Stanton      | Professor                                       | UF         |  |  |
| Gregory              | Stewart      | Professor                                       | UF         |  |  |
| Neil                 | Sullivan     | Professor                                       | UF         |  |  |
| Yasumasa             | Takano       | Professor                                       | UF         |  |  |
| Daniel               | Talham       | Professor                                       | UF         |  |  |
| David                | Tanner       | Professor                                       | UF         |  |  |
| David                | Vaillancourt | Professor                                       | UF         |  |  |
| Krista               | Vandenborne  | Professor                                       | UF         |  |  |
| Sergey               | Vasenkov     | Professor                                       | UF         |  |  |
| Glenn                | Walter       | Professor                                       | UF         |  |  |
| Perihan              | Brown        | Research Administrator II                       | UF         |  |  |
| Amy                  | Howe         | Research Coordinator II                         | UF         |  |  |
| Chao                 | Huan         | Research Faculty I                              | UF         |  |  |
| Lucia                | Steinke      | Research Faculty II                             | UF         |  |  |
| Naoto                | Masuhara     | Research Faculty III                            | UF         |  |  |
| Huadong              | Zeng         | Research Faculty III                            | UF         |  |  |
| Kelly                | Jenkins      | RF Coil Engineer                                | UF         |  |  |
| Malathy              | Elumalai     | RF Engineer                                     | UF         |  |  |
| James                | Rocca        | Senior Chemist & NMR Applications<br>Specialist | UF         |  |  |

# Geochemistry

Geochemistry

| First Name | Last Name      | Position Title                      | Department   |
|------------|----------------|-------------------------------------|--------------|
| Burt       | Wolff          | Assistant In Research               | Geochemistry |
| Alyssa     | Atwood         | Assistant Professor                 | Geochemistry |
| Jeremy     | Owens          | Assistant Professor                 | Geochemistry |
| Robert     | Spencer        | Assistant Professor                 | Geochemistry |
| Michael    | Stukel         | Assistant Professor                 | Geochemistry |
| Seth       | Young          | Assistant Professor                 | Geochemistry |
| Nur        | Ahmed          | Graduate Research Assistant         | Geochemistry |
| Lindsi     | Allman         | Graduate Research Assistant         | Geochemistry |
| Megan      | Behnke         | Graduate Research Assistant         | Geochemistry |
| Samantha   | Bosman         | Graduate Research Assistant         | Geochemistry |
| Gary       | Fowler         | Graduate Research Assistant         | Geochemistry |
| Christian  | Gfatter        | Graduate Research Assistant         | Geochemistry |
| Daniel     | Govert         | Graduate Research Assistant         | Geochemistry |
| Chance     | Hannold        | Graduate Research Assistant         | Geochemistry |
| Amy        | Holt           | Graduate Research Assistant         | Geochemistry |
| Johanna    | Imhoff         | Graduate Research Assistant         | Geochemistry |
| Shakura    | Jahan          | Graduate Research Assistant         | Geochemistry |
| Adam       | Karl           | Graduate Research Assistant         | Geochemistry |
| Nevin      | Kozik          | Graduate Research Assistant         | Geochemistry |
| Martin     | Kurek          | Graduate Research Assistant         | Geochemistry |
| Siqi       | Li             | Graduate Research Assistant         | Geochemistry |
| Mary       | Lupo           | Graduate Research Assistant         | Geochemistry |
| Sean       | Newby          | Graduate Research Assistant         | Geochemistry |
| Luis       | Rodriguez      | Graduate Research Assistant         | Geochemistry |
| Jasmin     | Schoenzart     | Graduate Research Assistant         | Geochemistry |
| Srishti    | Sharma         | Graduate Research Assistant         | Geochemistry |
| Daniel     | Sheikh         | Graduate Research Assistant         | Geochemistry |
| Steffanie  | Sillitoe-Kukas | Graduate Research Assistant         | Geochemistry |
| Fajun      | Sun            | Graduate Research Assistant         | Geochemistry |
| Yahyia     | Talebi         | Graduate Research Assistant         | Geochemistry |
| Yin        | Zhang          | Graduate Research Assistant         | Geochemistry |
| Kristie    | Dick           | Laboratory Assistant / Technician   | Geochemistry |
| Xinming    | Chen           | Postdoctoral Associate              | Geochemistry |
| Anne       | Kellerman      | Postdoctoral Associate              | Geochemistry |
| Qing-Feng  | Mei            | Postdoctoral Associate              | Geochemistry |
| Derrick    | Vaughn         | Postdoctoral Associate              | Geochemistry |
| Dominic    | Woelki         | Postdoctoral Associate              | Geochemistry |
| Shuying    | Yang           | Postdoctoral Associate Geochemistry |              |
| Jeff       | Chanton        | Professor                           | Geochemistry |

#### 2020 MagLab Annual Report - Appendix 1 - Personnel

| First Name | Last Name    | Position Title                   | Department   |
|------------|--------------|----------------------------------|--------------|
| Munir      | Humayun      | Professor                        | Geochemistry |
| William    | Landing      | Professor                        | Geochemistry |
| Leroy      | Odom         | Professor                        | Geochemistry |
| Vincent    | Salters      | Professor                        | Geochemistry |
| Yang       | Wang         | Professor                        | Geochemistry |
| Philip     | Froelich     | Research Faculty III             | Geochemistry |
| Afi        | Sachi-Kocher | Scientific Research Specialist   | Geochemistry |
| Gary       | White        | Scientific Research Specialist   | Geochemistry |
| Theodore   | Zateslo      | Senior Engineer                  | Geochemistry |
| Lauren     | Hearn        | Undergraduate Research Assistant | Geochemistry |
| John       | Kerigan      | Undergraduate Research Assistant | Geochemistry |
| Jane       | Wadhams      | Undergraduate Student            | Geochemistry |
| Peter      | Morton       | Visiting Assistant In            | Geochemistry |

AMRIS

#### AMRIS



Seven user facilities — AMRIS (NMR-MRI@UF), DC Field, EMR, High B/T, ICR, NMR-MRI @FSU, and Pulsed Field — each with exceptional instrumentation and highly qualified staff scientists and staff, comprise the magnet lab's user program. In this appendix, each facility presents detailed information about its user demographics, operations statistics and requests for magnet time. A user is an individual or a member of a research group that is allocated magnet time. The user does not have to be "on site" for the experiment. A researcher who sends samples for analysis; a scientist who uses new lab technologies to conduct experiments remotely; or a PI who sends students to the magnet lab, are all considered users. All user numbers reflect distinct individuals, i.e. if a user has multiple proposals (different scientific thrusts) or is allocated magnet time more than once during the year, he/she is counted only once. All user data in the user facility statistics is as of February 4, 2021.

#### 1. AMRIS Facility

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| Senior Personnel, U.S.     | 36                 | 4                     | 24                            | 8                                   | 27   | 3      | 0     | 6                                     |
| Senior Personnel, non-U.S. | 2                  | 1                     | 1                             | 0                                   | 2    | 0      | 0     | 0                                     |
| Postdocs, U.S.             | 10                 | 1                     | 7                             | 2                                   | 6    | 3      | 0     | 1                                     |
| Postdocs, non-U.S.         | 2                  | 0                     | 1                             | 1                                   | 2    | 0      | 0     | 0                                     |
| Students, U.S.             | 31                 | 1                     | 18                            | 12                                  | 16   | 7      | 0     | 8                                     |
| Students, non-U.S.         | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                     |
| Technician, U.S.           | 7                  | 0                     | 5                             | 2                                   | 2    | 4      | 0     | 1                                     |
| Technician, non-U.S.       | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                     |
| TOTAL                      | 88                 | 7                     | 56                            | 25                                  | 55   | 17     | 0     | 16                                    |

Table 1a. Users by Demographic – NSF-Funded

| T - I - I - 1 I - | 1         |              | – Non-NHMFL-Funded |
|-------------------|-----------|--------------|--------------------|
| Ianie in          | LISPES DV | Demodraphic  |                    |
| TUDIC ID.         | 03013 09  | Dornographic |                    |

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No<br>Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|----------------------------------------|------|--------|-------|------------------------------------------|
| Senior Personnel, U.S.     | 96                 | 7                     | 57                            | 32                                     | 48   | 20     | 0     | 28                                       |
| Senior Personnel, non-U.S. | 1                  | 0                     | 1                             | 0                                      | 0    | 1      | 0     | 0                                        |
| Postdocs, U.S.             | 48                 | 6                     | 25                            | 17                                     | 20   | 12     | 0     | 16                                       |
| Postdocs, non-U.S.         | 0                  | 0                     | 0                             | 0                                      | 0    | 0      | 0     | 0                                        |
| Students, U.S.             | 93                 | 9                     | 47                            | 37                                     | 30   | 32     | 0     | 31                                       |
| Students, non-U.S.         | 0                  | 0                     | 0                             | 0                                      | 0    | 0      | 0     | 0                                        |
| Technician, U.S.           | 47                 | 6                     | 19                            | 22                                     | 10   | 17     | 0     | 20                                       |

|                      | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No<br>Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to Gender <sup>3</sup> |
|----------------------|--------------------|-----------------------|-------------------------------|----------------------------------------|------|--------|-------|------------------------------------------|
| Technician, non-U.S. | 0                  | 0                     | 0                             | 0                                      | 0    | 0      | 0     | 0                                        |
| TOTAL                | 285                | 28                    | 149                           | 108                                    | 108  | 82     | 0     | 95                                       |

### Table 1c. Users by Demographic – Summary

|                  | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| NSF-FUNDED       | 88                 | 7                     | 56                            | 25                                  | 55   | 17     | 0     | 16                                    |
| NON-NHMFL-FUNDED | 285                | 28                    | 149                           | 108                                 | 108  | 82     | 0     | 95                                    |
| TOTAL            | 373                | 35                    | 205                           | 133                                 | 163  | 99     | 0     | 111                                   |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status <u>includes</u> the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status <u>excludes</u> Asian and White-Not of Hispanic Origin.

<sup>3</sup> Includes pending user account activations.

## Table 2a. Users by Participation - NSF-Funded

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 36                 | 20            | 3                                        | 2                                    | 11                                     |
| Senior Personnel, non-U.S. | 2                  | 0             | 0                                        | 0                                    | 2                                      |
| Postdocs, U.S.             | 10                 | 10            | 0                                        | 0                                    | 0                                      |
| Postdocs, non-U.S.         | 2                  | 0             | 0                                        | 0                                    | 2                                      |
| Students, U.S.             | 31                 | 25            | 2                                        | 0                                    | 4                                      |
| Students, non-U.S.         | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, U.S.           | 7                  | 7             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| TOTAL                      | 88                 | 62            | 5                                        | 2                                    | 19                                     |

### Table 2b. Users by Participation - Non-NHMFL-Funded

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 96                 | 64            | 0                                        | 0                                    | 32                                     |
| Senior Personnel, non-U.S. | 1                  | 0             | 0                                        | 0                                    | 1                                      |
| Postdocs, U.S.             | 48                 | 42            | 1                                        | 0                                    | 5                                      |
| Postdocs, non-U.S.         | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Students, U.S.             | 93                 | 86            | 0                                        | 1                                    | 6                                      |
| Students, non-U.S.         | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, U.S.           | 47                 | 45            | 0                                        | 0                                    | 2                                      |
| Technician, non-U.S.       | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| TOTAL                      | 285                | 237           | 1                                        | 1                                    | 46                                     |

#### Table 2c. Users by Participation - Summary

|            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| NSF-FUNDED | 88                 | 62            | 5                                        | 2                                    | 19                                     |

|                  | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| NON-NHMFL-FUNDED | 285                | 237           | 1                                        | 1                                    | 46                                     |
| TOTAL            | 373                | 299           | 6                                        | 3                                    | 65                                     |

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

#### Table 3a. Users by Organization – NSF-Funded

|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |
|----------------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------|
| Senior Personnel, U.S.     | 36                 | 17                | 6                        | 13                                         | 0                         | 36                        | 0         |
| Senior Personnel, non-U.S. | 2                  | 2                 | 0                        | 0                                          | 0                         | 2                         | 0         |
| Postdocs, U.S.             | 10                 | 2                 | 7                        | 1                                          | 0                         | 10                        | 0         |
| Postdocs, non-U.S.         | 2                  | 2                 | 0                        | 0                                          | 0                         | 2                         | 0         |
| Students, U.S.             | 31                 | 12                | 19                       | 0                                          | 0                         | 31                        | 0         |
| Students, non-U.S.         | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0         |
| Technician, U.S.           | 7                  | 0                 | 0                        | 7                                          | 0                         | 7                         | 0         |
| Technician, non-U.S.       | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0         |
| TOTAL                      | 88                 | 35                | 32                       | 21                                         | 0                         | 88                        | 0         |

#### Table 3b. Users by Organization - Non-NHMFL-Funded

|                            | Users <sup>1</sup> | External Users | Local<br>Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|----------------|-----------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 96                 | 43             | 38                          | 15                                         | 2                         | 92                        | 2                     |
| Senior Personnel, non-U.S. | 1                  | 1              | 0                           | 0                                          | 0                         | 1                         | 0                     |
| Postdocs, U.S.             | 48                 | 22             | 24                          | 2                                          | 0                         | 48                        | 0                     |
| Postdocs, non-U.S.         | 0                  | 0              | 0                           | 0                                          | 0                         | 0                         | 0                     |
| Students, U.S.             | 93                 | 35             | 58                          | 0                                          | 1                         | 92                        | 0                     |
| Students, non-U.S.         | 0                  | 0              | 0                           | 0                                          | 0                         | 0                         | 0                     |
| Technician, U.S.           | 47                 | 20             | 20                          | 7                                          | 0                         | 47                        | 0                     |
| Technician, non-U.S.       | 0                  | 0              | 0                           | 0                                          | 0                         | 0                         | 0                     |
| TOTAL                      | 285                | 121            | 140                         | 24                                         | 3                         | 280                       | 2                     |

Table 3c. Users by Organization - Summary

|                  | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| NSF-FUNDED       | 88                 | 35                | 32                       | 21                                         | 0                         | 88                        | 0                     |
| NON-NHMFL-FUNDED | 285                | 121               | 140                      | 24                                         | 3                         | 280                       | 2                     |
| TOTAL            | 373                | 156               | 172                      | 45                                         | 3                         | 368                       | 2                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local

users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

| Table 4a. Users by Discipline – NSF-Funded |  |
|--------------------------------------------|--|
|--------------------------------------------|--|

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 36                 | 0                           | 6                          | 7           | 0                     | 23                                      |
| Senior Personnel, non-U.S. | 2                  | 0                           | 0                          | 0           | 0                     | 2                                       |
| Postdocs, U.S.             | 10                 | 0                           | 1                          | 0           | 1                     | 8                                       |
| Postdocs, non-U.S.         | 2                  | 1                           | 1                          | 0           | 0                     | 0                                       |
| Students, U.S.             | 31                 | 0                           | 12                         | 8           | 1                     | 10                                      |
| Students, non-U.S.         | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, U.S.           | 7                  | 0                           | 0                          | 3           | 4                     | 0                                       |
| Technician, non-U.S.       | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                      | 88                 | 1                           | 20                         | 18          | 6                     | 43                                      |

## Table 4b. Users by Discipline - Non-NHMFL-Funded

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 96                 | 0                           | 5                          | 8           | 4                     | 79                                      |
| Senior Personnel, non-U.S. | 1                  | 0                           | 0                          | 0           | 0                     | 1                                       |
| Postdocs, U.S.             | 48                 | 0                           | 4                          | 4           | 2                     | 38                                      |
| Postdocs, non-U.S.         | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Students, U.S.             | 93                 | 1                           | 10                         | 12          | 11                    | 59                                      |
| Students, non-U.S.         | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, U.S.           | 47                 | 0                           | 0                          | 3           | 11                    | 33                                      |
| Technician, non-U.S.       | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                      | 285                | 1                           | 19                         | 27          | 28                    | 210                                     |

## Table 4c. Users by Discipline - Summary

|                  | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NSF-FUNDED       | 88                 | 1                           | 20                         | 18          | 6                     | 43                                      |
| NON-NHMFL-FUNDED | 285                | 1                           | 19                         | 27          | 28                    | 210                                     |
| TOTAL            | 373                | 2                           | 39                         | 45          | 34                    | 253                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

## Table 5 Subscription Rate – Summary

|                  | Experiments<br>Submitted<br>(Current<br>Year) | Experiments<br>Submitted<br>(Deferred<br>from prev.<br>year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experi-<br>ments<br>Declined | Experi-<br>ments<br>Declined<br>Percentage | Experi-<br>ments<br>Reviewed | Experiments<br>Subscription<br>Percentage |
|------------------|-----------------------------------------------|--------------------------------------------------------------|---------------------------|-----------------------------------------|------------------------------|--------------------------------------------|------------------------------|-------------------------------------------|
| NSF-FUNDED       | 10                                            | 21                                                           | 31                        | 100 %                                   | 0                            | 0 %                                        | 31                           | 100%                                      |
| NON-NHMFL-FUNDED | 65                                            | 71                                                           | 127                       | 93.4 %                                  | 9                            | 6.6 %                                      | 136                          | 107.1 %                                   |
| TOTAL            | 75                                            | 92                                                           | 158                       |                                         | 9                            |                                            | 167                          |                                           |

|                  | Total<br>Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |
|------------------|---------------------------------|-----------------------|--------------|---------------------|---------------------|------|-------|-----------------------|
| NSF-FUNDED       | 31                              | 3                     | 23           | 5                   | 7                   | 21   | 0     | 3                     |
| NON-NHMFL-FUNDED | 99                              | 10                    | 60           | 29                  | 25                  | 51   | 0     | 23                    |
| TOTAL            | 130                             | 13                    | 83           | 34                  | 32                  | 72   | 0     | 26                    |

#### Table 6a. Research Proposals <sup>1</sup> Profile (Demographics) with Magnet Time – Summary

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

#### Table 6b. Research Proposals <sup>1</sup> Profile (Discipline) with Magnet Time – Summary

|                  | Total<br>Proposals <sup>1</sup> | СМР | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology, Biochem,<br>Biophys. |
|------------------|---------------------------------|-----|----------------------------|-------------|-----------------------|-------------------------------|
| NSF-FUNDED       | 31                              | 0   | 4                          | 5           | 0                     | 22                            |
| NON-NHMFL-FUNDED | 99                              | 0   | 0                          | 0           | 0                     | 99                            |
| TOTAL            | 130                             | 0   | 4                          | 5           | 0                     | 121                           |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

#### Find the list of user proposals in Appendix V and on our website

| Table 7a. Operations by Magnet System Group – NSF-Funded | Table 7a. | Operations b | y Magnet System | Group – NSF-Funded |
|----------------------------------------------------------|-----------|--------------|-----------------|--------------------|
|----------------------------------------------------------|-----------|--------------|-----------------|--------------------|

|                                  | Total<br>Days<br>Used | % of<br>Total<br>Days<br>Used | 500<br>MHz<br>NMR | 600 MHz<br>NMR Cryo<br>probe | 600<br>MHz<br>NMR<br>Warm<br>Bore | 600<br>MHz<br>NMR | 600<br>MHz<br>Wide<br>Bore | 750<br>MHz<br>Wide | 800<br>MHz,<br>63<br>mm | 800<br>MHz<br>NMR<br>Cryo-<br>probe | 4.7<br>T/33<br>MRI | 11<br>T/40<br>MRI |
|----------------------------------|-----------------------|-------------------------------|-------------------|------------------------------|-----------------------------------|-------------------|----------------------------|--------------------|-------------------------|-------------------------------------|--------------------|-------------------|
| NHMFL-Affiliated                 | 191.9                 | 14.6 %                        | 0                 | 20.2                         | 0                                 | 0                 | 71.3                       | 0                  | 40.8                    | 59.2                                | 0.5                | 0                 |
| Local                            | 13.4                  | 1 %                           | 0                 | 0                            | 0                                 | 8.9               | 1.5                        | 0                  | 0                       | 3                                   | 0                  | 0                 |
| University, U.S.                 | 349.7                 | 26.6 %                        | 0                 | 12.7                         | 122.2                             | 27.3              | 28.3                       | 70.3               | 37.5                    | 44                                  | 0                  | 7.3               |
| University, non-<br>U.S.         | 59.7                  | 4.5 %                         | 0                 | 9.7                          | 1.0                               | 26.7              | 1.0                        | 0                  | 4.7                     | 15.7                                | 0                  | 1.0               |
| Government Lab,<br>U.S.          | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Government Lab,<br>non-U.S.      | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Industry, U.S.                   | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Industry, non-U.S.               | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Test/Calibration/<br>Maintenance | 701.3                 | 53.3 %                        | 89                | 100.5                        | 50.8                              | 81.1              | 26.8                       | 41.7               | 72.1                    | 38.2                                | 103.5              | 97.7              |
| Method<br>Development            | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Analytical<br>Chemistry          | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Setup                            | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| Repair                           | 0                     | 0 %                           | 0                 | 0                            | 0                                 | 0                 | 0                          | 0                  | 0                       | 0                                   | 0                  | 0                 |
| TOTAL                            | 1,316                 |                               | 89                | 143                          | 174                               | 144               | 129                        | 112                | 155                     | 160                                 | 104                | 106               |

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|                                      | Total<br>Days<br>Used | % of<br>Total<br>Days<br>Used | 500<br>MHz<br>NMR | 600<br>MHz<br>NMR<br>Cryo-<br>probe | 600<br>MHz<br>NMR<br>Warm<br>Bore | 600<br>MHz<br>NMR | 600<br>MHz<br>Wide<br>Bore | 750<br>MHz<br>Wide<br>Bore | 800<br>MHz,<br>63<br>mm | 800<br>MHz<br>NMR<br>Cryo-<br>probe | 3T Sie-<br>mens | 3T<br>Phil-<br>lips | 4.7T<br>/33 | 11T<br>/40 |
|--------------------------------------|-----------------------|-------------------------------|-------------------|-------------------------------------|-----------------------------------|-------------------|----------------------------|----------------------------|-------------------------|-------------------------------------|-----------------|---------------------|-------------|------------|
| NHMFL-<br>Affiliated                 | 326.2                 | 27.1 %                        | 62                | 0.5                                 | 11                                | 0                 | 27.5                       | 102.3                      | 26                      | 18.3                                | 22.6            | 1                   | 4           | 51         |
| Local                                | 157.8                 | 13.1 %                        | 0                 | 23.1                                | 0                                 | 6.2               | 0                          | 26.5                       | 8.0                     | 0                                   | 45.5            | 10.1                | 5           | 33.5       |
| University,<br>U.S.                  | 652.3                 | 54.1 %                        | 0                 | 101.4                               | 45                                | 116.8             | 22.5                       | 34.2                       | 0                       | 93.7                                | 122.8           | 68.5                | 12          | 35.5       |
| University,<br>non-U.S.              | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Government<br>Lab, U.S.              | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Government<br>Lab, non-U.S.          | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Industry, U.S.                       | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Industry, non-<br>U.S.               | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Test/<br>Calibration/<br>Maintenance | 69.6                  | 5.8 %                         | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 20.2            | 49.5                | 0           | 0          |
| Method<br>Development                | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Analytical<br>Chemistry              | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Setup                                | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| Repair                               | 0                     | 0 %                           | 0                 | 0                                   | 0                                 | 0                 | 0                          | 0                          | 0                       | 0                                   | 0               | 0                   | 0           | 0          |
| TOTAL                                | 1,206                 |                               | 62                | 125                                 | 56                                | 123               | 50                         | 163                        | 34                      | 112                                 | 211             | 129                 | 21          | 120        |

| Tabla 7h  | Operations by | Magnat System Croup Nan NUMEL Euroday    | Ч |
|-----------|---------------|------------------------------------------|---|
| laple /p. | Operations D  | / Magnet System Group – Non-NHMFL-Funded | J |

### Table 7c. Operations by Magnet Systems - Summary

|                      | Total<br>Days<br>Used | 500<br>MHz<br>NMR | 600<br>MHz<br>NMR<br>Cryo-<br>probe | 600<br>MHz<br>NMR<br>Warm<br>Bore | 600<br>MHz<br>NMR | 600<br>MHz<br>Wide<br>Bore | 750<br>MHz<br>Wide<br>Bore | 800<br>MHz,<br>63 mm | 800<br>MHz<br>NMR<br>Cryo-<br>probe | 3T<br>Sie-<br>mens | 3T<br>Phil-<br>lips | 4.7T<br>/33 | 11T<br>/40 |
|----------------------|-----------------------|-------------------|-------------------------------------|-----------------------------------|-------------------|----------------------------|----------------------------|----------------------|-------------------------------------|--------------------|---------------------|-------------|------------|
| NSF-FUNDED           | 1,316                 | 89                | 143                                 | 174                               | 144               | 129                        | 112                        | 155                  | 160                                 | 0                  | 0                   | 104         | 106        |
| NON-NHMFL-<br>FUNDED | 1,206                 | 62                | 125                                 | 56                                | 123               | 50                         | 163                        | 34                   | 112                                 | 211                | 129                 | 21          | 120        |
| TOTAL                | 2,522                 | 151               | 268                                 | 230                               | 267               | 179                        | 275                        | 189                  | 272                                 | 211                | 129                 | 125         | 226        |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

## Table 8a. Operations by Discipline - NSF-Funded

|                          | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|--------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated         | 191.9                           | 0                           | 0                          | 0           | 0                     | 191.9                                   |
| Local                    | 13.4                            | 0                           | 10.4                       | 0           | 0                     | 3                                       |
| University, U.S.         | 349.7                           | 0                           | 48.7                       | 148.8       | 0                     | 152.2                                   |
| University, non-U.S.     | 59.7                            | 0                           | 0                          | 0           | 0                     | 59.7                                    |
| Government Lab, U.S.     | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S. | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, U.S.           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |

|                                   | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|-----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Industry, non-U.S.                | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/ Calibration/<br>Maintenance | 701.3                           | 0                           | 0                          | 0           | 346.4                 | 354.9                                   |
| Method Development                | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry              | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                             | 1,316                           | 0                           | 59.1                       | 148.8       | 346.4                 | 761.7                                   |

## Table 8b. Operations by Discipline – Non-NHMFL-Funded

|                                   | Total Days Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|-----------------------------------|------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                  | 326.2                        | 0                           | 0                          | 0.1         | 0                     | 326.1                                   |
| Local                             | 157.8                        | 0                           | 0                          | 0           | 0                     | 157.8                                   |
| University, U.S.                  | 652.3                        | 0                           | 27                         | 49.8        | 0                     | 575.5                                   |
| University, non-U.S.              | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, U.S.              | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.          | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, U.S.                    | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, non-U.S.                | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/ Calibration/<br>Maintenance | 69.6                         | 0                           | 0                          | 0           | 0                     | 69.6                                    |
| Method Development                | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry              | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                             | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                            | 0                            | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                             | 1,206                        | 0                           | 27                         | 50          | 0                     | 1,129                                   |

## Table 8c. Operations by Discipline - Summary

|                  | Total Days Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|------------------|------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NSF-FUNDED       | 1,316                        | 0                           | 59.1                       | 148.8       | 346.4                 | 761.7                                   |
| NON-NHMFL-FUNDED | 1,206                        | 0                           | 27                         | 50          | 0                     | 1,129                                   |
| TOTAL            | 2,522                        | 0                           | 86.1                       | 198.8       | 346.4                 | 1,890.7                                 |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

### Table 9a. New Pls1 and New Users - NSF-Funded

|                            | Pis | New PIs at the MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 27  | 7                     | 7                      | 20                              | 36        | 3                             | 3                        | 33                                |
| Senior Personnel, non-U.S. | 2   | 0                     | 0                      | 2                               | 2         | 0                             | 0                        | 2                                 |
| Postdocs, U.S.             | 0   | 0                     | 0                      | 0                               | 10        | 2                             | 2                        | 8                                 |

|                      | Pls | New PIs at<br>the MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------|-----|--------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Postdocs, non-U.S.   | 1   | 0                        | 0                      | 1                               | 2         | 0                             | 0                        | 2                                 |
| Students, U.S.       | 1   | 0                        | 0                      | 1                               | 31        | 4                             | 4                        | 27                                |
| Students, non-U.S.   | 0   | 0                        | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, U.S.     | 0   | 0                        | 0                      | 0                               | 7         | 0                             | 0                        | 7                                 |
| Technician, non-U.S. | 0   | 0                        | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| TOTAL                | 31  | 7                        | 7                      | 24                              | 88        | 9                             | 9                        | 79                                |

## Table 9b. New Pls<sup>1</sup> and New Users – Non-NHMFL-Funded

|                            | PIs | New PIs at the MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users at<br>Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 64  | 12                    | 14                     | 50                              | 96        | 0                             | 1                        | 95                                |
| Senior Personnel, non-U.S. | 0   | 0                     | 0                      | 0                               | 1         | 0                             | 0                        | 1                                 |
| Postdocs, U.S.             | 9   | 0                     | 0                      | 9                               | 48        | 5                             | 5                        | 43                                |
| Postdocs, non-U.S.         | 0   | 0                     | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Students, U.S.             | 1   | 0                     | 1                      | 0                               | 93        | 14                            | 18                       | 75                                |
| Students, non-U.S.         | 0   | 0                     | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, U.S.           | 0   | 0                     | 0                      | 0                               | 47        | 1                             | 2                        | 45                                |
| Technician, non-U.S.       | 0   | 0                     | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| TOTAL                      | 74  | 12                    | 15                     | 59                              | 285       | 20                            | 26                       | 259                               |

## Table 9c. New Pls<sup>1</sup> and New Users - Summary

|                  | PIs | New PIs at<br>the MagLab | New PIs at<br>Facility | Returning<br>Pls at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|------------------|-----|--------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| NSF-FUNDED       | 31  | 7                        | 7                      | 24                              | 88        | 9                             | 9                        | 79                                |
| NON-NHMFL-FUNDED | 74  | 12                       | 15                     | 59                              | 285       | 20                            | 26                       | 259                               |
| TOTAL            | 105 | 19                       | 22                     | 83                              | 373       | 29                            | 35                       | 338                               |

<sup>1</sup> Pls who received magnet time for the first time.

## Table 10a. New <sup>1</sup> User Pls – NSF-Funded

| Name            | Organization                             |        | Year of Magnet Time | Is New to<br>MagLab |
|-----------------|------------------------------------------|--------|---------------------|---------------------|
| Johnny Figueroa | Loma Linda University                    | P19197 | Received 2020       | Yes                 |
| Michael Harris  | University of Florida                    | P19469 | Received 2020       | Yes                 |
| Jonathan Judy   | University of Florida                    | P19466 | Received 2020       | Yes                 |
| Peder Larson    | University of California - San Francisco | P17846 | Received 2020       | Yes                 |
| Mario Rivera    | Louisiana State University               | P19426 | Received 2020       | Yes                 |
| Jeffrey Rudolf  | University of Florida                    | P19437 | Received 2020       | Yes                 |
| Carsten Sievers | Georgia Institute of Technology          | P19432 | Received 2020       | Yes                 |

## Table 10b. New <sup>1</sup> User Pls – Non-NHMFL-Funded

| Name Organization     |                           | Proposal | Year of Magnet Time | ls New to<br>MagLab |
|-----------------------|---------------------------|----------|---------------------|---------------------|
| Matthew Eddy          | University of Florida     | P19523   | Received 2020       | No                  |
| Hugo Guerrero-Cazares | Mayo Clinic, Jacksonville | P19417   | Received 2020       | Yes                 |

| Name                | Organization                   | Proposal | Year of Magnet Time | ls New to<br>MagLab |
|---------------------|--------------------------------|----------|---------------------|---------------------|
| Robert Huigens      | University of Florida          | P19489   | Received 2020       | No                  |
| Daniel Isom         | aniel Isom University of Miami |          | Received 2020       | Yes                 |
| Eric Krause         | University of Florida          | P19560   | Received 2020       | Yes                 |
| Andrew Maurer       | University of Florida          | P19449   | Received 2020       | No                  |
| Giuseppe Morelli    | University of Florida          | P19481   | Received 2020       | Yes                 |
| Brian Odegaard      | University of Florida          | P19304   | Received 2020       | Yes                 |
| Jeffrey Rudolf      | University of Florida          | P19436   | Received 2020       | Yes                 |
| Terence Ryan        | University of Florida          | P19454   | Received 2020       | Yes                 |
| Dietmar Siemann     | University of Florida          | P19526   | Received 2020       | Yes                 |
| Maurice Swanson     | University of Florida          | P19281   | Received 2020       | Yes                 |
| Shahabeddin Vahdat  | University of Florida          | P19296   | Received 2020       | Yes                 |
| Christopher Wendler | University of Florida          | P19347   | Received 2020       | Yes                 |
| Lakiesha Williams   | University of Florida          | P19527   | Received 2020       | Yes                 |

<sup>1</sup> Pls who received magnet time for the first time.

## 2. DC Field Facility

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| Senior Personnel, U.S.     | 141                | 6                     | 117                           | 18                                  | 108  | 21     | 0     | 12                                    |
| Senior Personnel, non-U.S. | 43                 | 5                     | 30                            | 8                                   | 31   | 6      | 0     | 6                                     |
| Postdocs, U.S.             | 50                 | 3                     | 39                            | 8                                   | 39   | 8      | 0     | 3                                     |
| Postdocs, non-U.S.         | 11                 | 1                     | 6                             | 4                                   | 4    | 2      | 0     | 5                                     |
| Students, U.S.             | 122                | 4                     | 95                            | 23                                  | 83   | 26     | 0     | 13                                    |
| Students, non-U.S.         | 28                 | 2                     | 20                            | 6                                   | 21   | 3      | 0     | 4                                     |
| Technician, U.S.           | 7                  | 0                     | 6                             | 1                                   | 4    | 2      | 0     | 1                                     |
| Technician, non-U.S.       | 2                  | 0                     | 1                             | 1                                   | 2    | 0      | 0     | 0                                     |
| TOTAL                      | 404                | 21                    | 314                           | 69                                  | 292  | 68     | 0     | 44                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status includes the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status excludes Asian and White-Not of Hispanic Origin.

<sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 141                | 72            | 0                                        | 16                                   | 53                                     |
| Senior Personnel, non-U.S. | 43                 | 12            | 0                                        | 9                                    | 22                                     |
| Postdocs, U.S.             | 50                 | 24            | 0                                        | 2                                    | 24                                     |
| Postdocs, non-U.S.         | 11                 | 5             | 0                                        | 0                                    | 6                                      |
| Students, U.S.             | 122                | 67            | 0                                        | 6                                    | 49                                     |
| Students, non-U.S.         | 28                 | 14            | 0                                        | 1                                    | 13                                     |
| Technician, U.S.           | 7                  | 7             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 2                  | 1             | 0                                        | 0                                    | 1                                      |
| TOTAL                      | 404                | 202           | 0                                        | 34                                   | 168                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

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|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 141                | 82                | 8                        | 51                                         | 15                        | 125                       | 1                     |
| Senior Personnel, non-U.S. | 43                 | 43                | 0                        | 0                                          | 9                         | 33                        | 1                     |
| Postdocs, U.S.             | 50                 | 39                | 3                        | 8                                          | 5                         | 45                        | 0                     |
| Postdocs, non-U.S.         | 11                 | 11                | 0                        | 0                                          | 2                         | 9                         | 0                     |
| Students, U.S.             | 122                | 99                | 14                       | 9                                          | 7                         | 115                       | 0                     |
| Students, non-U.S.         | 28                 | 28                | 0                        | 0                                          | 1                         | 27                        | 0                     |
| Technician, U.S.           | 7                  | 0                 | 0                        | 7                                          | 0                         | 7                         | 0                     |
| Technician, non-U.S.       | 2                  | 2                 | 0                        | 0                                          | 0                         | 2                         | 0                     |

|       | Users <sup>1</sup> | External<br>Users Local Users <sup>2</sup> |    | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |  |
|-------|--------------------|--------------------------------------------|----|--------------------------------------------|---------------------------|---------------------------|-----------|--|
| TOTAL | 404                | 304                                        | 25 | 75                                         | 39                        | 363                       | 2         |  |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU,

UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 141                | 90                          | 18                         | 11          | 12                    | 10                                      |
| Senior Personnel, non-U.S. | 43                 | 28                          | 7                          | 2           | 4                     | 2                                       |
| Postdocs, U.S.             | 50                 | 41                          | 1                          | 1           | 1                     | 6                                       |
| Postdocs, non-U.S.         | 11                 | 9                           | 1                          | 0           | 1                     | 0                                       |
| Students, U.S.             | 122                | 95                          | 13                         | 7           | 3                     | 4                                       |
| Students, non-U.S.         | 28                 | 22                          | 3                          | 1           | 2                     | 0                                       |
| Technician, U.S.           | 7                  | 0                           | 0                          | 0           | 6                     | 1                                       |
| Technician, non-U.S.       | 2                  | 1                           | 0                          | 1           | 0                     | 0                                       |
| TOTAL                      | 404                | 286                         | 43                         | 23          | 29                    | 23                                      |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current<br>Year) | Experiments<br>Submitted<br>(Deferred from<br>prev. year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experiments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|-----------------------------------------------|-----------------------------------------------------------|---------------------------|-----------------------------------------|-------------------------|---------------------------------------|-------------------------|------------------------------------|-------------------------------------------|
| 289                                           | 34                                                        | 146                       | 45.2 %                                  | 177                     | 54.8 %                                | 323                     | 2.2                                | 221.2 %                                   |

#### Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for<br>Inst., Dev., Test<br>and Maint. | Total Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|--------------------------------------------------|--------------------|------------------------------|------------------------------------|
| 2,253             | 779.8                         | 7                          | 209.3                                    | 25                                               | 1,021.1            | 2.2                          | 221.3 %                            |

#### Table 6a. Research Proposals 1 Profile (Demographics) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No<br>Gender Response |
|---------------------------------|-----------------------|--------------|---------------------|---------------------|------|-------|-----------------------|
| 108                             | 5                     | 96           | 7                   | 22                  | 82   | 0     | 4                     |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

#### Table 6b. Research Proposals <sup>1</sup> Profile (Discipline) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Condensed Matter<br>Physics | Chemistry, Geo-<br>chemistry | Engineering | Magnets, Materials | Biology, Biochem,<br>Biophys. |
|---------------------------------|-----------------------------|------------------------------|-------------|--------------------|-------------------------------|
| 108                             | 77                          | 11                           | 0           | 15                 | 5                             |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

|                              | Total Days<br>Used | % of<br>Total Days Used | 45T | Resistive | SCH | Super-<br>conducting |
|------------------------------|--------------------|-------------------------|-----|-----------|-----|----------------------|
| NHMFL-Affiliated             | 209.3              | 20.5 %                  | 5   | 75.3      | 12  | 117                  |
| Local                        | 7                  | 0.7 %                   | 0   | 0         | 0   | 7                    |
| University, U.S.             | 502.8              | 49.2 %                  | 29  | 118.8     | 17  | 338                  |
| University, non-U.S.         | 174.1              | 17.1 %                  | 4   | 53.1      | 15  | 102                  |
| Government Lab, U.S.         | 26.9               | 2.6 %                   | 9   | 7.9       | 0   | 10                   |
| Government Lab, non-U.S.     | 76                 | 7.4 %                   | 5   | 0         | 0   | 71                   |
| Industry, U.S.               | 0                  | 0 %                     | 0   | 0         | 0   | 0                    |
| Industry, non-U.S.           | 0                  | 0 %                     | 0   | 0         | 0   | 0                    |
| Test/Calibration/Maintenance | 16                 | 1.6 %                   | 0   | 0         | 0   | 16                   |
| Method Development           | 9                  | 0.9 %                   | 0   | 0         | 0   | 9                    |
| Analytical Chemistry         | 0                  | 0 %                     | 0   | 0         | 0   | 0                    |
| Setup                        | 0                  | 0 %                     | 0   | 0         | 0   | 0                    |
| Repair                       | 0                  | 0 %                     | 0   | 0         | 0   | 0                    |
| TOTAL                        | 1,021.1            |                         | 52  | 255.1     | 44  | 670                  |

## Find the list of user proposals in Appendix V and on our website

Table 7 Operations by Magnet Syste

<sup>1</sup>Each 20 MW resistive magnet requires two power supplies to run, the 45 T hybrid magnet requires three power supplies and the 36 T Series Connected Hybrid requires one power supply. Thus there can be four resistive magnets + three superconducting magnets operating or the 45 T hybrid, series connected hybrid, two resistive magnets and three superconducting magnets. User Units are defined as magnet days. Users of water-cooled resistive or hybrid magnets can typically expect to receive enough energy for 7 hours a day of magnet usage so a magnet day is defined as 7 hours. Superconducting magnets are scheduled typically 24 hours a day. There is an annual four week shutdown in fall of powered DC resistive and hybrid magnets for infrastructure maintenance and a two week shutdown period for the university mandated holiday break.

|                              | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated             | 209.3                           | 172                         | 0                          | 0           | 32.4                  | 5                                       |
| Local                        | 7                               | 0                           | 7                          | 0           | 0                     | 0                                       |
| University, U.S.             | 502.8                           | 378                         | 76                         | 0           | 39.7                  | 9                                       |
| University, non-U.S.         | 174.1                           | 119.7                       | 31                         | 0           | 23.5                  | 0                                       |
| Government Lab, U.S.         | 26.9                            | 26.9                        | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.     | 76                              | 76                          | 0                          | 0           | 0                     | 0                                       |
| Industry, U.S.               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, non-U.S.           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/Calibration/Maintenance | 16                              | 16                          | 0                          | 0           | 0                     | 0                                       |
| Method Development           | 9                               | 9                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry         | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                        | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                       | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                        | 1,021.1                         | 797.6                       | 114                        | 0           | 95.5                  | 14                                      |

Table 8 Operations by Discipline

<sup>1</sup> Each 20 MW resistive magnet requires two power supplies to run, the 45 T hybrid magnet requires three power supplies and the 36 T Series Connected Hybrid requires one power supply. Thus there can be four resistive magnets + three superconducting magnets operating or the 45 T hybrid, series connected hybrid, two resistive magnets and three superconducting magnets. User Units are defined as magnet days. Users of water-cooled resistive or hybrid magnets can typically expect to receive enough energy for 7 hours a day of magnet usage so a magnet day is defined as 7 hours. Superconducting magnets are scheduled typically 24 hours a day. There is an annual four week shutdown in fall of powered DC resistive and hybrid magnets for infrastructure maintenance and a two week shutdown period for the university mandated holiday break.

|                            | Pis | New Pls<br>at the<br>MagLab | New PIs<br>at Facility | Returning<br>PIs at Facility | All Users | New Users at<br>the MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------------|------------------------|------------------------------|-----------|----------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 69  | 10                          | 15                     | 54                           | 141       | 4                          | 6                        | 135                               |
| Senior Personnel, non-U.S. | 25  | 3                           | 5                      | 20                           | 43        | 4                          | 5                        | 38                                |
| Postdocs, U.S.             | 0   | 0                           | 0                      | 0                            | 50        | 4                          | 6                        | 44                                |
| Postdocs, non-U.S.         | 0   | 0                           | 0                      | 0                            | 11        | 2                          | 2                        | 9                                 |
| Students, U.S.             | 0   | 0                           | 0                      | 0                            | 122       | 23                         | 30                       | 92                                |
| Students, non-U.S.         | 0   | 0                           | 0                      | 0                            | 28        | 8                          | 9                        | 19                                |
| Technician, U.S.           | 0   | 0                           | 0                      | 0                            | 7         | 1                          | 2                        | 5                                 |
| Technician, non-U.S.       | 0   | 0                           | 0                      | 0                            | 2         | 0                          | 0                        | 2                                 |
| TOTAL                      | 94  | 13                          | 20                     | 74                           | 404       | 46                         | 60                       | 344                               |

## Table 9. New Pls<sup>1</sup> and New Users

<sup>1</sup> PIs who received magnet time for the first time.

## Table 10. New <sup>1</sup> User Pls

| Name              | Organization                                      | Proposal | Year of<br>Magnet Time | Is New to<br>MagLab |
|-------------------|---------------------------------------------------|----------|------------------------|---------------------|
| Shalinee Chikara  | National High Magnetic Field Laboratory           | P19144   | Received 2020          | No                  |
| Irinel Chiorescu  | National High Magnetic Field Laboratory           | P19218   | Received 2020          | No                  |
| Enrique Colacio   | University of Granada                             | P17454   | Received 2020          | No                  |
| Tim Cross         | National High Magnetic Field Laboratory           | P17493   | Received 2020          | No                  |
| Mikel Holcomb     | West Virginia University                          | P19291   | Received 2020          | Yes                 |
| Hua-Fen Hsu       | National Cheng Kung University                    | P19128   | Received 2020          | Yes                 |
| Lin Jiao          | National High Magnetic Field Laboratory           | P19480   | Received 2020          | Yes                 |
| Xueqian Kong      | Zhejiang University                               | P19235   | Received 2020          | No                  |
| Henry La Pierre   | Georgia Institute of Technology                   | P19236   | Received 2020          | Yes                 |
| Bing Lv           | University of Texas, Dallas                       | P19227   | Received 2020          | Yes                 |
| Vlad Pribiag      | University of Minnesota, Twin Cities              | P19258   | Received 2020          | Yes                 |
| Jeffrey Rinehart  | University of California, San Diego               | P19253   | Received 2020          | Yes                 |
| Efrain Rodriguez  | University of Maryland, College Park              | P18006   | Received 2020          | Yes                 |
| Aaron Rossini     | Iowa State University                             | P17500   | Received 2020          | No                  |
| Keshav Shrestha   | Texas A&M University                              | P19467   | Received 2020          | Yes                 |
| Benjamin Stein    | Los Alamos National Laboratory                    | P19152   | Received 2020          | No                  |
| Mas Subramanian   | Oregon State University                           | P19361   | Received 2020          | Yes                 |
| Akiyasu Yamamoto  | Tokyo University of Agriculture and<br>Technology | P19232   | Received 2020          | Yes                 |
| Matthew Yankowitz | University of Washington                          | P19146   | Received 2020          | Yes                 |
| Qi Zhang          | Nanjing University                                | P19349   | Received 2020          | Yes                 |

<sup>1</sup> PIs who received magnet time for the first time.

#### 3. EMR Facility maaraahia Table 1 Hears by

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| Senior Personnel, U.S.     | 51                 | 2                     | 41                            | 8                                   | 40   | 5      | 0     | 6                                     |
| Senior Personnel, non-U.S. | 15                 | 1                     | 12                            | 2                                   | 7    | 7      | 0     | 1                                     |
| Postdocs, U.S.             | 8                  | 0                     | 7                             | 1                                   | 7    | 1      | 0     | 0                                     |
| Postdocs, non-U.S.         | 4                  | 0                     | 3                             | 1                                   | 1    | 2      | 0     | 1                                     |
| Students, U.S.             | 30                 | 1                     | 20                            | 9                                   | 17   | 7      | 0     | 6                                     |
| Students, non-U.S.         | 4                  | 0                     | 2                             | 2                                   | 2    | 1      | 0     | 1                                     |
| Technician, U.S.           | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | C                                     |
| Technician, non-U.S.       | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | C                                     |
| TOTAL                      | 112                | 4                     | 85                            | 23                                  | 74   | 23     | 0     | 15                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status includes the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status excludes Asian and White-Not of Hispanic Origin. <sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 51                 | 30            | 0                                        | 7                                    | 14                                     |
| Senior Personnel, non-U.S. | 15                 | 0             | 0                                        | 4                                    | 11                                     |
| Postdocs, U.S.             | 8                  | 6             | 0                                        | 1                                    | 1                                      |
| Postdocs, non-U.S.         | 4                  | 2             | 0                                        | 0                                    | 2                                      |
| Students, U.S.             | 30                 | 17            | 0                                        | 3                                    | 10                                     |
| Students, non-U.S.         | 4                  | 2             | 0                                        | 0                                    | 2                                      |
| Technician, U.S.           | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| TOTAL                      | 112                | 57            | 0                                        | 15                                   | 40                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

| Table | 3  | Users | bv     | Oraal | nization  |
|-------|----|-------|--------|-------|-----------|
| TUDIC | Ο. | 03013 | $\sim$ | orga  | IL GIIOII |

|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 51                 | 23                | 6                        | 22                                         | 5                         | 46                        | 0                     |
| Senior Personnel, non-U.S. | 15                 | 15                | 0                        | 0                                          | 1                         | 14                        | 0                     |
| Postdocs, U.S.             | 8                  | 3                 | 3                        | 2                                          | 2                         | 6                         | 0                     |
| Postdocs, non-U.S.         | 4                  | 3                 | 0                        | 1                                          | 1                         | 3                         | 0                     |
| Students, U.S.             | 30                 | 17                | 9                        | 4                                          | 0                         | 30                        | 0                     |
| Students, non-U.S.         | 4                  | 4                 | 0                        | 0                                          | 0                         | 4                         | 0                     |
| Technician, U.S.           | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |
| Technician, non-U.S.       | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |

|       | Users <sup>1</sup> External Local Users <sup>2</sup> |    | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |   |
|-------|------------------------------------------------------|----|--------------------------------------------|---------------------------|---------------------------|-----------|---|
| TOTAL | 112                                                  | 65 | 18                                         | 29                        | 9                         | 103       | 0 |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 51                 | 12                          | 28                         | 2           | 0                     | 9                                       |
| Senior Personnel, non-U.S. | 15                 | 1                           | 13                         | 0           | 1                     | 0                                       |
| Postdocs, U.S.             | 8                  | 4                           | 3                          | 0           | 1                     | 0                                       |
| Postdocs, non-U.S.         | 4                  | 0                           | 3                          | 0           | 1                     | 0                                       |
| Students, U.S.             | 30                 | 6                           | 22                         | 0           | 2                     | 0                                       |
| Students, non-U.S.         | 4                  | 1                           | 3                          | 0           | 0                     | 0                                       |
| Technician, U.S.           | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, non-U.S.       | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                      | 112                | 24                          | 72                         | 2           | 5                     | 9                                       |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current Year) | Experiments<br>Submitted<br>(Deferred from<br>prev. year) | Experi-<br>ments With<br>Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experiments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|--------------------------------------------|-----------------------------------------------------------|--------------------------------|-----------------------------------------|-------------------------|---------------------------------------|-------------------------|------------------------------------|-------------------------------------------|
| 93                                         | 15                                                        | 99                             | 91.7 %                                  | 9                       | 8.3 %                                 | 108                     | 1.1                                | 109.1 %                                   |

#### Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for Inst.,<br>Dev., Test and<br>Maint. | Total Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|--------------------------------------------------|--------------------|------------------------------|------------------------------------|
| 960               | 486.5                         | 7                          | 78.5                                     | 56                                               | 704                | 1.4                          | 1.4 %                              |

#### Table 6a. Research Proposals 1 Profile (Demographics) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |
|---------------------------------|-----------------------|--------------|---------------------|---------------------|------|-------|-----------------------|
| 45                              | 4                     | 38           | 3                   | 6                   | 38   | 0     | 1                     |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

#### Table 6b. Research Proposals <sup>1</sup> Profile (Discipline) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets, Materials | Biology, Biochem,<br>Biophys. |  |
|---------------------------------|-----------------------------|----------------------------|-------------|--------------------|-------------------------------|--|
| 45                              | 7                           | 24                         | 1           | 6                  | 7                             |  |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

Find the list of user proposals in Appendix V and on our website

|                                  | Total Days Used | Percentage of<br>Total Days Used | 12.5T<br>Superconducting<br>Magnet, Pulsed EPR | 17T<br>Superconducting<br>Magnet | Bruker | HiPER |
|----------------------------------|-----------------|----------------------------------|------------------------------------------------|----------------------------------|--------|-------|
| NHMFL-Affiliated                 | 78.5            | 11.2 %                           | 22                                             | 19.5                             | 3      | 3     |
| Local                            | 7               | 1 %                              | 0                                              | 5                                | 1      |       |
| University, U.S.                 | 373.5           | 53.1 %                           | 78                                             | 98.5                             | 108    | 8     |
| University, non-U.S.             | 106             | 15.1 %                           | 19                                             | 43                               | 11     | 3     |
| Government Lab, U.S.             | 2               | 0.3 %                            | 0                                              | 2                                | 0      |       |
| Government Lab, non-U.S.         | 5               | 0.7 %                            | 5                                              | 0                                | 0      |       |
| Industry, U.S.                   | 0               | 0 %                              | 0                                              | 0                                | 0      |       |
| Industry, non-U.S.               | 0               | 0 %                              | 0                                              | 0                                | 0      |       |
| Test/Calibration/<br>Maintenance | 56              | 8 %                              | 0                                              | 2                                | 30     | 2     |
| Method Development               | 76              | 10.8 %                           | 0                                              | 0                                | 19     | 5     |
| Analytical Chemistry             | 0               | 0 %                              | 0                                              | 0                                | 0      |       |
| Setup                            | 0               | 0 %                              | 0                                              | 0                                | 0      |       |
| Repair                           | 0               | 0 %                              | 0                                              | 0                                | 0      |       |
| TOTAL                            | 704             |                                  | 124                                            | 170                              | 172    | 23    |

## Table 7. Operations by Magnet System

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

### Table 8. Operations by Discipline

|                                  | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 78.5                            | 19                          | 22                         | 0           | 11.5                  | 26                                      |
| Local                            | 7                               | 0                           | 7                          | 0           | 0                     | 0                                       |
| University, U.S.                 | 373.5                           | 43                          | 228                        | 7           | 1.5                   | 94                                      |
| University, non-U.S.             | 106                             | 24                          | 43                         | 0           | 39                    | 0                                       |
| Government Lab, U.S.             | 2                               | 2                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.         | 5                               | 0                           | 5                          | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, non-U.S.               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 56                              | 0                           | 0                          | 0           | 20                    | 36                                      |
| Method Development               | 76                              | 0                           | 0                          | 0           | 39                    | 37                                      |
| Analytical Chemistry             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 704                             | 88                          | 305                        | 7           | 111                   | 193                                     |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

#### Table 9. New Pls<sup>1</sup> and New Users

|                            | PIs | New PIs at<br>the<br>MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 29  | 4                           | 5                      | 24                              | 51        | 4                             | 8                        | 43                                |
| Senior Personnel, non-U.S. | 9   | 3                           | 3                      | 6                               | 15        | 3                             | 3                        | 12                                |

|                      | Pls | New PIs at<br>the<br>MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Postdocs, U.S.       | 1   | 0                           | 0                      | 1                               | 8         | 2                             | 3                        | 5                                 |
| Postdocs, non-U.S.   | 1   | 0                           | 0                      | 1                               | 4         | 1                             | 1                        | 3                                 |
| Students, U.S.       | 0   | 0                           | 0                      | 0                               | 30        | 8                             | 15                       | 15                                |
| Students, non-U.S.   | 0   | 0                           | 0                      | 0                               | 4         | 1                             | 2                        | 2                                 |
| Technician, U.S.     | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, non-U.S. | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| TOTAL                | 40  | 7                           | 8                      | 32                              | 112       | 19                            | 32                       | 80                                |

<sup>1</sup> PIs who received magnet time for the first time.

## Table 10. New <sup>1</sup> User Pls

| Name            | Organization                                 | Proposal | Year of Magnet Time | ls New to<br>MagLab |
|-----------------|----------------------------------------------|----------|---------------------|---------------------|
| Igor Fritsky    | Taras Shevchenko National University of Kyiv | P19517   | Received 2020       | Yes                 |
| Marta Hatzell   | Georgia Institute of Technology              | P19459   | Received 2020       | Yes                 |
| Kirill Kovnir   | Iowa State University                        | P19330   | Received 2020       | Yes                 |
| Henry La Pierre | Georgia Institute of Technology              | P19275   | Received 2020       | Yes                 |
| Michal Leskes   | Weizmann Institute of Science                | P19484   | Received 2020       | Yes                 |
| Mas Subramanian | Oregon State University                      | P19361   | Received 2020       | Yes                 |
| Rudi van Eldik  | University of Erlangen-Nuremberg, Germany    | P19314   | Received 2020       | Yes                 |
| Sungsool Wi     | National High Magnetic Field Laboratory      | P18056   | Received 2020       | No                  |

<sup>1</sup> PIs who received magnet time for the first time.

HBT

## 4. High B/T Facility

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|------------------------------------------|
| Senior Personnel, U.S.     | 3                  | 0                     | 2                             | 1                                   | 2    | 0      | 0     | 1                                        |
| Senior Personnel, non-U.S. | 1                  | 0                     | 1                             | 0                                   | 1    | 0      | 0     | 0                                        |
| Postdocs, U.S.             | 3                  | 0                     | 1                             | 2                                   | 1    | 1      | 0     | 1                                        |
| Postdocs, non-U.S.         | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                        |
| Students, U.S.             | 3                  | 0                     | 3                             | 0                                   | 2    | 0      | 0     | 1                                        |
| Students, non-U.S.         | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                        |
| Technician, U.S.           | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                        |
| Technician, non-U.S.       | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                        |
| TOTAL                      | 10                 | 0                     | 7                             | 3                                   | 6    | 1      | 0     | 3                                        |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status <u>includes</u> the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status <u>excludes</u> Asian and White-Not of Hispanic Origin.

<sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 3                  | 2             | 0                                        | 0                                    | 1                                      |
| Senior Personnel, non-U.S. | 1                  | 1             | 0                                        | 0                                    | 0                                      |
| Postdocs, U.S.             | 3                  | 3             | 0                                        | 0                                    | 0                                      |
| Postdocs, non-U.S.         | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Students, U.S.             | 3                  | 3             | 0                                        | 0                                    | 0                                      |
| Students, non-U.S.         | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, U.S.           | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| TOTAL                      | 10                 | 9             | 0                                        | 0                                    | 1                                      |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 3                  | 1                 | 0                        | 2                                          | 0                         | 3                         | 0                     |
| Senior Personnel, non-U.S. | 1                  | 1                 | 0                        | 0                                          | 0                         | 1                         | 0                     |
| Postdocs, U.S.             | 3                  | 1                 | 0                        | 2                                          | 0                         | 3                         | 0                     |
| Postdocs, non-U.S.         | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |
| Students, U.S.             | 3                  | 0                 | 3                        | 0                                          | 0                         | 3                         | 0                     |
| Students, non-U.S.         | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |
| Technician, U.S.           | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |
| Technician, non-U.S.       | 0                  | 0                 | 0                        | 0                                          | 0                         | 0                         | 0                     |

Table 3. Users by Organization

<sup>&</sup>lt;sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

|       | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|-------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| TOTAL | 10                 | 3                 | 3                        | 4                                          | 0                         | 10                        | 0                     |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU,

UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                                | Users <sup>1</sup> | Condensed Matter<br>Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|--------------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.         | 3                  | 2                           | 0                          | 0           | 0                     | 1                                       |
| Senior Personnel, non-<br>U.S. | 1                  | 1                           | 0                          | 0           | 0                     | 0                                       |
| Postdocs, U.S.                 | 3                  | 2                           | 0                          | 0           | 0                     | 1                                       |
| Postdocs, non-U.S.             | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Students, U.S.                 | 3                  | 3                           | 0                          | 0           | 0                     | 0                                       |
| Students, non-U.S.             | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, U.S.               | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, non-U.S.           | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                          | 10                 | 8                           | 0                          | 0           | 0                     | 2                                       |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current Year) | Experiments<br>Submitted<br>(Deferred from<br>prev. year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experi-<br>ments<br>Declined | Experiments<br>Declined<br>Percentage | Experi-<br>ments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|--------------------------------------------|-----------------------------------------------------------|---------------------------|-----------------------------------------|------------------------------|---------------------------------------|------------------------------|------------------------------------|-------------------------------------------|
| 8                                          | 2                                                         | 2                         | 20 %                                    | 8                            | 80 %                                  | 10                           | 5                                  | 500 %                                     |

#### Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for<br>Inst., Dev., Test<br>and Maint. | Total Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|--------------------------------------------------|--------------------|------------------------------|------------------------------------|
| 640               | 170                           | 0                          | 0                                        | 0                                                | 170                | 3.8                          | 376.5 %                            |

#### Table 6a. Research Proposals <sup>1</sup> Profile (Demographics) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |
|---------------------------------|-----------------------|------------------|---------------------|---------------------|------|-------|-----------------------|
| 2                               | 0                     | 2                | 0                   | 0                   | 2    | 0     | 0                     |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

#### Table 6b. Research Proposals <sup>1</sup> Profile (Discipline) with Magnet Time

| TOTAL<br>Proposals <sup>1</sup> | Condensed Matter<br>Physics | Chemistry,<br>Geochemistry | Engineering | Magnets, Materials | Biology, Biochem,<br>Biophys. |
|---------------------------------|-----------------------------|----------------------------|-------------|--------------------|-------------------------------|
| 2                               | 2                           | 0                          | 0           | 0                  | 0                             |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female. **Note:** The table refers to proposal disciplines.

## Find the list of user proposals in Appendix V and on our website

Table 7. Operations by Magnet System

HBT

|                                  | Total Days<br>Used | Percentage of Total<br>Days Used | Bay 2<br>(UF Microkelvin Lab)<br>0.02mK, 8T | Bay 3<br>(UF Microkelvin Lab)<br>0.3mK, 16T | Williamson Hall (UF<br>Physics)<br>40mK, 10T (fast cycling) |
|----------------------------------|--------------------|----------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------------------------|
| NHMFL-Affiliated                 | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Local                            | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| University, U.S.                 | 85                 | 50 %                             | 85                                          | 0                                           | 0                                                           |
| University, non-U.S.             | 85                 | 50 %                             | 0                                           | 85                                          | 0                                                           |
| Government Lab, U.S.             | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Government Lab, non-U.S.         | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Industry, U.S.                   | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Industry, non-U.S.               | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Test/Calibration/<br>Maintenance | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Method Development               | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Analytical Chemistry             | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Setup                            | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| Repair                           | 0                  | 0 %                              | 0                                           | 0                                           | 0                                                           |
| TOTAL                            | 170                |                                  | 85                                          | 85                                          | 0                                                           |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

#### Table 8. Operations by Discipline

|                                  | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Local                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| University, U.S.                 | 85                              | 85                          | 0                          | 0           | 0                     | 0                                       |
| University, non-U.S.             | 85                              | 85                          | 0                          | 0           | 0                     | 0                                       |
| Government Lab, U.S.             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.         | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, non-U.S.               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Method Development               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 170                             | 170                         | 0                          | 0           | 0                     | 0                                       |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

|                            | Pls | New PIs at<br>the<br>MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 0   | 0                           | 0                      | 0                               | 3         | 0                             | 0                        | 3                                 |
| Senior Personnel, non-U.S. | 1   | 0                           | 0                      | 1                               | 1         | 0                             | 0                        | 1                                 |
| Postdocs, U.S.             | 1   | 0                           | 0                      | 1                               | 3         | 0                             | 0                        | 3                                 |
| Postdocs, non-U.S.         | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Students, U.S.             | 0   | 0                           | 0                      | 0                               | 3         | 0                             | 0                        | 3                                 |
| Students, non-U.S.         | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, U.S.           | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, non-U.S.       | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| TOTAL                      | 2   | 0                           | 0                      | 2                               | 10        | 0                             | 0                        | 10                                |

## Table 9. New Pls<sup>1</sup> and New Users

<sup>1</sup> Pls who received magnet time for the first time.

Table 10. New <sup>1</sup> User Pls - none

## 5. ICR Facility

| Table 1. Users by Demogro  | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No<br>Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|----------------------------------------|------|--------|-------|------------------------------------------|
| Senior Personnel, U.S.     | 106                | 8                     | 71                            | 27                                     | 57   | 26     | 0     | 23                                       |
| Senior Personnel, non-U.S. | 27                 | 3                     | 12                            | 12                                     | 13   | 2      | 0     | 12                                       |
| Postdocs, U.S.             | 23                 | 1                     | 15                            | 7                                      | 9    | 9      | 0     | 5                                        |
| Postdocs, non-U.S.         | 6                  | 0                     | 5                             | 1                                      | 1    | 4      | 0     | 1                                        |
| Students, U.S.             | 56                 | 5                     | 43                            | 8                                      | 24   | 26     | 0     | 6                                        |
| Students, non-U.S.         | 7                  | 1                     | 3                             | 3                                      | 3    | 2      | 0     | 2                                        |
| Technician, U.S.           | 6                  | 1                     | 0                             | 5                                      | 0    | 1      | 0     | 5                                        |
| Technician, non-U.S.       | 20                 | 0                     | 2                             | 18                                     | 2    | 1      | 0     | 17                                       |
| TOTAL                      | 251                | 19                    | 151                           | 81                                     | 109  | 71     | 0     | 71                                       |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status <u>includes</u> the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status <u>excludes</u> Asian and White-Not of Hispanic Origin.

<sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 106                | 16            | 0                                        | 18                                   | 72                                     |
| Senior Personnel, non-U.S. | 27                 | 2             | 0                                        | 3                                    | 22                                     |
| Postdocs, U.S.             | 23                 | 3             | 0                                        | 1                                    | 19                                     |
| Postdocs, non-U.S.         | 6                  | 0             | 0                                        | 1                                    | 5                                      |
| Students, U.S.             | 56                 | 22            | 0                                        | 5                                    | 29                                     |
| Students, non-U.S.         | 7                  | 0             | 0                                        | 0                                    | 7                                      |
| Technician, U.S.           | 6                  | 0             | 0                                        | 1                                    | 5                                      |
| Technician, non-U.S.       | 20                 | 0             | 0                                        | 0                                    | 20                                     |
| TOTAL                      | 251                | 43            | 0                                        | 29                                   | 179                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-<br>Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |
|----------------------------|--------------------|-------------------|--------------------------|------------------------------------------------|---------------------------|---------------------------|-----------|
| Senior Personnel, U.S.     | 106                | 93                | 3                        | 10                                             | 18                        | 79                        | 9         |
| Senior Personnel, non-U.S. | 27                 | 27                | 0                        | 0                                              | 11                        | 13                        | 3         |
| Postdocs, U.S.             | 23                 | 20                | 1                        | 2                                              | 3                         | 20                        | 0         |
| Postdocs, non-U.S.         | 6                  | 6                 | 0                        | 0                                              | 3                         | 3                         | 0         |
| Students, U.S.             | 56                 | 37                | 11                       | 8                                              | 1                         | 54                        | 1         |
| Students, non-U.S.         | 7                  | 7                 | 0                        | 0                                              | 0                         | 7                         | 0         |
| Technician, U.S.           | 6                  | 6                 | 0                        | 0                                              | 0                         | 4                         | 2         |

#### Table 3. Users by Organization

|                      | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-<br>Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |
|----------------------|--------------------|-------------------|--------------------------|------------------------------------------------|---------------------------|---------------------------|-----------|
| Technician, non-U.S. | 20                 | 20                | 0                        | 0                                              | 2                         | 16                        | 2         |
| TOTAL                | 251                | 216               | 15                       | 20                                             | 38                        | 196                       | 17        |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 106                | 0                           | 65                         | 21          | 1                     | 19                                      |
| Senior Personnel, non-U.S. | 27                 | 0                           | 15                         | 0           | 0                     | 12                                      |
| Postdocs, U.S.             | 23                 | 0                           | 12                         | 5           | 0                     | 6                                       |
| Postdocs, non-U.S.         | 6                  | 0                           | 4                          | 0           | 0                     | 2                                       |
| Students, U.S.             | 56                 | 0                           | 37                         | 12          | 1                     | 6                                       |
| Students, non-U.S.         | 7                  | 0                           | 4                          | 0           | 0                     | 3                                       |
| Technician, U.S.           | 6                  | 0                           | 1                          | 0           | 0                     | 5                                       |
| Technician, non-U.S.       | 20                 | 0                           | 2                          | 5           | 0                     | 13                                      |
| TOTAL                      | 251                | 0                           | 140                        | 43          | 2                     | 66                                      |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current Year) | Experiments<br>Submitted<br>(Deferred from<br>prev. year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experi-<br>ments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|--------------------------------------------|-----------------------------------------------------------|---------------------------|-----------------------------------------|-------------------------|---------------------------------------|------------------------------|------------------------------------|-------------------------------------------|
| 104                                        | 14                                                        | 92                        | 78 %                                    | 26                      | 22 %                                  | 118                          | 1.3                                | 128.3 %                                   |

## Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Method<br>Development | Total Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|-----------------------|--------------------|------------------------------|------------------------------------|
| 1,474             | 241                           | 36.7                       | 86.4                                     | 17.5                  | 612                | 2.4                          | 240.8 %                            |

## Table 6a. Research Proposals <sup>1</sup> Profile (Demographics) with Magnet Time

| Total<br>Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |  |
|---------------------------------|-----------------------|--------------|---------------------|---------------------|------|-------|-----------------------|--|
| 67                              | 4                     | 50           | 13                  | 13                  | 46   | 0     | 8                     |  |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

#### Table 6b. Research Proposals 1 Profile (Discipline) with Magnet Time

| Total<br>Proposals <sup>1</sup> | Condensed Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets, Materials | Biology, Biochem, Biophys. |
|---------------------------------|--------------------------|----------------------------|-------------|--------------------|----------------------------|
| 67                              | 0                        | 49                         | 3           | 2                  | 13                         |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

## Find the list of user proposals in Appendix V and on our website

| <b>T</b>     <b>D</b> | <b>O</b> 11 |                  |
|-----------------------|-------------|------------------|
| lahlo /               | ()nerations | by Magnet System |
|                       | operations  |                  |

|                                  | Total Days Used | Percentage of<br>Total Days Used | 9.4T, 155 mm<br>bore FT-ICR MS | 9.4T, 220 mm<br>bore FT-ICR MS | 14.5T<br>Hybrid LTQ/<br>FT-ICR MS | 21T Hybrid<br>LTQ/FT-ICR MS |
|----------------------------------|-----------------|----------------------------------|--------------------------------|--------------------------------|-----------------------------------|-----------------------------|
| NHMFL-Affiliated                 | 86.4            | 14.1 %                           | 0                              | 38.8                           | 1.3                               | 46.3                        |
| Local                            | 36.7            | 6 %                              | 0                              | 31.5                           | 0                                 | 5.2                         |
| University, U.S.                 | 145.9           | 23.8 %                           | 0                              | 61                             | 0                                 | 84.9                        |
| University, non-U.S.             | 32.5            | 5.3 %                            | 0                              | 0                              | 0                                 | 32.5                        |
| Government Lab, U.S.             | 16.1            | 2.6 %                            | 0                              | 8                              | 0                                 | 8.1                         |
| Government Lab, non-U.S.         | 8.9             | 1.5 %                            | 0                              | 7                              | 0                                 | 1.9                         |
| Industry, U.S.                   | 5               | 0.8 %                            | 0                              | 5                              | 0                                 | 0                           |
| Industry, non-U.S.               | 32.7            | 5.3 %                            | 0                              | 25.2                           | 2.5                               | 5                           |
| Test/Calibration/<br>Maintenance | 17.5            | 2.9 %                            | 0                              | 1.5                            | 15                                | 1.0                         |
| Method Development               | 0               | 0 %                              | 0                              | 0                              | 0                                 | 0                           |
| Analytical Chemistry             | 230.4           | 37.6 %                           | 0                              | 5                              | 153.3                             | 72.2                        |
| Setup                            | 0               | 0 %                              | 0                              | 0                              | 0                                 | 0                           |
| Repair                           | 0               | 0 %                              | 0                              | 0                              | 0                                 | 0                           |
| TOTAL                            | 612             |                                  | 0                              | 183                            | 172                               | 257                         |

<sup>1</sup>User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

### Table 8. Operations by Discipline

|                                  | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 86.4                            | 0                           | 84.4                       | 0           | 2.0                   | 0                                       |
| Local                            | 36.7                            | 0                           | 36.7                       | 0           | 0                     | 0                                       |
| University, U.S.                 | 145.9                           | 0                           | 89.7                       | 3.9         | 6.0                   | 46.3                                    |
| University, non-U.S.             | 32.5                            | 0                           | 2.7                        | 0           | 0                     | 29.8                                    |
| Government Lab, U.S.             | 16.1                            | 0                           | 13.7                       | 2.0         | 0                     | 0.3                                     |
| Government Lab, non-U.S.         | 8.9                             | 0                           | 8.9                        | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 5.0                             | 0                           | 5.0                        | 0           | 0                     | 0                                       |
| Industry, non-U.S.               | 32.7                            | 0                           | 32.7                       | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 17.5                            | 0                           | 17.5                       | 0           | 0                     | 0                                       |
| Method Development               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry             | 230.4                           | 0                           | 230.4                      | 0           | 0                     | 0                                       |
| Setup                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 612                             | 0                           | 521.6                      | 5.9         | 8                     | 76.5                                    |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

## Table 9. New Pls<sup>1</sup> and New Users

|                            | PIs | New PIs at<br>the MagLab | New PIs at<br>Facility | Returning PIs<br>at Facility | All Users | New Users at the MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|--------------------------|------------------------|------------------------------|-----------|-------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 45  | 10                       | 10                     | 35                           | 106       | 21                      | 21                       | 85                                |
| Senior Personnel, non-U.S. | 6   | 1                        | 1                      | 5                            | 27        | 17                      | 17                       | 10                                |
| Postdocs, U.S.             | 1   | 1                        | 1                      | 0                            | 23        | 8                       | 8                        | 15                                |
| Postdocs, non-U.S.         | 2   | 1                        | 1                      | 1                            | 6         | 1                       | 1                        | 5                                 |
| Students, U.S.             | 0   | 0                        | 0                      | 0                            | 56        | 22                      | 22                       | 34                                |
| Students, non-U.S.         | 0   | 0                        | 0                      | 0                            | 7         | 3                       | 3                        | 4                                 |
| Technician, U.S.           | 0   | 0                        | 0                      | 0                            | 6         | 4                       | 4                        | 2                                 |
| Technician, non-U.S.       | 1   | 1                        | 1                      | 0                            | 20        | 10                      | 10                       | 10                                |
| TOTAL                      | 55  | 14                       | 14                     | 41                           | 251       | 86                      | 86                       | 165                               |

<sup>1</sup> PIs who received magnet time for the first time.

## Table 10. New <sup>1</sup> User Pls

| Name              | Organization                                                     | Proposal | Year of<br>Magnet Time | ls New to<br>MagLab |
|-------------------|------------------------------------------------------------------|----------|------------------------|---------------------|
| Kenneth Carroll   | New Mexico State University                                      | P19321   | Received 2020          | Yes                 |
| Núria Catalán     | U.S. Geological Survey (USGS)                                    | P19309   | Received 2020          | Yes                 |
| David Harper      | University of Tennessee, Knoxville                               | P19320   | Received 2020          | Yes                 |
| Jon Hawkings      | Florida State University                                         | P19475   | Received 2020          | Yes                 |
| Leslie Hicks      | University of North Carolina at Chapel Hill                      |          | Received 2020          | Yes                 |
| Samantha Joye     | University of Georgia                                            | P19460   | Received 2020          | Yes                 |
| Xiaolin Li        | Xiamen University                                                | P19493   | Received 2020          | Yes                 |
| Jason Masoner     | U.S. Geological Survey                                           | P19279   | Received 2020          | Yes                 |
| Colleen McMahan   | U.S. Department of Agriculture                                   | P19457   | Received 2020          | Yes                 |
| Karina Meredith   | Australia's Nuclear Science and Technology<br>Organization       | P19277   | Received 2020          | Yes                 |
| Amin Mirkouei     | University of Idaho                                              | P19334   | Received 2020          | Yes                 |
| Calvin Mukarakate | National Renewable Energy Laboratory                             | P19502   | Received 2020          | Yes                 |
| Raghab Ray        | The University of Tokyo, Atmosphere and Ocean Research Institute | P19448   | Received 2020          | Yes                 |
| Estrella Rogel    | Chevron ETC                                                      | P19359   | Received 2020          | Yes                 |

<sup>1</sup> PIs who received magnet time for the first time.

#### 6. NMR Facility amaaranhia Table 1 Hears by

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| Senior Personnel, U.S.     | 84                 | 4                     | 68                            | 12                                  | 65   | 11     | 0     | 8                                     |
| Senior Personnel, non-U.S. | 39                 | 3                     | 20                            | 16                                  | 21   | 7      | 0     | 11                                    |
| Postdocs, U.S.             | 24                 | 2                     | 14                            | 8                                   | 9    | 8      | 0     | 7                                     |
| Postdocs, non-U.S.         | 5                  | 0                     | 2                             | 3                                   | 0    | 2      | 0     | 3                                     |
| Students, U.S.             | 63                 | 3                     | 42                            | 18                                  | 33   | 18     | 0     | 12                                    |
| Students, non-U.S.         | 15                 | 2                     | 5                             | 8                                   | 5    | 3      | 0     | 7                                     |
| Technician, U.S.           | 3                  | 0                     | 3                             | 0                                   | 2    | 1      | 0     | 0                                     |
| Technician, non-U.S.       | 1                  | 0                     | 0                             | 1                                   | 0    | 0      | 0     | 1                                     |
| TOTAL                      | 234                | 14                    | 154                           | 66                                  | 135  | 50     | 0     | 49                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status includes the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status excludes Asian and White-Not of Hispanic Origin. <sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 84                 | 33            | 4                                        | 11                                   | 36                                     |
| Senior Personnel, non-U.S. | 39                 | 5             | 1                                        | 5                                    | 28                                     |
| Postdocs, U.S.             | 24                 | 13            | 2                                        | 2                                    | 7                                      |
| Postdocs, non-U.S.         | 5                  | 1             | 0                                        | 2                                    | 2                                      |
| Students, U.S.             | 63                 | 39            | 3                                        | 11                                   | 10                                     |
| Students, non-U.S.         | 15                 | 3             | 0                                        | 4                                    | 8                                      |
| Technician, U.S.           | 3                  | 3             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 1                  | 0             | 0                                        | 0                                    | 1                                      |
| TOTAL                      | 234                | 97            | 10                                       | 35                                   | 92                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

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|                            | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 84                 | 53                | 8                        | 23                                         | 2                         | 79                        | 3                     |
| Senior Personnel, non-U.S. | 39                 | 39                | 0                        | 0                                          | 4                         | 34                        | 1                     |
| Postdocs, U.S.             | 24                 | 13                | 7                        | 4                                          | 3                         | 20                        | 1                     |
| Postdocs, non-U.S.         | 5                  | 5                 | 0                        | 0                                          | 2                         | 3                         | 0                     |
| Students, U.S.             | 63                 | 34                | 18                       | 11                                         | 0                         | 63                        | 0                     |
| Students, non-U.S.         | 15                 | 15                | 0                        | 0                                          | 1                         | 14                        | 0                     |
| Technician, U.S.           | 3                  | 0                 | 0                        | 3                                          | 0                         | 3                         | 0                     |
| Technician, non-U.S.       | 1                  | 1                 | 0                        | 0                                          | 1                         | 0                         | 0                     |

|       | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry⁵ |
|-------|--------------------|-------------------|--------------------------|--------------------------------------------|---------------------------|---------------------------|-----------|
| TOTAL | 234                | 160               | 33                       | 41                                         | 13                        | 216                       | 5         |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU,

UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 84                 | 3                           | 37                         | 10          | 1                     | 33                                      |
| Senior Personnel, non-U.S. | 39                 | 0                           | 25                         | 3           | 2                     | 9                                       |
| Postdocs, U.S.             | 24                 | 3                           | 4                          | 0           | 2                     | 15                                      |
| Postdocs, non-U.S.         | 5                  | 0                           | 4                          | 0           | 0                     | 1                                       |
| Students, U.S.             | 63                 | 2                           | 30                         | 11          | 1                     | 19                                      |
| Students, non-U.S.         | 15                 | 0                           | 6                          | 5           | 0                     | 4                                       |
| Technician, U.S.           | 3                  | 0                           | 0                          | 1           | 1                     | 1                                       |
| Technician, non-U.S.       | 1                  | 0                           | 1                          | 0           | 0                     | 0                                       |
| TOTAL                      | 234                | 8                           | 107                        | 30          | 7                     | 82                                      |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current Year) | Experiments<br>Submitted<br>(Deferred from<br>prev. year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experi-<br>ments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|--------------------------------------------|-----------------------------------------------------------|---------------------------|-----------------------------------------|-------------------------|---------------------------------------|------------------------------|------------------------------------|-------------------------------------------|
| 430                                        | 15                                                        | 411                       | 92.4 %                                  | 34                      | 7.6 %                                 | 445                          | 1.1                                | 108.3 %                                   |

#### Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for<br>Inst., Dev., Test<br>and Maint. | TOTAL Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|--------------------------------------------------|--------------------|------------------------------|------------------------------------|
| 2,770             | 1,485                         | 77                         | 1,060                                    | 139                                              | 2,761              | 1.0                          | 100.3%                             |

#### Table 6a. Research Proposals 1 Profile (Demographics) with Magnet Time

| E | Total Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |
|---|------------------------------|-----------------------|------------------|---------------------|---------------------|------|-------|-----------------------|
|   | 76                           | 4                     | 60               | 12                  | 15                  | 57   | 0     | 4                     |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

#### Table 6b. Research Proposals 1 Profile (Discipline) with Magnet Time

| Total Proposals <sup>1</sup> | Condensed Matter<br>Physics | Chemistry, Geochemis-<br>try | Engineering | Magnets, Materials | Biology, Biochem,<br>Biophys. |
|------------------------------|-----------------------------|------------------------------|-------------|--------------------|-------------------------------|
| 76                           | 2                           | 21                           | 6           | 6                  | 41                            |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

## Find the list of user proposals in Appendix V and on our <u>website</u>

Table 7. Operations by Magnet System

| Usage Type                           | Total<br>Days<br>Used | % of<br>Total<br>Days<br>Used | 900<br>MHz<br>105<br>mm<br>bore<br>21.1T | 830<br>MHz<br>31<br>mm<br>bore<br>19.6T | 800<br>MHz<br>63<br>mm<br>bore<br>(MB)<br>18.8T<br>#1 | 800<br>MHz<br>63<br>mm<br>bore<br>(MB)<br>18.8T<br>#2 | 800<br>MHz<br>54<br>mm<br>bore<br>(NB)<br>18.8T | 600<br>MHz<br>89<br>mm<br>bore<br>14T<br>#1 | 600 MHz<br>89<br>mm bore<br>14T<br>#2 | 600<br>MHz<br>89<br>mm<br>bore<br>MAS<br>DNP | 600<br>MHz<br>52<br>mm<br>bore<br>14T | 500<br>MHz<br>89<br>mm<br>bore<br>11.7T | 500<br>MHz<br>89<br>bore<br>11.7T<br>(Engine<br>ering<br>School) | Cell<br>14<br>36T<br>40<br>mm<br>SCH |
|--------------------------------------|-----------------------|-------------------------------|------------------------------------------|-----------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------|---------------------------------------------|---------------------------------------|----------------------------------------------|---------------------------------------|-----------------------------------------|------------------------------------------------------------------|--------------------------------------|
| NHMFL-<br>Affiliated                 | 1,060                 | 38.4 %                        | 156                                      | 36                                      | 148                                                   | 213                                                   | 110                                             | 193                                         | 139                                   | 10                                           | 1                                     | 44                                      | 0                                                                | 10                                   |
| Local                                | 77                    | 2.8 %                         | 4                                        | 0                                       | 2                                                     | 0                                                     | 16                                              | 7                                           | 0                                     | 2                                            | 0                                     | 46                                      | 0                                                                | 0                                    |
| University,<br>U.S.                  | 1,034.<br>5           | 37.5 %                        | 8                                        | 229                                     | 146                                                   | 47                                                    | 217                                             | 68                                          | 101                                   | 27.5                                         | 0                                     | 174                                     | 0                                                                | 17                                   |
| University,<br>non-U.S.              | 361.5                 | 13.1 %                        | 10                                       | 82                                      | 39                                                    | 37                                                    | 0                                               | 7                                           | 69                                    | 76.5                                         | 15                                    | 11                                      | 0                                                                | 15                                   |
| Government<br>Lab, U.S.              | 0                     | 0 %                           | 0                                        | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Government<br>Lab, non-U.S.          | 10                    | 0.4 %                         | 0                                        | 2                                       | 0                                                     | 0                                                     | 0                                               | 8                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Industry, U.S.                       | 79                    | 2.9 %                         | 79                                       | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Industry, non-<br>U.S.               | 0                     | 0 %                           | 0                                        | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Test/Calibrati<br>on/Maintenan<br>ce | 127                   | 4.6 %                         | 2                                        | 0                                       | 0                                                     | 0                                                     | 2                                               | 0                                           | 0                                     | 123                                          | 0                                     | 0                                       | 0                                                                | 0                                    |
| Method<br>Development                | 10                    | 0.4 %                         | 0                                        | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 10                                           | 0                                     | 0                                       | 0                                                                | 0                                    |
| Analytical<br>Chemistry              | 0                     | 0 %                           | 0                                        | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Setup                                | 2                     | 0.1 %                         | 0                                        | 0                                       | 2                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| Repair                               | 0                     | 0 %                           | 0                                        | 0                                       | 0                                                     | 0                                                     | 0                                               | 0                                           | 0                                     | 0                                            | 0                                     | 0                                       | 0                                                                | 0                                    |
| TOTAL                                | 2,761                 |                               | 259                                      | 349                                     | 337                                                   | 297                                                   | 345                                             | 283                                         | 309                                   | 249                                          | 16                                    | 275                                     | 0                                                                | 42                                   |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

### Table 8. Operations by Discipline

|                                  | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 1,060                           | 18                          | 322                        | 5           | 61                    | 654                                     |
| Local                            | 77                              | 0                           | 48                         | 24          | 0                     | 5                                       |
| University, U.S.                 | 1,034.5                         | 0                           | 479                        | 5           | 17                    | 533.5                                   |
| University, non-U.S.             | 361.5                           | 0                           | 144                        | 5.5         | 40                    | 172                                     |
| Government Lab, U.S.             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.         | 10                              | 0                           | 10                         | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 79                              | 0                           | 0                          | 0           | 0                     | 79                                      |
| Industry, non-U.S.               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 127                             | 0                           | 0                          | 0           | 12                    | 115                                     |
| Method Development               | 10                              | 0                           | 10                         | 0           | 0                     | 0                                       |
| Analytical Chemistry             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                            | 2                               | 0                           | 0                          | 0           | 2.0                   | 0                                       |
| Repair                           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 2,761                           | 18                          | 1,013                      | 39.5        | 132                   | 1,558.5                                 |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

## Table 9. New Pls<sup>1</sup> and New Users

|                            | Pis | New PIs at the<br>MagLab | New PIs at<br>Facility | Returning<br>Pls at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returnin<br>g Users at<br>Facility |
|----------------------------|-----|--------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|------------------------------------|
| Senior Personnel, U.S.     | 44  | 3                        | 5                      | 39                              | 84        | 8                             | 10                       | 74                                 |
| Senior Personnel, non-U.S. | 16  | 4                        | 4                      | 12                              | 39        | 10                            | 10                       | 29                                 |
| Postdocs, U.S.             | 0   | 0                        | 0                      | 0                               | 24        | 4                             | 6                        | 18                                 |
| Postdocs, non-U.S.         | 0   | 0                        | 0                      | 0                               | 5         | 4                             | 4                        | 1                                  |
| Students, U.S.             | 1   | 0                        | 0                      | 1                               | 63        | 11                            | 17                       | 46                                 |
| Students, non-U.S.         | 0   | 0                        | 0                      | 0                               | 15        | 5                             | 6                        | 9                                  |
| Technician, U.S.           | 1   | 0                        | 0                      | 1                               | 3         | 0                             | 0                        | 3                                  |
| Technician, non-U.S.       | 0   | 0                        | 0                      | 0                               | 1         | 0                             | 0                        | 1                                  |
| TOTAL                      | 62  | 7                        | 9                      | 53                              | 234       | 42                            | 53                       | 181                                |

<sup>1</sup> PIs who received magnet time for the first time.

## Table 10. New <sup>1</sup> User Pls

| Name                       | Organization                            | Proposal | Year of<br>Magnet Time | ls New to<br>MagLab |
|----------------------------|-----------------------------------------|----------|------------------------|---------------------|
| Rivera de la Rosa          | Autonomous University of Nuevo León     | P19479   | Received 2020          | Yes                 |
| David Fenning              | University of California, San Diego     | P19478   | Received 2020          | Yes                 |
| Sami Jannin                | École normale supérieure de Lyon        | P19284   | Received 2020          | Yes                 |
| Isabelle Marcotte          | University of Quebec at Montreal        | P19442   | Received 2020          | Yes                 |
| Ildefonso Marin-Montesinos | Universidade de Aveiro                  | P19491   | Received 2020          | Yes                 |
| Joseph Noel                | Salk Institute for Biological Studies   | P19225   | Received 2020          | Yes                 |
| Geoffrey Strouse           | National High Magnetic Field Laboratory | P19372   | Received 2020          | No                  |
| Pingchuan Sun              | Nankai University                       | P19331   | Received 2020          | Yes                 |
| Adam Veige                 | University of Florida                   | P19170   | Received 2020          | No                  |

<sup>1</sup> PIs who received magnet time for the first time.

PFF

# 7. Pulsed Field Facility

|                            | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No Response<br>to Race <sup>3</sup> | Male | Female | Other | No Response<br>to Gender <sup>3</sup> |
|----------------------------|--------------------|-----------------------|-------------------------------|-------------------------------------|------|--------|-------|---------------------------------------|
| Senior Personnel, U.S.     | 44                 | 2                     | 40                            | 2                                   | 32   | 10     | 0     | 2                                     |
| Senior Personnel, non-U.S. | 10                 | 1                     | 5                             | 4                                   | 8    | 0      | 0     | 2                                     |
| Postdocs, U.S.             | 24                 | 0                     | 21                            | 3                                   | 16   | 7      | 0     | 1                                     |
| Postdocs, non-U.S.         | 3                  | 0                     | 3                             | 0                                   | 2    | 1      | 0     | 0                                     |
| Students, U.S.             | 24                 | 1                     | 21                            | 2                                   | 16   | 7      | 0     | 1                                     |
| Students, non-U.S.         | 5                  | 0                     | 5                             | 0                                   | 5    | 0      | 0     | 0                                     |
| Technician, U.S.           | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                     |
| Technician, non-U.S.       | 0                  | 0                     | 0                             | 0                                   | 0    | 0      | 0     | 0                                     |
| TOTAL                      | 110                | 4                     | 95                            | 11                                  | 79   | 25     | 0     | 6                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status includes the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status excludes Asian and White-Not of Hispanic Origin. <sup>3</sup> Includes pending user account activations.

#### Table 2. Users by Participation

|                            | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|----------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| Senior Personnel, U.S.     | 44                 | 23            | 0                                        | 2                                    | 19                                     |
| Senior Personnel, non-U.S. | 10                 | 1             | 0                                        | 0                                    | 9                                      |
| Postdocs, U.S.             | 24                 | 19            | 0                                        | 1                                    | 4                                      |
| Postdocs, non-U.S.         | 3                  | 0             | 0                                        | 1                                    | 2                                      |
| Students, U.S.             | 24                 | 10            | 0                                        | 2                                    | 12                                     |
| Students, non-U.S.         | 5                  | 3             | 0                                        | 1                                    | 1                                      |
| Technician, U.S.           | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| Technician, non-U.S.       | 0                  | 0             | 0                                        | 0                                    | 0                                      |
| TOTAL                      | 110                | 56            | 0                                        | 7                                    | 47                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

| Table | 3  | lleore | hv | Oraa | niza   | ntion |
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|                            | Users <sup>1</sup> | External<br>Users | Local<br>Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|----------------------------|--------------------|-------------------|-----------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| Senior Personnel, U.S.     | 44                 | 22                | 6                           | 16                                         | 20                        | 24                        | 0                     |
| Senior Personnel, non-U.S. | 10                 | 10                | 0                           | 0                                          | 3                         | 7                         | 0                     |
| Postdocs, U.S.             | 24                 | 8                 | 6                           | 10                                         | 19                        | 5                         | 0                     |
| Postdocs, non-U.S.         | 3                  | 3                 | 0                           | 0                                          | 1                         | 2                         | 0                     |
| Students, U.S.             | 24                 | 23                | 1                           | 0                                          | 8                         | 16                        | 0                     |
| Students, non-U.S.         | 5                  | 5                 | 0                           | 0                                          | 0                         | 5                         | 0                     |
| Technician, U.S.           | 0                  | 0                 | 0                           | 0                                          | 0                         | 0                         | 0                     |
| Technician, non-U.S.       | 0                  | 0                 | 0                           | 0                                          | 0                         | 0                         | 0                     |

|       | Users <sup>1</sup> | External<br>Users | Local<br>Users <sup>2</sup> | NHMFL-Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,5</sup> | University <sup>4,5</sup> | Industry <sup>5</sup> |
|-------|--------------------|-------------------|-----------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------|
| TOTAL | 110                | 71                | 13                          | 26                                         | 51                        | 59                        | 0                     |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The TOTAL of university, industry, and national lab users will equal the TOTAL number of users.

#### Table 4. Users by Discipline

|                            | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.     | 44                 | 40                          | 1                          | 0           | 0                     | 3                                       |
| Senior Personnel, non-U.S. | 10                 | 10                          | 0                          | 0           | 0                     | 0                                       |
| Postdocs, U.S.             | 24                 | 22                          | 0                          | 0           | 2                     | 0                                       |
| Postdocs, non-U.S.         | 3                  | 3                           | 0                          | 0           | 0                     | 0                                       |
| Students, U.S.             | 24                 | 21                          | 2                          | 0           | 1                     | 0                                       |
| Students, non-U.S.         | 5                  | 5                           | 0                          | 0           | 0                     | 0                                       |
| Technician, U.S.           | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| Technician, non-U.S.       | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                      | 110                | 101                         | 3                          | 0           | 3                     | 3                                       |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

#### Table 5a. Subscription Rate (Experiments)

| Experiments<br>Submitted<br>(Current Year) | Experiments<br>Submitted (Deferred<br>from prev. year) | Experiments<br>With Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experi-<br>ments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|--------------------------------------------|--------------------------------------------------------|---------------------------|-----------------------------------------|-------------------------|---------------------------------------|------------------------------|------------------------------------|-------------------------------------------|
| 76                                         | 16                                                     | 41                        | 44.6 %                                  | 51                      | 55.4 %                                | 92                           | 2.2                                | 224.4 %                                   |

#### Table 5b. Subscription Rate (Magnet Days)

| Days<br>Submitted | Days Used by<br>External User | Days Used by<br>Local User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for<br>Inst., Dev., Test<br>and Maint. | TOTAL Days<br>Used | Days<br>Subscription<br>Rate | Days<br>Subscription<br>Percentage |
|-------------------|-------------------------------|----------------------------|------------------------------------------|--------------------------------------------------|--------------------|------------------------------|------------------------------------|
| 786               | 181                           | 36                         | 88                                       | 0                                                | 305                | 2.6                          | 257.7 %                            |

### Table 6a. Research Proposals 1 Profile (Demographics) with Magnet Time

| Total Proposals <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority | No Race<br>Response | Female <sup>3</sup> | Male | Other | No Gender<br>Response |
|------------------------------|-----------------------|------------------|---------------------|---------------------|------|-------|-----------------------|
| 29                           | 1                     | 25               | 3                   | 9                   | 19   | 0     | 1                     |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

**Note:** The table refers to proposal disciplines.

#### Table 6b. Research Proposals 1 Profile (Discipline) with Magnet Time

| Total Proposals <sup>1</sup> | Condensed Matter<br>Physics | Chemistry,<br>Geochemistry | Engineering | Magnets, Materials | Biology, Biochem,<br>Biophys. |
|------------------------------|-----------------------------|----------------------------|-------------|--------------------|-------------------------------|
| 29                           | 26                          | 1                          | 0           | 2                  | 0                             |

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

Find the list of user proposals in Appendix V and on our website

|                                  | Total Days<br>Used | Percentage of Total<br>Days Used | 100T | Duplex | Short Pulse | Single Turn |
|----------------------------------|--------------------|----------------------------------|------|--------|-------------|-------------|
| NHMFL-Affiliated                 | 88                 | 28.9 %                           | 0    | 0      | 88          | 0           |
| Local                            | 36                 | 11.8 %                           | 0    | 10     | 26          | 0           |
| University, U.S.                 | 93                 | 30.5 %                           | 0    | 20     | 73          | 0           |
| University, non-U.S.             | 30                 | 9.8 %                            | 0    | 0      | 30          | 0           |
| Government Lab, U.S.             | 53                 | 17.4 %                           | 0    | 0      | 53          | 0           |
| Government Lab, non-U.S.         | 5                  | 1.6 %                            | 0    | 0      | 5           | 0           |
| Industry, U.S.                   | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Industry, non-U.S.               | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Test/Calibration/<br>Maintenance | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Method Development               | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Analytical Chemistry             | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Setup                            | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| Repair                           | 0                  | 0 %                              | 0    | 0      | 0           | 0           |
| TOTAL                            | 305                |                                  | 0    | 30     | 275         | 0           |

## Table 7. Operations by Magnet System Group

<sup>1</sup>User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

#### Table 8. Operations by Discipline

|                                  | Total Days<br>Used <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|---------------------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 88                              | 73                          | 0                          | 0           | 15                    | 0                                       |
| Local                            | 36                              | 36                          | 0                          | 0           | 0                     | 0                                       |
| University, U.S.                 | 93                              | 85                          | 8                          | 0           | 0                     | 0                                       |
| University, non-U.S.             | 30                              | 30                          | 0                          | 0           | 0                     | 0                                       |
| Government Lab, U.S.             | 53                              | 53                          | 0                          | 0           | 0                     | 0                                       |
| Government Lab, non-U.S.         | 5                               | 5                           | 0                          | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Industry, non-U.S.               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Method Development               | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Analytical Chemistry             | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Setup                            | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| Repair                           | 0                               | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 305                             | 282                         | 8                          | 0           | 15                    | 0                                       |

<sup>1</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

## Table 9. New Pls<sup>1</sup> and New Users

|                            | PIs | New PIs at<br>the<br>MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.     | 19  | 1                           | 1                      | 18                              | 44        | 0                             | 4                        | 40                                |
| Senior Personnel, non-U.S. | 2   | 0                           | 0                      | 2                               | 10        | 0                             | 0                        | 10                                |
| Postdocs, U.S.             | 3   | 1                           | 1                      | 2                               | 24        | 1                             | 1                        | 23                                |
| Postdocs, non-U.S.         | 0   | 0                           | 0                      | 0                               | 3         | 0                             | 0                        | 3                                 |
| Students, U.S.             | 1   | 0                           | 0                      | 1                               | 24        | 3                             | 4                        | 20                                |
| Students, non-U.S.         | 1   | 1                           | 1                      | 0                               | 5         | 1                             | 1                        | 4                                 |
| Technician, U.S.           | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| Technician, non-U.S.       | 0   | 0                           | 0                      | 0                               | 0         | 0                             | 0                        | 0                                 |
| TOTAL                      | 26  | 3                           | 3                      | 23                              | 110       | 5                             | 10                       | 100                               |

<sup>1</sup> PIs who received magnet time for the first time.

## Table 10. New <sup>1</sup> User Pls

| Name             | Organization                                | Proposal | Year of Magnet<br>Time | Is New to<br>MagLab |
|------------------|---------------------------------------------|----------|------------------------|---------------------|
| Taehwan Jang     | Pohang University of Science and Technology | P19407   | Received 2020          | Yes                 |
| Rico Schoenemann | Los Alamos National Laboratory              | P19194   | Received 2020          | Yes                 |
| Laurel Winter    | National High Magnetic Field Laboratory     | P18062   | Received 2020          | Yes                 |

<sup>1</sup> PIs who received magnet time for the first time.

# Appendix 3 – User Facilities Overview

All user data in the user facility overview appendix is as of February 4, 2021. Table 1a. Users by Demographic of All Facilities

|                               | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No<br>Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to<br>Gender <sup>3</sup> |
|-------------------------------|--------------------|-----------------------|-------------------------------|----------------------------------------|------|--------|-------|---------------------------------------------|
| Senior Personnel, U.S.        | 561                | 33                    | 420                           | 108                                    | 379  | 96     | 0     | 86                                          |
| Senior Personnel,<br>non-U.S. | 138                | 14                    | 82                            | 42                                     | 83   | 23     | 0     | 32                                          |
| Postdocs, U.S.                | 190                | 13                    | 129                           | 48                                     | 107  | 49     | 0     | 34                                          |
| Postdocs, non-U.S.            | 31                 | 1                     | 20                            | 10                                     | 10   | 11     | 0     | 10                                          |
| Students, U.S.                | 422                | 24                    | 289                           | 109                                    | 221  | 123    | 0     | 78                                          |
| Students, non-U.S.            | 59                 | 5                     | 35                            | 19                                     | 36   | 9      | 0     | 14                                          |
| Technician, U.S.              | 70                 | 7                     | 33                            | 30                                     | 18   | 25     | 0     | 27                                          |
| Technician, non-U.S.          | 23                 | 0                     | 3                             | 20                                     | 4    | 1      | 0     | 18                                          |
| TOTAL                         | 1,494              | 97                    | 1,011                         | 386                                    | 858  | 337    | 0     | 299                                         |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status <u>includes</u> the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status <u>excludes</u> Asian and White-Not of Hispanic Origin.
<sup>3</sup> Includes pending user account activations.

| Table 1b. | Users by D | emographic | by Facilitie | es |
|-----------|------------|------------|--------------|----|
|           |            |            |              |    |

|                              | Users <sup>1</sup> | Minority <sup>2</sup> | Non-<br>Minority <sup>2</sup> | No<br>Response<br>to Race <sup>3</sup> | Male | Female | Other | No<br>Response<br>to<br>Gender <sup>3</sup> |
|------------------------------|--------------------|-----------------------|-------------------------------|----------------------------------------|------|--------|-------|---------------------------------------------|
| AMRIS – NSF-Funded           | 88                 | 7                     | 56                            | 25                                     | 55   | 17     | 0     | 16                                          |
| AMRIS – Non-NHMFL-<br>Funded | 285                | 28                    | 149                           | 108                                    | 108  | 82     | 0     | 95                                          |
| DC Field                     | 404                | 21                    | 314                           | 69                                     | 292  | 68     | 0     | 44                                          |
| EMR                          | 112                | 4                     | 85                            | 23                                     | 74   | 23     | 0     | 15                                          |
| High B/T                     | 10                 | 0                     | 7                             | 3                                      | 6    | 1      | 0     | 3                                           |
| ICR                          | 251                | 19                    | 151                           | 81                                     | 109  | 71     | 0     | 71                                          |
| NMR                          | 234                | 14                    | 154                           | 66                                     | 135  | 50     | 0     | 49                                          |
| Pulsed Field                 | 110                | 4                     | 95                            | 11                                     | 79   | 25     | 0     | 6                                           |
| TOTAL                        | 1,494              | 97                    | 1,011                         | 386                                    | 858  | 337    | 0     | 299                                         |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NSF Minority status <u>includes</u> the following races: American Indian, Alaska Native, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander. The definition also includes Hispanic Ethnicity as a minority group. Minority status <u>excludes</u> Asian and White-Not of Hispanic Origin.
 <sup>3</sup> Includes pending user account activations.

| Table 2a  | Users by | Participation | of All Facilities |
|-----------|----------|---------------|-------------------|
| 10010 20. | 03013 0  |               |                   |

|                               | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators⁴ |  |
|-------------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------|--|
| Senior Personnel, U.S.        | 561                | 260           | 7                                        | 56                                   | 238                        |  |
| Senior Personnel,<br>non-U.S. | 138                | 21            | 1                                        | 21                                   | 95                         |  |

|                      | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |  |
|----------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|--|
| Postdocs, U.S.       | 190                | 120           | 3                                        | 7                                    | 60                                     |  |
| Postdocs, non-U.S.   | 31                 | 8             | 0                                        | 4                                    | 19                                     |  |
| Students, U.S.       | 422                | 269           | 5                                        | 28                                   | 120                                    |  |
| Students, non-U.S.   | 59                 | 22            | 0                                        | 6                                    | 31                                     |  |
| Technician, U.S.     | 70                 | 62            | 0                                        | 1                                    | 7                                      |  |
| Technician, non-U.S. | 23                 | 1             | 0                                        | 0                                    | 22                                     |  |
| TOTAL                | 1,494              | 763           | 16                                       | 123                                  | 592                                    |  |

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

Table 2b. Users by Participation by Facilities

|                              | Users <sup>1</sup> | Users Present | Users Operating<br>Remotely <sup>2</sup> | Users Sending<br>Sample <sup>3</sup> | Off-Site<br>Collaborators <sup>4</sup> |
|------------------------------|--------------------|---------------|------------------------------------------|--------------------------------------|----------------------------------------|
| AMRIS – NSF-Funded           | 88                 | 62            | 5                                        | 2                                    | 19                                     |
| AMRIS – Non-NHMFL-<br>Funded | 285                | 237           | 1                                        | 1                                    | 46                                     |
| DC Field                     | 404                | 202           | 0                                        | 34                                   | 168                                    |
| EMR                          | 112                | 57            | 0                                        | 15                                   | 40                                     |
| High B/T                     | 10                 | 9             | 0                                        | 0                                    | 1                                      |
| ICR                          | 251                | 43            | 0                                        | 29                                   | 179                                    |
| NMR                          | 234                | 97            | 10                                       | 35                                   | 92                                     |
| Pulsed Field                 | 110                | 56            | 0                                        | 7                                    | 47                                     |
| TOTAL                        | 1,494              | 763           | 16                                       | 123                                  | 592                                    |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> "Users Operating Remotely" refers to users who operate the magnet system from a remote location. Remote operations are not currently available in all facilities.

<sup>3</sup> "Users Sending Sample" refers to users who send the sample to the facility and/or research group and the experiment is conducted by other

collaborators on the experiment. Users at UF, FSU, and LANL cannot be "sample senders" for facilities located on their campuses.

<sup>4</sup> "Off-Site Users" are scientific or technical participants on the experiment; who will not be present, sending sample, or operating the magnet system remotely; and who are not located on the campus of that facility (i.e., they are off-site).

|                               | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-<br>Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,</sup><br>5 | University <sup>4,5</sup> | Industry⁵ |
|-------------------------------|--------------------|-------------------|--------------------------|------------------------------------------------|-------------------------------|---------------------------|-----------|
| Senior Personnel, U.S.        | 561                | 334               | 75                       | 152                                            | 62                            | 484                       | 15        |
| Senior Personnel,<br>non-U.S. | 138                | 138               | 0                        | 0                                              | 28                            | 105                       | 5         |
| Postdocs, U.S.                | 190                | 108               | 51                       | 31                                             | 32                            | 157                       | 1         |
| Postdocs, non-U.S.            | 31                 | 30                | 0                        | 1                                              | 9                             | 22                        | 0         |
| Students, U.S.                | 422                | 257               | 133                      | 32                                             | 17                            | 404                       | 1         |
| Students, non-U.S.            | 59                 | 59                | 0                        | 0                                              | 2                             | 57                        | 0         |
| Technician, U.S.              | 70                 | 26                | 20                       | 24                                             | 0                             | 68                        | 2         |
| Technician, non-U.S.          | 23                 | 23                | 0                        | 0                                              | 3                             | 18                        | 2         |

#### Table 3a. Users by Organization of All Facilities

|       | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-<br>Affiliated<br>Users <sup>2,3,4</sup> | Laboratory <sup>3,</sup><br><sup>5</sup> | University <sup>4,5</sup> | Industry⁵ |
|-------|--------------------|-------------------|--------------------------|------------------------------------------------|------------------------------------------|---------------------------|-----------|
| TOTAL | 1,494              | 975               | 279                      | 240                                            | 153                                      | 1,315                     | 26        |

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The total of university, industry, and national lab users will equal the total number of users.

#### Table 3b. Users by Organization by Facilities

|                              | Users <sup>1</sup> | External<br>Users | Local Users <sup>2</sup> | NHMFL-<br>Affiliated<br>Users <sup>2,3,4</sup> | Laboratory<br>3,5 | University<br><sub>4,5</sub> | Industry⁵ |
|------------------------------|--------------------|-------------------|--------------------------|------------------------------------------------|-------------------|------------------------------|-----------|
| AMRIS – NSF-Funded           | 88                 | 35                | 32                       | 21                                             | 0                 | 88                           | 0         |
| AMRIS – Non-<br>NHMFL-Funded | 285                | 121               | 140                      | 24                                             | 3                 | 280                          | 2         |
| DC Field                     | 404                | 304               | 25                       | 75                                             | 39                | 363                          | 2         |
| EMR                          | 112                | 65                | 18                       | 29                                             | 9                 | 103                          | 0         |
| High B/T                     | 10                 | 3                 | 3                        | 4                                              | 0                 | 10                           | 0         |
| ICR                          | 251                | 216               | 15                       | 20                                             | 38                | 196                          | 17        |
| NMR                          | 234                | 160               | 33                       | 41                                             | 13                | 216                          | 5         |
| Pulsed Field                 | 110                | 71                | 13                       | 26                                             | 51                | 59                           | 0         |
| TOTAL                        | 1,494              | 975               | 279                      | 240                                            | 153               | 1,315                        | 26        |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

<sup>2</sup> NHMFL-Affiliated users are defined as anyone in the lab's personnel system (i.e. on our web site/directory), even if they travel to another site. Local users are defined as any non-NHMFL-Affiliated researchers originating at any of the institutions in proximity to the MagLab sites (i.e. researchers at FSU, UF, FAMU, or LANL), even if they travel to another site.

<sup>3</sup> Users with primary affiliations at NHMFL/LANL are reported in NHMFL-Affiliated Users and National Laboratory.

<sup>4</sup> Users with primary affiliations at FSU, UF, or FAMU are reported in NHMFL-Affiliated Users and National University.

<sup>5</sup> The total of university, industry, and national lab users will equal the total number of users.

Table 4a. Users by Discipline of All Facilities

|                               | Users <sup>1</sup> | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|-------------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| Senior Personnel, U.S.        | 561                | 147                         | 160                        | 59          | 18                    | 177                                     |
| Senior Personnel,<br>non-U.S. | 138                | 40                          | 60                         | 5           | 7                     | 26                                      |
| Postdocs, U.S.                | 190                | 72                          | 25                         | 10          | 9                     | 74                                      |
| Postdocs, non-U.S.            | 31                 | 13                          | 13                         | 0           | 2                     | 3                                       |
| Students, U.S.                | 422                | 128                         | 126                        | 50          | 20                    | 98                                      |
| Students, non-U.S.            | 59                 | 28                          | 16                         | 6           | 2                     | 7                                       |
| Technician, U.S.              | 70                 | 0                           | 1                          | 7           | 22                    | 40                                      |
| Technician, non-U.S.          | 23                 | 1                           | 3                          | 6           | 0                     | 13                                      |
| TOTAL                         | 1,494              | 429                         | 404                        | 143         | 80                    | 438                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

### Table 4b. Users by Discipline by Facilities

|                              | Users <sup>1</sup> | Condensed Chemistry,<br>Matter Physics Geochemistry |     | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|------------------------------|--------------------|-----------------------------------------------------|-----|-------------|-----------------------|-----------------------------------------|
| AMRIS – NSF-Funded           | 88                 | 1                                                   | 20  | 18          | 6                     | 43                                      |
| AMRIS – Non-<br>NHMFL-Funded | 285                | 1                                                   | 19  | 27          | 28                    | 210                                     |
| DC Field                     | 404                | 286                                                 | 43  | 23          | 29                    | 23                                      |
| EMR                          | 112                | 24                                                  | 72  | 2           | 5                     | 9                                       |
| High B/T                     | 10                 | 8                                                   | 0   | 0           | 0                     | 2                                       |
| ICR                          | 251                | 0                                                   | 140 | 43          | 2                     | 66                                      |
| NMR                          | 234                | 8                                                   | 107 | 30          | 7                     | 82                                      |
| Pulsed Field                 | 110                | 101                                                 | 3   | 0           | 3                     | 3                                       |
| TOTAL                        | 1,494              | 429                                                 | 404 | 143         | 80                    | 438                                     |

<sup>1</sup> Users using multiple facilities are counted in each facility listed.

## Table 5a. Subscription Rate (Experiments) by Facilities

|                              | Experiments<br>Submitted<br>(Current<br>Year) | Experiments<br>Submitted<br>(Deferred<br>from prev.<br>year) | Experiments<br>With<br>Usage | Experiments<br>With Usage<br>Percentage | Experiments<br>Declined | Experiments<br>Declined<br>Percentage | Experiments<br>Reviewed | Experiment<br>Subscription<br>Rate | Experiments<br>Subscription<br>Percentage |
|------------------------------|-----------------------------------------------|--------------------------------------------------------------|------------------------------|-----------------------------------------|-------------------------|---------------------------------------|-------------------------|------------------------------------|-------------------------------------------|
| AMRIS – NSF-Funded           | 10                                            | 21                                                           | 31                           | 100 %                                   | 0                       | 0 %                                   | 31                      | 1                                  | 100 %                                     |
| AMRIS – Non-<br>NHMFL-Funded | 65                                            | 71                                                           | 127                          | 93.4 %                                  | 9                       | 6.6 %                                 | 136                     | 1.1                                | 107.1 %                                   |
| DC Field                     | 290                                           | 34                                                           | 146                          | 45.1 %                                  | 178                     | 54.9 %                                | 324                     | 2.2                                | 221.9 %                                   |
| EMR                          | 94                                            | 14                                                           | 99                           | 91.7 %                                  | 9                       | 8.3 %                                 | 108                     | 1.1                                | 109.1 %                                   |
| High B/T                     | 8                                             | 2                                                            | 2                            | 20 %                                    | 8                       | 80 %                                  | 10                      | 5                                  | 500 %                                     |
| ICR                          | 104                                           | 14                                                           | 92                           | 78 %                                    | 26                      | 22 %                                  | 118                     | 1.3                                | 128.3 %                                   |
| NMR                          | 417                                           | 28                                                           | 411                          | 92.4 %                                  | 34                      | 7.6 %                                 | 445                     | 1.1                                | 108.3 %                                   |
| Pulsed Field                 | 76                                            | 16                                                           | 41                           | 44.6 %                                  | 51                      | 55.4 %                                | 92                      | 2.2                                | 224.4 %                                   |
| TOTAL                        | 1,064                                         | 200                                                          | 949                          |                                         | 315                     |                                       | 1,264                   |                                    |                                           |

## Table 5b. Subscription Rate (Magnet Days) by Facilities

|                              | Days<br>Submitted | Days Used<br>by<br>External<br>User | Days Used<br>by<br>Local User | Days Used<br>by NHMFL-<br>Affiliated<br>User | Days Used<br>for Inst.,<br>Dev., Test<br>and Maint. | Total Days<br>Used | Days Sub-<br>scription<br>Rate | Days Sub-<br>scription<br>Percentage |
|------------------------------|-------------------|-------------------------------------|-------------------------------|----------------------------------------------|-----------------------------------------------------|--------------------|--------------------------------|--------------------------------------|
| AMRIS – NSF-Funded           | 1,316             | 409.3                               | 13.4                          | 191.9                                        | 701.3                                               | 1,316              | 1                              | 100 %                                |
| AMRIS – Non-<br>NHMFL-Funded | 1,206             | 652.3                               | 157.8                         | 326.2                                        | 69.6                                                | 1,206              | 1                              | 100 %                                |
| DC Field                     | 2,260             | 779.8                               | 7                             | 209.3                                        | 25                                                  | 1,021.1            | 2.2                            | 221.3 %                              |
| EMR                          | 967               | 486.5                               | 7                             | 78.5                                         | 132                                                 | 704                | 1.4                            | 137.4 %                              |
| High B/T                     | 640               | 170                                 | 0                             | 0                                            | 0                                                   | 170                | 3.8                            | 376.5 %                              |
| ICR                          | 1,474             | 241                                 | 36.7                          | 86.4                                         | 247.9                                               | 612                | 2.4                            | 240.8 %                              |
| NMR                          | 2,688             | 1,485                               | 77                            | 1,060                                        | 139                                                 | 2,761              | 1                              | 97.4 %                               |
| Pulsed Field                 | 786               | 181                                 | 36                            | 88                                           | 0                                                   | 305                | 2.6                            | 257.7 %                              |
| TOTAL                        | 11,337            | 4,404.9                             | 334.9                         | 2,040.4                                      | 1,314.9                                             | 8,095.1            |                                |                                      |

|                              | Total<br>Pro-<br>posals <sup>1</sup> | Minor-<br>ity <sup>2</sup> | Non-<br>Minor-<br>ity | No<br>Race<br>Re-<br>sponse | Fe-<br>male <sup>3</sup> | Male | Other | No<br>Gen-<br>der Re-<br>sponse | Con-<br>densed<br>Matter<br>Physics | Chem-<br>istry,<br>Geo-<br>chem-<br>istry | Engi-<br>neer-<br>ing | Mag-<br>nets,<br>Mate-<br>rials | Biol-<br>ogy,<br>Bio-<br>chem,<br>Bio-<br>phys. |
|------------------------------|--------------------------------------|----------------------------|-----------------------|-----------------------------|--------------------------|------|-------|---------------------------------|-------------------------------------|-------------------------------------------|-----------------------|---------------------------------|-------------------------------------------------|
| AMRIS – NSF-Funded           | 31                                   | 3                          | 23                    | 5                           | 7                        | 21   | 0     | 3                               | 0                                   | 4                                         | 5                     | 0                               | 22                                              |
| AMRIS – Non-<br>NHMFL-Funded | 99                                   | 10                         | 60                    | 29                          | 25                       | 51   | 0     | 23                              | 0                                   | 0                                         | 0                     | 0                               | 99                                              |
| DC Field                     | 108                                  | 5                          | 96                    | 7                           | 22                       | 82   | 0     | 4                               | 77                                  | 11                                        | 0                     | 15                              | 5                                               |
| EMR                          | 45                                   | 4                          | 38                    | 3                           | 6                        | 38   | 0     | 1                               | 7                                   | 24                                        | 1                     | 6                               | 7                                               |
| High B/T                     | 2                                    | 0                          | 2                     | 0                           | 0                        | 2    | 0     | 0                               | 2                                   | 0                                         | 0                     | 0                               | 0                                               |
| ICR                          | 67                                   | 4                          | 50                    | 13                          | 13                       | 46   | 0     | 8                               | 0                                   | 49                                        | 3                     | 2                               | 13                                              |
| NMR                          | 76                                   | 4                          | 60                    | 12                          | 15                       | 57   | 0     | 4                               | 2                                   | 21                                        | 6                     | 6                               | 41                                              |
| Pulsed Field                 | 29                                   | 1                          | 25                    | 3                           | 9                        | 19   | 0     | 1                               | 26                                  | 1                                         | 0                     | 2                               | 0                                               |
| TOTAL                        | 457                                  | 31                         | 354                   | 72                          | 97                       | 316  | 0     | 44                              | 114                                 | 110                                       | 15                    | 31                              | 187                                             |

Table 6. Research Proposals 1 Profile with Magnet Time by Facilities

<sup>1</sup> A "proposal" may have associated with it a single experiment or a group of closely related experiments. A PI may have more than one proposal.

<sup>2</sup> The number of proposals satisfying the following condition: The PI is a minority.

<sup>3</sup> The number of proposals satisfying the following condition: The PI is a female.

Note: The table refers to proposal disciplines.

#### Find the list of user proposals in Appendix V and on our website

|                                           | Total Days Used | Days Used by<br>External User | Days Used by Local<br>User | Days Used by<br>NHMFL-Affiliated<br>User | Days Used for<br>Test/Calibr./ Maint.,<br>Method Dev., Analy.<br>Chem., Setup, Repair |
|-------------------------------------------|-----------------|-------------------------------|----------------------------|------------------------------------------|---------------------------------------------------------------------------------------|
| AMRIS – NSF-Funded <sup>1</sup>           | 1,316           | 409.3                         | 13.4                       | 191.9                                    | 701.3                                                                                 |
| AMRIS – Non-NHMFL-<br>Funded <sup>1</sup> | 1,206           | 652.3                         | 157.8                      | 326.2                                    | 69.6                                                                                  |
| DC Field <sup>2</sup>                     | 1,021.1         | 779.8                         | 7                          | 209.3                                    | 25                                                                                    |
| EMR <sup>3</sup>                          | 704             | 486.5                         | 7                          | 78.5                                     | 132                                                                                   |
| High B/T <sup>4</sup>                     | 170             | 170                           | 0                          | 0                                        | 0                                                                                     |
| ICR⁵                                      | 612             | 241                           | 36.7                       | 86.4                                     | 247.9                                                                                 |
| NMR <sup>6</sup>                          | 2,761           | 1,485                         | 77                         | 1,060                                    | 139                                                                                   |
| Pulsed Field <sup>7</sup>                 | 305             | 181                           | 36                         | 88                                       | 0                                                                                     |
| TOTAL                                     | 8,095.1         | 4,404.9                       | 334.9                      | 2,040.4                                  | 1,314.9                                                                               |

#### Table 7. Operations by User Type by Facilities

<sup>1</sup> User Units are defined as magnet days; time utilized is recorded to the nearest 15 minutes. Magnet day definitions for AMRIS instruments: Verticals (500, 600s, & 750 MHz), 1 magnet day = 24 hours. Horizontals (4.7 and 11.1 T), 1 magnet day = 8 hours. This accounts for the difficulty in running animal or human studies overnight. Magnet days were calculated by adding the total number of real used for each instrument and dividing by 24 (vertical) or 8 (horizontal). Note: Due to the nature of the 4.7 T and 11 T studies, almost all studies with external users were collaborative with UF investigators.

<sup>2</sup> Each 20 MW resistive magnet requires two power supplies to run, the 45 T hybrid magnet requires three power supplies and the 36 T Series Connected Hybrid requires one power supply. Thus there can be four resistive magnets + three superconducting magnets operating or the 45 T hybrid, series connected hybrid, two resistive magnets and three superconducting magnets. User Units are defined as magnet days. Users of water-cooled resistive or hybrid magnets can typically expect to receive enough energy for 7 hours a day of magnet usage so a magnet day is defined as 7 hours. Superconducting magnets are scheduled typically 24 hours a day. There is an annual four week shutdown in fall of powered DC resistive and hybrid magnets for infrastructure maintenance and a two week shutdown period for the university mandated holiday break.

<sup>3, 4, 5, 6</sup> User Units are defined as magnet days. One magnet day is defined as 24 hours in superconducting magnets.

<sup>7</sup> User Units are defined as magnet days. Magnets are scheduled typically 12 hours a day.

<sup>8</sup> Days to external users at facility => all U.S. University, U.S. Govt. Lab., U.S. Industry, Non-U.S. excluding NHMFL Affiliated, Local, Test, Calibration, Setup, Maintenance, Inst. Dev.

<sup>9</sup>Days to NHMFL-Affiliated (in-house) research => NHMFL-Affiliated only

<sup>10</sup> Days to instrument development and maintenance (combined) => test, calibration, set-up, maintenance, inst. Dev.

<sup>11</sup> Days to local => local only

|                                  | Total Days<br>Used | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|----------------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| NHMFL-Affiliated                 | 2,040.4            | 282                         | 428.4                      | 5.1         | 121.9                 | 1,203                                   |
| Local                            | 334.9              | 36                          | 109.1                      | 24          | 0                     | 165.8                                   |
| University, U.S.                 | 3,236.6            | 591                         | 956.3                      | 214.5       | 64.2                  | 1,410.5                                 |
| University, non-U.S.             | 848.8              | 258.7                       | 220.7                      | 5.5         | 102.5                 | 261.5                                   |
| Government Lab, U.S.             | 97.9               | 81.9                        | 13.7                       | 2           | 0                     | 0.3                                     |
| Government Lab,<br>non-U.S.      | 104.9              | 81                          | 23.9                       | 0           | 0                     | 0                                       |
| Industry, U.S.                   | 84                 | 0                           | 5                          | 0           | 0                     | 79                                      |
| Industry, non-U.S.               | 32.7               | 0                           | 32.7                       | 0           | 0                     | 0                                       |
| Test/Calibration/<br>Maintenance | 987.5              | 16                          | 17.5                       | 0           | 378.4                 | 575.6                                   |
| Method Development               | 95                 | 9                           | 10                         | 0           | 39                    | 37                                      |
| Analytical Chemistry             | 230.4              | 0                           | 230.4                      | 0           | 0                     | 0                                       |
| Setup                            | 2                  | 0                           | 0                          | 0           | 2                     | 0                                       |
| Repair                           | 0                  | 0                           | 0                          | 0           | 0                     | 0                                       |
| TOTAL                            | 8,095.1            | 1,355.6                     | 2,047.7                    | 251.2       | 707.9                 | 3,732.7                                 |

Table 8. Operations by Discipline of All Facilities

### Table 8b. Operations by Discipline of All Facilities

|                                           | Total Days<br>Used | Condensed<br>Matter Physics | Chemistry,<br>Geochemistry | Engineering | Magnets,<br>Materials | Biology,<br>Biochemistry,<br>Biophysics |
|-------------------------------------------|--------------------|-----------------------------|----------------------------|-------------|-----------------------|-----------------------------------------|
| AMRIS – NSF-Funded <sup>1</sup>           | 1,316              | 0                           | 59.1                       | 148.8       | 346.4                 | 761.7                                   |
| AMRIS – Non-NHMFL-<br>Funded <sup>1</sup> | 1,206              | 0                           | 27                         | 50          | 0                     | 1,129                                   |
| DC Field <sup>2</sup>                     | 1,021.1            | 797.6                       | 114                        | 0           | 95.5                  | 14                                      |
| EMR <sup>3</sup>                          | 704                | 88                          | 305                        | 7           | 111                   | 193                                     |
| High B/T⁴                                 | 170                | 170                         | 0                          | 0           | 0                     | 0                                       |
| ICR <sup>5</sup>                          | 612                | 0                           | 521.6                      | 5.9         | 8                     | 76.5                                    |
| NMR <sup>6</sup>                          | 2,761              | 18                          | 1,013                      | 39.5        | 132                   | 1,558.5                                 |
| Pulsed Field <sup>7</sup>                 | 305                | 282                         | 8                          | 0           | 15                    | 0                                       |
| Total                                     | 8,095.1            | 1,355.6                     | 2,047.7                    | 251.2       | 707.9                 | 3,732.7                                 |

|  | Table 9a. | New Pls <sup>1</sup> | and New | Users | of All Facilities |
|--|-----------|----------------------|---------|-------|-------------------|
|--|-----------|----------------------|---------|-------|-------------------|

|                               | PIs | New PIs<br>at the<br>MagLab | New Pls at<br>Facility | Returning<br>Pls at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|-------------------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Senior Personnel, U.S.        | 297 | 47                          | 57                     | 240                             | 561       | 40                            | 53                       | 508                               |
| Senior Personnel,<br>non-U.S. | 61  | 11                          | 13                     | 48                              | 138       | 34                            | 35                       | 103                               |
| Postdocs, U.S.                | 15  | 2                           | 2                      | 13                              | 190       | 26                            | 31                       | 159                               |
| Postdocs, non-U.S.            | 4   | 1                           | 1                      | 3                               | 31        | 8                             | 8                        | 23                                |
| Students, U.S.                | 4   | 0                           | 1                      | 3                               | 422       | 85                            | 110                      | 312                               |
| Students, non-U.S.            | 1   | 1                           | 1                      | 0                               | 59        | 18                            | 21                       | 38                                |
| Technician, U.S.              | 1   | 0                           | 0                      | 1                               | 70        | 6                             | 8                        | 62                                |

|                      | Pis | New Pls<br>at the<br>MagLab | New PIs at<br>Facility | Returning<br>Pls at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|----------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| Technician, non-U.S. | 1   | 1                           | 1                      | 0                               | 23        | 10                            | 10                       | 13                                |
| TOTAL                | 384 | 63                          | 76                     | 308                             | 1,494     | 227                           | 276                      | 1,218                             |

<sup>1</sup> Pls who received magnet time for the first time.

#### Table 9b. New Pls1 and New Users by Facilities

|                              | PIs | New PIs<br>at the<br>MagLab | New PIs at<br>Facility | Returning<br>PIs at<br>Facility | All Users | New Users<br>at the<br>MagLab | New Users<br>at Facility | Returning<br>Users at<br>Facility |
|------------------------------|-----|-----------------------------|------------------------|---------------------------------|-----------|-------------------------------|--------------------------|-----------------------------------|
| AMRIS – NSF-Funded           | 31  | 7                           | 7                      | 24                              | 88        | 9                             | 9                        | 79                                |
| AMRIS – Non-NHMFL-<br>Funded | 74  | 12                          | 15                     | 59                              | 285       | 20                            | 26                       | 259                               |
| DC Field                     | 94  | 13                          | 20                     | 74                              | 404       | 46                            | 60                       | 344                               |
| EMR                          | 40  | 7                           | 8                      | 32                              | 112       | 19                            | 32                       | 80                                |
| High B/T                     | 2   | 0                           | 0                      | 2                               | 10        | 0                             | 0                        | 10                                |
| ICR                          | 55  | 14                          | 14                     | 41                              | 251       | 86                            | 86                       | 165                               |
| NMR                          | 62  | 7                           | 9                      | 53                              | 234       | 42                            | 53                       | 181                               |
| Pulsed Field                 | 26  | 3                           | 3                      | 23                              | 110       | 5                             | 10                       | 100                               |
| TOTAL                        | 384 | 63                          | 76                     | 308                             | 1,494     | 227                           | 276                      | 1,218                             |

<sup>1</sup> PIs who received magnet time for the first time.

#### Table 10a. Funding Source of Users' Research-Day Allotted (Counts) by Facilities

|                              | Total<br>Days<br>Used | NSF <sup>1</sup> | NIH   | DOE | DOD <sup>2</sup> | VSP | FFI | UF<br>MBI | EPA | Inter-<br>na-<br>tional | Na-<br>tional | In-<br>dustry<br>³ | Other |
|------------------------------|-----------------------|------------------|-------|-----|------------------|-----|-----|-----------|-----|-------------------------|---------------|--------------------|-------|
| AMRIS – NSF-Funded           | 1,316                 | 1,040            | 125   | 0   | 0                | 0   | 0   | 0         | 0   | 3                       | 148           | 0                  | 0     |
| AMRIS – Non-NHMFL-<br>Funded | 1,206                 | 92               | 702   | 0   | 3                | 0   | 0   | 15        | 0   | 0                       | 322           | 27                 | 4     |
| DC Field                     | 1,021                 | 441              | 14    | 188 | 37               | 15  | 0   | 0         | 0   | 212                     | 113           | 0                  | 0     |
| EMR                          | 704                   | 541              | 39    | 39  | 9                | 0   | 0   | 0         | 0   | 55                      | 22            | 0                  | 0     |
| High B/T                     | 170                   | 85               | 0     | 0   | 0                | 0   | 0   | 0         | 0   | 85                      | 0             | 0                  | 0     |
| ICR                          | 612                   | 439              | 11    | 17  | 24               | 0   | 2   | 0         | 0   | 51                      | 34            | 31                 | 0     |
| NMR                          | 2,761                 | 1,274            | 879   | 0   | 0                | 0   | 0   | 0         | 1   | 397                     | 151           | 63                 | 0     |
| Pulsed Field                 | 305                   | 110              | 0     | 118 | 4                | 0   | 0   | 0         | 0   | 25                      | 49            | 0                  | 0     |
| TOTAL                        | 8,095                 | 4,021            | 1,770 | 362 | 77               | 15  | 2   | 15        | 1   | 828                     | 839           | 121                | 4     |

<sup>1</sup> Includes NSF, UCGP, and 'No other support'.

<sup>2</sup> Includes NASA, US Army, US Navy, and US Air force.

<sup>3</sup> Includes US Industry and Non-US Industry.

Table 10b. Funding Source of Users' Research-Day Allotted (Percentage) by Facilities

|                              | NSF <sup>1</sup> | NIH  | DOE  | DOD <sup>2</sup> | VSP | FFI | UF<br>MBI | EPA | Inter-<br>na-<br>tional | Na-<br>tional | Indus-<br>try <sup>3</sup> | Other |
|------------------------------|------------------|------|------|------------------|-----|-----|-----------|-----|-------------------------|---------------|----------------------------|-------|
| AMRIS – NSF-Funded           | 79 %             | 10 % | 0 %  | 0 %              | 0 % | 0 % | 0 %       | 0%  | 0 %                     | 11 %          | 0 %                        | 0 %   |
| AMRIS – Non-NHMFL-<br>Funded | 8 %              | 58 % | 0 %  | 0 %              | 0 % | 0 % | 1%        | 0 % | 0 %                     | 27 %          | 2 %                        | 0 %   |
| DC Field                     | 43 %             | 1%   | 18 % | 4 %              | 1%  | 0 % | 0 %       | 0 % | 21 %                    | 11 %          | 0 %                        | 0 %   |
| EMR                          | 77 %             | 6 %  | 6 %  | 1%               | 0 % | 0 % | 0 %       | 0 % | 8 %                     | 3 %           | 0 %                        | 0 %   |
| High B/T                     | 50 %             | 0 %  | 0 %  | 0 %              | 0 % | 0 % | 0 %       | 0 % | 50 %                    | 0 %           | 0 %                        | 0 %   |

|              | NSF <sup>1</sup> | NIH  | DOE  | DOD <sup>2</sup> | VSP | FFI | UF<br>MBI | ΕΡΑ | Inter-<br>na-<br>tional | Na-<br>tional | Indus-<br>try <sup>3</sup> | Other |
|--------------|------------------|------|------|------------------|-----|-----|-----------|-----|-------------------------|---------------|----------------------------|-------|
| ICR          | 72 %             | 2 %  | 3 %  | 0 %              | 0 % | 0 % | 0 %       | 0 % | 8 %                     | 6 %           | 5 %                        | 0 %   |
| NMR          | 46 %             | 32 % | 0 %  | 0 %              | 0 % | 0 % | 0 %       | 0 % | 14 %                    | 5 %           | 2 %                        | 0 %   |
| Pulsed Field | 36 %             | 0 %  | 39 % | 1%               | 0 % | 0 % | 0 %       | 0 % | 8 %                     | 16 %          | 0 %                        | 0 %   |

Includes NSF, UCGP, and 'No other support'.
 Includes NASA, US Army, US Navy, and US Air force.
 Includes US Industry and Non-US Industry.

# Appendix 4 – Geographic Distribution

## AMRIS - National Users

| Facility | First Name | Last Name        | Organization             | State | Country |
|----------|------------|------------------|--------------------------|-------|---------|
| AMRIS    | Jose       | Abisambra        | University of Florida    | FL    | USA     |
| AMRIS    | Qutell     | Adderley         | Fisk University          | TN    | USA     |
| AMRIS    | Mavis      | Agbandje-McKenna | University of Florida    | FL    | USA     |
| AMRIS    | Maisha     | Akbar            | University of Florida    | FL    | USA     |
| AMRIS    | Meryl      | Alappattu        | University of Florida    | FL    | USA     |
| AMRIS    | Jane       | Aldrich          | University of Florida    | FL    | USA     |
| AMRIS    | Manish     | Amin             | University of Florida    | FL    | USA     |
| AMRIS    | Kara       | Anazia           | University of Florida    | FL    | USA     |
| AMRIS    | Anastasios | Angelopoulos     | University of Cincinnati | ОН    | USA     |
| AMRIS    | Tetsuo     | Ashizawa         | University of Florida    | FL    | USA     |
| AMRIS    | Guita      | Banan            | University of Florida    | FL    | USA     |
| AMRIS    | Amineh     | Baniani          | University of Florida    | FL    | USA     |
| AMRIS    | Alison     | Barnard          | University of Florida    | FL    | USA     |
| AMRIS    | Ana        | Barran-Berdon    | University of Florida    | FL    | USA     |
| AMRIS    | Elisabeth  | Barton           | University of Florida    | FL    | USA     |
| AMRIS    | Abhinandan | Batra            | University of Florida    | FL    | USA     |
| AMRIS    | Samuel     | Berens           | University of Florida    | FL    | USA     |
| AMRIS    | Avni       | Bhatt            | University of Florida    | FL    | USA     |
| AMRIS    | Steve      | Blackband        | University of Florida    | FL    | USA     |
| AMRIS    | Jeff       | Boissoneault     | University of Florida    | FL    | USA     |
| AMRIS    | Emanuel    | Boutzoukas       | University of Florida    | FL    | USA     |
| AMRIS    | Clifford   | Bowers           | University of Florida    | FL    | USA     |
| AMRIS    | Dawn       | Bowers           | University of Florida    | FL    | USA     |
| AMRIS    | Jeanine    | Brady            | University of Florida    | FL    | USA     |
| AMRIS    | Fernando   | Bril             | University of Florida    | FL    | USA     |
| AMRIS    | Albert     | Brotgandel       | University of Florida    | FL    | USA     |
| AMRIS    | Madison    | Bryan            | University of Florida    | FL    | USA     |

| Facility | First Name | Last Name        | Organization                        | State | Country |
|----------|------------|------------------|-------------------------------------|-------|---------|
| AMRIS    | Michael    | Bubb             | University of Florida               | FL    | USA     |
| AMRIS    | Α.         | Buchanan         | University of Florida               | FL    | USA     |
| AMRIS    | Roxana     | Burciu           | University of Florida               | FL    | USA     |
| AMRIS    | Matthew    | Burg             | University of Florida               | FL    | USA     |
| AMRIS    | Sara       | Burke            | University of Florida               | FL    | USA     |
| AMRIS    | Matthew    | Burns            | University of Florida               | FL    | USA     |
| AMRIS    | Rebecca    | Butcher          | University of Florida               | FL    | USA     |
| AMRIS    | Barry      | Byrne            | University of Florida               | FL    | USA     |
| AMRIS    | Weijing    | Cai              | University of Florida               | FL    | USA     |
| AMRIS    | Eduardo    | Candelario-Jalil | University of Florida               | FL    | USA     |
| AMRIS    | Josue      | Cardoso          | University of Florida               | FL    | USA     |
| AMRIS    | Mario      | Chang Reyes      | University of Florida               | FL    | USA     |
| AMRIS    | Shane      | Chatfield        | University of Florida               | FL    | USA     |
| AMRIS    | Munish     | Chauhan          | Arizona State University            | AZ    | USA     |
| AMRIS    | Qiyin      | Chen             | University of Florida               | FL    | USA     |
| AMRIS    | Cho-Lun    | Chiang           | University of Florida               | FL    | USA     |
| AMRIS    | Andreina   | Chinea           | University of Florida               | FL    | USA     |
| AMRIS    | Stephen    | Chrzanowski      | University of Florida               | FL    | USA     |
| AMRIS    | Winston    | Chu              | University of Florida               | FL    | USA     |
| AMRIS    | Jae Woo    | Chung            | University of Florida               | FL    | USA     |
| AMRIS    | David      | Clark            | Malcom Randall VA Medical<br>Center | FL    | USA     |
| AMRIS    | Virginia   | Clark            | University of Florida               | FL    | USA     |
| AMRIS    | Asia       | Cobb             | University of Florida               | FL    | USA     |
| AMRIS    | Ron        | Cohen            | University of Florida               | FL    | USA     |
| AMRIS    | Taylor     | Col              | University of Florida               | FL    | USA     |
| AMRIS    | Jeremy     | Coleman          | University of Florida               | FL    | USA     |
| AMRIS    | James H.P. | Collins          | University of Florida               | FL    | USA     |
| AMRIS    | Luis       | Colon-Perez      | University of California, Irvine    | СА    | USA     |
| AMRIS    | Stephen    | Coombes          | University of Florida               | FL    | USA     |
| AMRIS    | Manuela    | Corti            | University of Florida               | FL    | USA     |

| Facility | First Name | Last Name    | Organization                      | State | Country |
|----------|------------|--------------|-----------------------------------|-------|---------|
| AMRIS    | Tina       | Cousins      | University of Florida             | FL    | USA     |
| AMRIS    | Yenisel    | Cruz-Almeida | University of Florida             | FL    | USA     |
| AMRIS    | Kenneth    | Cusi         | University of Florida             | FL    | USA     |
| AMRIS    | Abdul Rouf | Dar          | University of Florida             | FL    | USA     |
| AMRIS    | Kristin    | Dayton       | University of Florida             | FL    | USA     |
| AMRIS    | Liselotte  | de Wit       | University of Florida             | FL    | USA     |
| AMRIS    | Brittany   | DeFeis       | University of Florida             | FL    | USA     |
| AMRIS    | Phuong     | Deleyrolle   | University of Florida             | FL    | USA     |
| AMRIS    | Jesse      | DeSimone     | University of Texas, Southwestern | TX    | USA     |
| AMRIS    | Yousong    | Ding         | University of Florida             | FL    | USA     |
| AMRIS    | Jon        | Dobson       | University of Florida             | FL    | USA     |
| AMRIS    | Joe        | Dragone      | University of Florida             | FL    | USA     |
| AMRIS    | Kyle       | Dyson        | University of Florida             | FL    | USA     |
| AMRIS    | Natalie    | Ebner        | University of Florida             | FL    | USA     |
| AMRIS    | Matthew    | Eddy         | University of Florida             | FL    | USA     |
| AMRIS    | Michelle   | Ehrenberger  | University of Florida             | FL    | USA     |
| AMRIS    | Malathy    | Elumalai     | University of Florida             | FL    | USA     |
| AMRIS    | Alec       | Esper        | University of Florida             | FL    | USA     |
| AMRIS    | Darin      | Falk         | University of Florida             | FL    | USA     |
| AMRIS    | Lei        | Fan          | University of Florida             | FL    | USA     |
| AMRIS    | Marcelo    | Febo         | University of Florida             | FL    | USA     |
| AMRIS    | Likui      | Feng         | University of Florida             | FL    | USA     |
| AMRIS    | Guillaume  | Ferre        | University of Florida             | FL    | USA     |
| AMRIS    | Daniel     | Ferris       | University of Florida             | FL    | USA     |
| AMRIS    | Tyler      | Fettrow      | University of Florida             | FL    | USA     |
| AMRIS    | Johnny     | Figueroa     | Loma Linda University             | CA    | USA     |
| AMRIS    | Matthew    | Fillingim    | University of Florida             | FL    | USA     |
| AMRIS    | Roger      | Fillingim    | University of Florida             | FL    | USA     |
| AMRIS    | Roberto    | Firpi-Morell | University of Florida             | FL    | USA     |
| AMRIS    | Jeremy     | Flint        | University of Florida             | FL    | USA     |

| Facility | First Name | Last Name        | Organization               | State | Country |
|----------|------------|------------------|----------------------------|-------|---------|
| AMRIS    | Briana     | Foerman          | University of Florida      | FL    | USA     |
| AMRIS    | Leo        | Fontenot         | Louisiana State University | LA    | USA     |
| AMRIS    | Megan      | Forbes           | University of Florida      | FL    | USA     |
| AMRIS    | Sean       | Forbes           | University of Florida      | FL    | USA     |
| AMRIS    | Evan       | Forman           | University of Florida      | FL    | USA     |
| AMRIS    | Anthony    | Giacalone        | University of Florida      | FL    | USA     |
| AMRIS    | Drew       | Gillett          | University of Florida      | FL    | USA     |
| AMRIS    | Michael    | Goertzen         | University of Florida      | FL    | USA     |
| AMRIS    | Hector     | Gonzalez         | University of Florida      | FL    | USA     |
| AMRIS    | Niloofar   | Gopal Pour       | University of Florida      | FL    | USA     |
| AMRIS    | Adam       | Grippin          | University of Florida      | FL    | USA     |
| AMRIS    | Anthony    | Gruber           | University of Florida      | FL    | USA     |
| AMRIS    | Matteo     | Grudny           | University of Florida      | FL    | USA     |
| AMRIS    | Hugo       | Guerrero-Cazares | Mayo Clinic, Jacksonville  | FL    | USA     |
| AMRIS    | Danielle   | Guess            | University of Florida      | FL    | USA     |
| AMRIS    | Kimberly   | Guice            | University of Florida      | FL    | USA     |
| AMRIS    | Joseph     | Gullett          | University of Florida      | FL    | USA     |
| AMRIS    | Hala       | Hachem           | University of Florida      | FL    | USA     |
| AMRIS    | Matthew    | Hamm             | University of Florida      | FL    | USA     |
| AMRIS    | Moriah     | Hanson           | University of Florida      | FL    | USA     |
| AMRIS    | Michael    | Harris           | University of Florida      | FL    | USA     |
| AMRIS    | Abigail    | Hatcher          | University of Florida      | FL    | USA     |
| AMRIS    | Linda      | Hayward          | University of Florida      | FL    | USA     |
| AMRIS    | Sara       | Heshmati         | University of Florida      | FL    | USA     |
| AMRIS    | Matthew    | Неу              | University of Florida      | FL    | USA     |
| AMRIS    | Febrian    | Hillman          | Texas A&M University       | TX    | USA     |
| AMRIS    | Josh       | Holbrook         | University of Florida      | FL    | USA     |
| AMRIS    | Chongyang  | Huang            | university of florida      | FL    | USA     |
| AMRIS    | Haiqing    | Huang            | University of Florida      | FL    | USA     |
| AMRIS    | Robert     | Huigens          | University of Florida      | FL    | USA     |

| Facility | First Name         | Last Name       | Organization                               | State | Country |
|----------|--------------------|-----------------|--------------------------------------------|-------|---------|
| AMRIS    | Kathleen           | Hupfeld         | University of Florida                      | FL    | USA     |
| AMRIS    | Bryant             | Hutchins        | University of Florida                      | FL    | USA     |
| AMRIS    | Bryan              | Ibarra          | University of Florida                      | FL    | USA     |
| AMRIS    | Aprinda            | Indahlastari    | University of Florida                      | FL    | USA     |
| AMRIS    | Daniel             | Isom            | University of Miami                        | FL    | USA     |
| AMRIS    | Noelle             | Jacobsen        | University of Florida                      | FL    | USA     |
| AMRIS    | Belita             | James           | University of Florida                      | FL    | USA     |
| AMRIS    | Kelly              | Jenkins         | University of Florida                      | FL    | USA     |
| AMRIS    | Hae-Kwon           | Jeong           | Texas A&M University                       | TX    | USA     |
| AMRIS    | Guangde            | Jiang           | University of Florida                      | FL    | USA     |
| AMRIS    | Keyanni            | Johnson         | University of Florida                      | FL    | USA     |
| AMRIS    | Rachel             | Jones           | University of Florida                      | FL    | USA     |
| AMRIS    | Jonathan           | Judy            | University of Florida                      | FL    | USA     |
| AMRIS    | Catherine          | Kaczorowski     | Jackson Laboratory                         | ME    | USA     |
| AMRIS    | Fatma              | Kaplan          | Kaplan Schiller Research, LLC              | FL    | USA     |
| AMRIS    | Aditya             | Kasinadhuni     | University of Florida                      | FL    | USA     |
| AMRIS    | Mary               | Kasper          | University of Florida                      | FL    | USA     |
| AMRIS    | Sushain            | Kaul            | University of Florida                      | FL    | USA     |
| AMRIS    | Andreas            | Keil            | University of Florida                      | FL    | USA     |
| AMRIS    | Wiliam R.          | Kem             | University of Florida                      | FL    | USA     |
| AMRIS    | Ram                | Khattri         | University of Florida                      | FL    | USA     |
| AMRIS    | Gee                | Kim             | University of Florida                      | FL    | USA     |
| AMRIS    | Jessica            | Kraft           | University of Florida                      | FL    | USA     |
| AMRIS    | Eric               | Krause          | University of Florida                      | FL    | USA     |
| AMRIS    | Lee                | Kugelmann       | University of Florida                      | FL    | USA     |
| AMRIS    | Magdoom<br>Mohamed | Kulam Najmudeen | University of Florida                      | FL    | USA     |
| AMRIS    | Damon              | Lamb            | University of Florida                      | FL    | USA     |
| AMRIS    | Peder              | Larson          | University of California, San<br>Francisco | CA    | USA     |
| AMRIS    | Brittany           | Lee             | Stanford University                        | СА    | USA     |

| Facility | First Name  | Last Name | Organization                    | State | Country |
|----------|-------------|-----------|---------------------------------|-------|---------|
| AMRIS    | Eli         | Levit     | University of Florida           | FL    | USA     |
| AMRIS    | Mark        | Lewis     | University of Florida           | FL    | USA     |
| AMRIS    | Hong        | Li        | Florida State University        | FL    | USA     |
| AMRIS    | Zining      | Li        | University of Florida           | FL    | USA     |
| AMRIS    | Denise      | Limdimas  | University of Florida           | FL    | USA     |
| AMRIS    | Dake        | LIU       | University of Florida           | FL    | USA     |
| AMRIS    | Ryan        | Lively    | Georgia Institute of Technology | GA    | USA     |
| AMRIS    | Joanna      | Long      | University of Florida           | FL    | USA     |
| AMRIS    | Christopher | Lopez     | University of Florida           | FL    | USA     |
| AMRIS    | Donovan     | Lott      | University of Florida           | FL    | USA     |
| AMRIS    | Hendrik     | Luesch    | University of Florida           | FL    | USA     |
| AMRIS    | Paige       | Lysne     | University of Florida           | FL    | USA     |
| AMRIS    | Rohit       | Mahar     | University of Florida           | FL    | USA     |
| AMRIS    | Wendi       | Malphurs  | University of Florida           | FL    | USA     |
| AMRIS    | Paul        | Mangal    | University of Florida           | FL    | USA     |
| AMRIS    | Thomas      | Mareci    | University of Florida           | FL    | USA     |
| AMRIS    | Kelsey      | Marr      | University of Florida           | FL    | USA     |
| AMRIS    | James       | Matthews  | University of Florida           | FL    | USA     |
| AMRIS    | Andrew      | Maurer    | University of Florida           | FL    | USA     |
| AMRIS    | Susanna     | McConn    | University of Florida           | FL    | USA     |
| AMRIS    | Johanna     | McCracken | University of Florida           | FL    | USA     |
| AMRIS    | Nikolaus    | McFarland | University of Florida           | FL    | USA     |
| AMRIS    | Marc        | McLeod    | University of Florida           | FL    | USA     |
| AMRIS    | Caitlin     | McNally   | University of Florida           | FL    | USA     |
| AMRIS    | Andrew      | Medford   | Georgia Institute of Technology | GA    | USA     |
| AMRIS    | Borna       | Mehrad    | University of Florida           | FL    | USA     |
| AMRIS    | Marlin      | Mejia     | University of Florida           | FL    | USA     |
| AMRIS    | David       | Mendez    | University of Florida           | FL    | USA     |
| AMRIS    | Matthew     | Merritt   | University of Florida           | FL    | USA     |
| AMRIS    | Zhihui      | Miao      | University of Florida           | FL    | USA     |

| Facility | First Name       | Last Name | Organization                    | State | Country |
|----------|------------------|-----------|---------------------------------|-------|---------|
| AMRIS    | Ann              | Mislovic  | University of Florida           | FL    | USA     |
| AMRIS    | Duane            | Mitchell  | University of Florida           | FL    | USA     |
| AMRIS    | Sahba            | Mobini    | University of Florida           | FL    | USA     |
| AMRIS    | Adam             | Monsalve  | University of Florida           | FL    | USA     |
| AMRIS    | Giuseppe         | Morelli   | University of Florida           | FL    | USA     |
| AMRIS    | Lauren           | Morelli   | University of Florida           | FL    | USA     |
| AMRIS    | Rebecca          | Morgan    | University of Florida           | FL    | USA     |
| AMRIS    | Zahra            | Moslemi   | University of Florida           | FL    | USA     |
| AMRIS    | Emma             | Mulry     | University of Florida           | FL    | USA     |
| AMRIS    | Maeve            | Murphy    | University of Florida           | FL    | USA     |
| AMRIS    | Sean             | Najmi     | Georgia Institute of Technology | GA    | USA     |
| AMRIS    | John             | Neubert   | University of Florida           | FL    | USA     |
| AMRIS    | Tammy            | Nicholson | University of Florida           | FL    | USA     |
| AMRIS    | Nicole           | Nissim    | University of Florida           | FL    | USA     |
| AMRIS    | Sara             | Nixon     | University of Florida           | FL    | USA     |
| AMRIS    | Samantha         | Norman    | University of Florida           | FL    | USA     |
| AMRIS    | Emily            | Norton    | Mayo Clinic, Jacksonville       | FL    | USA     |
| AMRIS    | Rebecca          | O'Connell | University of Florida           | FL    | USA     |
| AMRIS    | Brian            | Odegaard  | University of Florida           | FL    | USA     |
| AMRIS    | Walter           | O'Dell    | University of Florida           | FL    | USA     |
| AMRIS    | Edward           | Ofori     | University of Florida           | FL    | USA     |
| AMRIS    | Marite           | Ojeda     | University of Florida           | FL    | USA     |
| AMRIS    | Michael          | Okun      | University of Florida           | FL    | USA     |
| AMRIS    | Caitlin          | Orsini    | University of Florida           | FL    | USA     |
| AMRIS    | Andrew           | O'Shea    | University of Florida           | FL    | USA     |
| AMRIS    | Deirdre          | O'Shea    | University of Florida           | FL    | USA     |
| AMRIS    | Andrew           | Palmer    | Florida Institute of Technology | FL    | USA     |
| AMRIS    | Chris            | Pampo     | University of Florida           | FL    | USA     |
| AMRIS    | Valerie          | Paul      | Smithsonian Institution         | FL    | USA     |
| AMRIS    | Qingqing (Emily) | Peng      | University of Florida           | FL    | USA     |

| Facility | First Name  | Last Name | Organization               | State | Country |
|----------|-------------|-----------|----------------------------|-------|---------|
| AMRIS    | Wenbo       | Peng      | University of Florida      | FL    | USA     |
| AMRIS    | Leronne     | Perera    | University of Florida      | FL    | USA     |
| AMRIS    | Nathan      | Petro     | University of Florida      | FL    | USA     |
| AMRIS    | Benjamin    | Philmus   | Oregon State University    | OR    | USA     |
| AMRIS    | Marjory     | Pompilus  | University of Florida      | FL    | USA     |
| AMRIS    | Eric        | Porges    | University of Florida      | FL    | USA     |
| AMRIS    | Ryan        | Poulsen   | University of Florida      | FL    | USA     |
| AMRIS    | Danielle    | Poulton   | University of Florida      | FL    | USA     |
| AMRIS    | Cathy       | Powers    | University of Florida      | FL    | USA     |
| AMRIS    | Robert      | Prather   | University of Florida      | FL    | USA     |
| AMRIS    | Catherine   | Price     | University of Florida      | FL    | USA     |
| AMRIS    | Wonn        | Pyon      | University of Florida      | FL    | USA     |
| AMRIS    | Mukundan    | Ragavan   | University of Florida      | FL    | USA     |
| AMRIS    | Maryam      | Rahman    | University of Florida      | FL    | USA     |
| AMRIS    | Sakthivel   | Ravi      | University of Florida      | FL    | USA     |
| AMRIS    | Arka Prabha | Ray       | University of Florida      | FL    | USA     |
| AMRIS    | Alyssa      | Ray       | University of Florida      | FL    | USA     |
| AMRIS    | Julian      | Rey       | University of Florida      | FL    | USA     |
| AMRIS    | Matthew     | Reyna     | University of Florida      | FL    | USA     |
| AMRIS    | Roxanne     | Rezaei    | University of Florida      | FL    | USA     |
| AMRIS    | Lori        | Rice      | University of Florida      | FL    | USA     |
| AMRIS    | Sutton      | Richmond  | University of Florida      | FL    | USA     |
| AMRIS    | Samuel      | Riehl     | University of Florida      | FL    | USA     |
| AMRIS    | Mario       | Rivera    | Louisiana State University | LA    | USA     |
| AMRIS    | Gwladys     | Riviere   | University of Florida      | FL    | USA     |
| AMRIS    | Elizabeth   | Roberts   | University of Florida      | FL    | USA     |
| AMRIS    | Kimberly    | Robertson | University of Florida      | FL    | USA     |
| AMRIS    | Michael     | Robinson  | University of Florida      | FL    | USA     |
| AMRIS    | James       | Rocca     | University of Florida      | FL    | USA     |
| AMRIS    | Alexandra   | Roder     | University of Arizona      | AZ    | USA     |

| Facility | First Name | Last Name      | Organization                    | State | Country |
|----------|------------|----------------|---------------------------------|-------|---------|
| AMRIS    | Jens       | Rosenberg      | NHMFL                           | FL    | USA     |
| AMRIS    | Pratik     | Roy            | University of Florida           | FL    | USA     |
| AMRIS    | Jeffrey    | Rudolf         | University of Florida           | FL    | USA     |
| AMRIS    | Anna       | Rushin         | University of Florida           | FL    | USA     |
| AMRIS    | Terence    | Ryan           | University of Florida           | FL    | USA     |
| AMRIS    | Rosalind   | Sadleir        | Arizona State University        | AZ    | USA     |
| AMRIS    | Stephanie  | Salabarria     | University of Florida           | FL    | USA     |
| AMRIS    | Addison    | Sans           | University of Florida           | FL    | USA     |
| AMRIS    | Malisa     | Sarntinoranont | University of Florida           | FL    | USA     |
| AMRIS    | Elias      | Sayour         | University of Florida           | FL    | USA     |
| AMRIS    | Michael    | Schär          | Johns Hopkins University        | MD    | USA     |
| AMRIS    | Christine  | Schmidt        | University of Florida           | FL    | USA     |
| AMRIS    | Rachael    | Seidler        | University of Florida           | FL    | USA     |
| AMRIS    | Medina     | Serdarevic     | University of Florida           | FL    | USA     |
| AMRIS    | Barry      | Setlow         | University of Florida           | FL    | USA     |
| AMRIS    | Valay      | Shah           | University of Florida           | FL    | USA     |
| AMRIS    | Bryanna    | Sharot         | University of Florida           | FL    | USA     |
| AMRIS    | Qingyao    | Shou           | University of Florida           | FL    | USA     |
| AMRIS    | Priyank    | Shukla         | University of Florida           | FL    | USA     |
| AMRIS    | Kimberly   | Sibille        | University of Florida           | FL    | USA     |
| AMRIS    | Dietmar    | Siemann        | University of Florida           | FL    | USA     |
| AMRIS    | Carsten    | Sievers        | Georgia Institute of Technology | GA    | USA     |
| AMRIS    | Prashant   | Singh          | University of Florida           | FL    | USA     |
| AMRIS    | Shruti     | Siva Kumar     | University of Florida           | FL    | USA     |
| AMRIS    | Joshua     | Slade          | University of Florida           | FL    | USA     |
| AMRIS    | Amanda     | Slater         | University of Florida           | FL    | USA     |
| Amris    | Glenn      | Smith          | University of Florida           | FL    | USA     |
| Amris    | Jasmine    | Smith          | University of Florida           | FL    | USA     |
| AMRIS    | Jessie     | Somerville     | University of Florida           | FL    | USA     |
| AMRIS    | Judith     | Steadman       | University of Florida           | FL    | USA     |

| Facility | First Name   | Last Name    | Organization          | State | Country |
|----------|--------------|--------------|-----------------------|-------|---------|
| AMRIS    | Bethany      | Stennett     | University of Florida | FL    | USA     |
| AMRIS    | S. Patricia  | Stock        | University of Arizona | AZ    | USA     |
| AMRIS    | Amanda       | Studnicki    | University of Florida | FL    | USA     |
| AMRIS    | Brent        | Sumerlin     | University of Florida | FL    | USA     |
| AMRIS    | Maurice      | Swanson      | University of Florida | FL    | USA     |
| AMRIS    | Lee          | Sweeney      | University of Florida | FL    | USA     |
| AMRIS    | Christi      | Swiers       | University of Florida | FL    | USA     |
| AMRIS    | Daniel R.    | Talham       | University of Florida | FL    | USA     |
| AMRIS    | Mai          | Tanaka       | University of Florida | FL    | USA     |
| AMRIS    | Srinivasarao | Tenneti      | University of Florida | FL    | USA     |
| AMRIS    | Ellen        | Terry        | University of Florida | FL    | USA     |
| AMRIS    | Naveen       | Thakur       | University of Florida | FL    | USA     |
| AMRIS    | Nagheme      | Thomas       | University of Florida | FL    | USA     |
| AMRIS    | Grace        | Thompson     | University of Florida | FL    | USA     |
| AMRIS    | Adrian       | Todd         | University of Florida | FL    | USA     |
| AMRIS    | Zhaohui      | Tong         | University of Florida | FL    | USA     |
| AMRIS    | Yvette       | Trahan       | University of Florida | FL    | USA     |
| AMRIS    | David        | Tran         | University of Florida | FL    | USA     |
| AMRIS    | Nhi          | Tran         | University of Florida | FL    | USA     |
| AMRIS    | Tram-Ahn     | Tran         | University of Florida | FL    | USA     |
| AMRIS    | Monica       | Tschosik     | University of Florida | FL    | USA     |
| AMRIS    | Shahabeddin  | Vahdat       | University of Florida | FL    | USA     |
| AMRIS    | David        | Vaillancourt | University of Florida | FL    | USA     |
| AMRIS    | К.           | Vandenborne  | University of Florida | FL    | USA     |
| AMRIS    | Sergey       | Vasenkov     | University of Florida | FL    | USA     |
| AMRIS    | Adam         | Veige        | University of Florida | FL    | USA     |
| AMRIS    | Ravneet      | Vohra        | University of Florida | FL    | USA     |
| AMRIS    | Aparna       | Wagle Shukla | University of Florida | FL    | USA     |
| AMRIS    | Zachary      | Wakefield    | University of Florida | FL    | USA     |
| AMRIS    | Glenn        | Walter       | University of Florida | FL    | USA     |

| Facility | First Name  | Last Name      | Organization                        | State | Country |
|----------|-------------|----------------|-------------------------------------|-------|---------|
| AMRIS    | Kevin       | Wang           | University of Florida               | FL    | USA     |
| AMRIS    | Yuting      | Wang           | University of Florida               | FL    | USA     |
| AMRIS    | Zheng       | Wang           | University of Florida               | FL    | USA     |
| AMRIS    | Eric        | Weber          | University of Florida               | FL    | USA     |
| AMRIS    | Steven      | Weisberg       | University of Florida               | FL    | USA     |
| AMRIS    | Thomas      | Weldeghiorghis | Louisiana State University          | LA    | USA     |
| AMRIS    | Christopher | Wendler        | University of Florida               | FL    | USA     |
| AMRIS    | Keith       | White          | University of Florida               | FL    | USA     |
| AMRIS    | Tyler       | Wildes         | University of Florida               | FL    | USA     |
| AMRIS    | Bradley     | Wilkes         | University of Florida               | FL    | USA     |
| AMRIS    | Rebecca     | Willcocks      | University of Florida               | FL    | USA     |
| AMRIS    | Lakiesha    | Williams       | University of Florida               | FL    | USA     |
| AMRIS    | John        | Williamson     | University of Florida               | FL    | USA     |
| AMRIS    | Adam        | Woods          | University of Florida               | FL    | USA     |
| AMRIS    | Brandon     | Wummer         | University of Florida               | FL    | USA     |
| AMRIS    | Benjamin    | Wylie          | Texas Tech University               | TX    | USA     |
| AMRIS    | Baofu       | Χυ             | University of Florida               | FL    | USA     |
| AMRIS    | Hongfen     | Yang           | University of Florida               | FL    | USA     |
| AMRIS    | Zhihui      | Yang           | University of Florida               | FL    | USA     |
| AMRIS    | Muhammad    | Yusufali       | Malcom Randall VA Medical<br>Center | FL    | USA     |
| AMRIS    | Zareen      | Zaidi          | University of Florida               | FL    | USA     |
| AMRIS    | Huadong     | Zeng           | University of Florida               | FL    | USA     |
| AMRIS    | Fengli      | Zhang          | NHMFL                               | FL    | USA     |
| AMRIS    | Peilan      | Zhang          | University of Florida               | FL    | USA     |
| AMRIS    | Yi          | Zhang          | University of Florida               | FL    | USA     |
| AMRIS    | Xinxing     | Zhang          | University of Florida               | FL    | USA     |
| AMRIS    | Erkang      | Zhou           | Georgia Institute of Technology     | GA    | USA     |
| AMRIS    | Tian        | Zhu            | University of Florida               | FL    | USA     |
| AMRIS    | Eric        | Ziegler        | Florida Institute of Technology     | FL    | USA     |
| AMRIS    | Abigail     | Zulich         | University of Florida               | FL    | USA     |

| Facility | First Name | Last Name | Organization          | State | Country |
|----------|------------|-----------|-----------------------|-------|---------|
| AMRIS    | Ran        | Ζυο       | University of Florida | FL    | USA     |

DC Field - National Users

| Facility | First Name   | Last Name    | Organization                                      | State | Country |
|----------|--------------|--------------|---------------------------------------------------|-------|---------|
| DC Field | Dmytro       | Abraimov     | NHMFL                                             | FL    | USA     |
| DC Field | Muhtar       | Ahart        | University of Illinois at Chicago                 | IL    | USA     |
| DC Field | Mashael      | Altaiary     | University of California, Riverside               | СА    | USA     |
| DC Field | Laurel       | Anderson     | Harvard University                                | MA    | USA     |
| DC Field | Stephen      | Armstrong    | Caltech                                           | СА    | USA     |
| DC Field | Neil         | Ashcroft     | Cornell University                                | NY    | USA     |
| DC Field | Can          | Aygen        | Northwestern University                           | IL    | USA     |
| DC Field | Hongwoo      | Baek         | NHMFL                                             | FL    | USA     |
| DC Field | Rabindranath | Bag          | Duke University                                   | NC    | USA     |
| DC Field | Paul         | Baity        | NHMFL                                             | FL    | USA     |
| DC Field | Shreyas      | Balachandran | Florida State University                          | FL    | USA     |
| DC Field | Kirk         | Baldwin      | Princeton University                              | NJ    | USA     |
| DC Field | Luis         | Balicas      | NHMFL                                             | FL    | USA     |
| DC Field | Alimamy      | Bangura      | NHMFL                                             | FL    | USA     |
| DC Field | Dimitri      | Basov        | University of California, San Diego               | СА    | USA     |
| DC Field | Ryan         | Baumbach     | NHMFL                                             | FL    | USA     |
| DC Field | Christianne  | Beekman      | NHMFL                                             | FL    | USA     |
| DC Field | Maximilian   | Bernbeck     | University of California, San Diego               | СА    | USA     |
| DC Field | John         | Berry        | University of Wisconsin, Madison                  | WI    | USA     |
| DC Field | Tushar       | Bhowmick     | University of Utah                                | UT    | USA     |
| DC Field | Greg         | Boebinger    | NHMFL                                             | FL    | USA     |
| DC Field | Scott        | Bole         | NHMFL                                             | FL    | USA     |
| DC Field | Alexandria   | Bone         | University of Tennessee, Knoxville                | TN    | USA     |
| DC Field | Stanimir     | Bonev        | Lawrence Livermore National<br>Laboratory         | СА    | USA     |
| DC Field | Ernesto      | Bosque       | NHMFL                                             | FL    | USA     |
| DC Field | William      | Brey         | NHMFL                                             | FL    | USA     |
| DC Field | Nicholas     | Butch        | National Institute of Standards and<br>Technology | MD    | USA     |
| DC Field | Gang         | Сао          | University of Colorado, Boulder                   | СО    | USA     |

| Facility | First Name | Last Name     | Organization                               | State | Country |
|----------|------------|---------------|--------------------------------------------|-------|---------|
| DC Field | Robert     | Chang         | Northwestern University                    | IL    | USA     |
| DC Field | Ramakanta  | Chapai        | Louisiana State University                 | LA    | USA     |
| DC Field | Shouvik    | Chatterjee    | University of California Santa<br>Barbara  | CA    | USA     |
| DC Field | Joseph     | Checkelsky    | Massachusetts Institute of<br>Technology   | MA    | USA     |
| DC Field | Kuizhi     | Chen          | NHMFL                                      | FL    | USA     |
| DC Field | Kuan-Wen   | Chen          | University of Michigan                     | MI    | USA     |
| DC Field | Lu         | Chen          | University of Michigan                     | MI    | USA     |
| DC Field | Po-Hsiu    | Chien         | Florida State University                   | FL    | USA     |
| DC Field | Shalinee   | Chikara       | NHMFL                                      | FL    | USA     |
| DC Field | Irinel     | Chiorescu     | NHMFL                                      | FL    | USA     |
| DC Field | Eun Sang   | Choi          | NHMFL                                      | FL    | USA     |
| DC Field | Jiun-Haw   | Chu           | University of Washington                   | WA    | USA     |
| DC Field | Josiah     | Cochran       | NHMFL                                      | FL    | USA     |
| DC Field | Emilio     | Codecido      | Ohio State University                      | OH    | USA     |
| DC Field | William    | Coniglio      | NHMFL                                      | FL    | USA     |
| DC Field | Carolina   | Corvalan Moya | Los Alamos National Laboratory             | NM    | USA     |
| DC Field | Tim        | Cross         | NHMFL                                      | FL    | USA     |
| DC Field | Pengcheng  | Dai           | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Bryon      | Dalton        | NHMFL                                      | FL    | USA     |
| DC Field | Kristiaan  | De Greve      | Harvard University                         | MA    | USA     |
| DC Field | Shanti     | Deemyad       | University of Utah                         | UT    | USA     |
| DC Field | Connor     | Dempsey       | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | Нао        | Deng          | Princeton University                       | NJ    | USA     |
| DC Field | Aravind    | Devarakonda   | Massachusetts Institute of<br>Technology   | MA    | USA     |
| DC Field | Timothy    | Diethrich     | University of Maryland, College<br>Park    | MD    | USA     |
| DC Field | Xiaxin     | Ding          | Idaho National Laboratory                  | ID    | USA     |
| DC Field | Sachith    | Dissanayake   | Duke University                            | NC    | USA     |

| Facility | First Name | Last Name       | Organization                               | State | Country |
|----------|------------|-----------------|--------------------------------------------|-------|---------|
| DC Field | Charuni    | Dissanayake     | University of Central Florida              | FL    | USA     |
| DC Field | Rick       | Dorn            | Iowa State University                      | IA    | USA     |
| DC Field | Sabri      | Elatresh        | Cornell University                         | NY    | USA     |
| DC Field | Rebecca    | Engelke         | Harvard University                         | MA    | USA     |
| DC Field | Matthew    | Ennis           | Duke University                            | NC    | USA     |
| DC Field | Cristian   | Escobar         | NHMFL                                      | FL    | USA     |
| DC Field | Zaiyao     | Fei             | University of Washington                   | WA    | USA     |
| DC Field | Rafael     | Fernandes       | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Adam       | Fiedler         | Marquette University                       | WI    | USA     |
| DC Field | Aikaterini | Flessa Savvidou | NHMFL                                      | FL    | USA     |
| DC Field | Ashleigh   | Francis         | NHMFL                                      | FL    | USA     |
| DC Field | Giovanni   | Franco-Rivera   | NHMFL                                      | FL    | USA     |
| DC Field | Riqiang    | Fυ              | NHMFL                                      | FL    | USA     |
| DC Field | Hailong    | Fu              | Pennsylvania State University              | PA    | USA     |
| DC Field | Xlaojun    | Fυ              | University of Minnesota, Twin Cities       | MI    | USA     |
| DC Field | Jorge      | Galeano Cabral  | Florida State University                   | FL    | USA     |
| DC Field | Eduard     | Galstyan        | University of Houston                      | TX    | USA     |
| DC Field | Zhehong    | Gan             | NHMFL                                      | FL    | USA     |
| DC Field | Xueshi     | Gao             | Ohio State University                      | ОН    | USA     |
| DC Field | Ryan       | Gelly           | Harvard University                         | MA    | USA     |
| DC Field | Stephanie  | Gnewuch         | University of Maryland, College<br>Park    | MD    | USA     |
| DC Field | Krzysztof  | Gofryk          | Idaho National Laboratory                  | ID    | USA     |
| DC Field | Thaige     | Gompa           | Georgia Institute of Technology            | GA    | USA     |
| DC Field | Tata       | Gopinath        | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Larry      | Gordon          | NHMFL                                      | FL    | USA     |
| DC Field | Aranya     | Goswami         | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | David      | Graf            | NHMFL                                      | FL    | USA     |
| DC Field | Matthew    | Grayson         | Northwestern University                    | IL    | USA     |
| DC Field | Elizabeth  | Green           | NHMFL                                      | FL    | USA     |

| Facility | First Name  | Last Name       | Organization                               | State | Country |
|----------|-------------|-----------------|--------------------------------------------|-------|---------|
| DC Field | Samuel      | Greer           | Los Alamos National Laboratory             | NM    | USA     |
| DC Field | Audrey      | Grockowiak      | NHMFL                                      | FL    | USA     |
| DC Field | Onder       | Gul             | Harvard University                         | MA    | USA     |
| DC Field | Danial      | Haei Najafabadi | Harvard University                         | MA    | USA     |
| DC Field | Seungyong   | Hahn            | NHMFL                                      | FL    | USA     |
| DC Field | Alex        | Hamill          | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Minyong     | Han             | Massachusetts Institute of<br>Technology   | MA    | USA     |
| DC Field | Xingyue     | Han             | University of Pennsylvania                 | PA    | USA     |
| DC Field | Adam        | Hand            | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Scott       | Hannahs         | NHMFL                                      | FL    | USA     |
| DC Field | Zeyu        | Нао             | Harvard University                         | MA    | USA     |
| DC Field | Sara        | Haravifard      | Duke University                            | NC    | USA     |
| DC Field | Minhao      | Не              | University of Washington, Seattle          | WA    | USA     |
| DC Field | Brett       | Heischmidt      | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Eric        | Hellstrom       | NHMFL                                      | FL    | USA     |
| DC Field | Russell     | Hemley          | University of Illinois at Chicago          | IL    | USA     |
| DC Field | Michael     | Hicks           | NHMFL                                      | FL    | USA     |
| DC Field | Stephen     | Hill            | NHMFL                                      | FL    | USA     |
| DC Field | Pei-Chun    | Но              | California State University, Fresno        | CA    | USA     |
| DC Field | Roald       | Hoffmann        | Cornell University                         | NY    | USA     |
| DC Field | Mikel       | Holcomb         | West Virginia University                   | WV    | USA     |
| DC Field | Md Shafayat | Hossain         | Princeton University                       | NJ    | USA     |
| DC Field | Xinbo       | Hu              | NHMFL                                      | FL    | USA     |
| DC Field | Katie       | Huang           | Harvard University                         | MA    | USA     |
| DC Field | Ке          | Huang           | Pennsylvania State University              | PA    | USA     |
| DC Field | Qing        | Huang           | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Ivan        | Hung            | NHMFL                                      | FL    | USA     |
| DC Field | Hadass      | Inbar           | University of California, Santa<br>Barbara | СА    | USA     |

| Facility | First Name            | Last Name    | Organization                               | State | Country |
|----------|-----------------------|--------------|--------------------------------------------|-------|---------|
| DC Field | Hisashi               | Inoue        | Massachusetts Institute of<br>Technology   | ма    | USA     |
| DC Field | Marcelo               | Jaime        | NHMFL                                      | NM    | USA     |
| DC Field | Jan                   | Jaroszynski  | NHMFL                                      | FL    | USA     |
| DC Field | Luis                  | Jauregui     | Harvard University                         | MA    | USA     |
| DC Field | Zhigang               | Jiang        | Georgia Institute of Technology            | GA    | USA     |
| DC Field | Yuxuan                | Jiang        | NHMFL                                      | FL    | USA     |
| DC Field | Qianni                | Jiang        | University of Washington                   | WA    | USA     |
| DC Field | Lin                   | Jiao         | NHMFL                                      | FL    | USA     |
| DC Field | Rongying              | Jin          | Louisiana State University                 | LA    | USA     |
| DC Field | Andrew                | Joe          | Harvard University                         | MA    | USA     |
| DC Field | Kaifei                | Kang         | Cornell University                         | NY    | USA     |
| DC Field | Soumen                | Kar          | University of Houston                      | TX    | USA     |
| DC Field | Eliana                | Karr         | Florida State University                   | FL    | USA     |
| DC Field | Brian                 | Kettell      | University of Tennessee Space<br>Institute | TN    | USA     |
| DC Field | Philip                | Kim          | Harvard University                         | MA    | USA     |
| DC Field | Sangsoo               | Kim          | NHMFL                                      | FL    | USA     |
| DC Field | Brendan               | King         | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Mason                 | Klemm        | Rice University                            | TX    | USA     |
| DC Field | Mehdi                 | Kochat       | University of Houston                      | TX    | USA     |
| DC Field | Alexey                | Kovalev      | NHMFL                                      | FL    | USA     |
| DC Field | Jurek                 | Krzystek     | NHMFL                                      | FL    | USA     |
| DC Field | Takashi               | Kurumaji     | Massachusetts Institute of<br>Technology   | МА    | USA     |
| DC Field | John                  | Kynoch       | NHMFL                                      | FL    | USA     |
| DC Field | Henry                 | La Pierre    | Georgia Institute of Technology            | GA    | USA     |
| DC Field | David                 | Larbalestier | NHMFL                                      | FL    | USA     |
| DC Field | Erik                  | Larsen       | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Chun Ning<br>(Jeanie) | Lau          | Ohio State University                      | ОН    | USA     |
| DC Field | lan                   | Leahy        | University of Colorado, Boulder            | СО    | USA     |

| Facility | First Name | Last Name  | Organization                             | State | Country |
|----------|------------|------------|------------------------------------------|-------|---------|
| DC Field | Patrick    | Lee        | Massachusetts Institute of<br>Technology | МА    | USA     |
| DC Field | Seng Huat  | Lee        | Pennsylvania State University            | PA    | USA     |
| DC Field | Minhyea    | Lee        | University of Colorado, Boulder          | СО    | USA     |
| DC Field | Jia        | Li         | Brown University                         | RI    | USA     |
| DC Field | Xiang      | Li         | California Institute of Technology       | СА    | USA     |
| DC Field | Tingxin    | Li         | Cornell University                       | NY    | USA     |
| DC Field | Lu         | Li         | University of Michigan                   | MA    | USA     |
| DC Field | llya       | Litvak     | NHMFL                                    | FL    | USA     |
| DC Field | Хіаохие    | Liu        | Brown University                         | RI    | USA     |
| DC Field | Xiaomeng   | Liu        | Harvard University                       | MA    | USA     |
| DC Field | Erfu       | Liu        | University of California, Riverside      | СА    | USA     |
| DC Field | I-LIn      | Liu        | University of Maryland, College<br>Park  | MD    | USA     |
| DC Field | Zhaoyu     | Liu        | University of Washington                 | WA    | USA     |
| DC Field | Hongcheng  | Lu         | Duke University                          | NC    | USA     |
| DC Field | Zhengguang | Lu         | NHMFL                                    | FL    | USA     |
| DC Field | Chun Hung  | Lui        | University of California, Riverside      | СА    | USA     |
| DC Field | Bing       | Lv         | University of Texas, Dallas              | TX    | USA     |
| DC Field | Meng       | Ма         | Princeton University                     | NJ    | USA     |
| DC Field | Kin Fai    | Mak        | Pennsylvania State University            | PA    | USA     |
| DC Field | Paul       | Malinowski | University of Washington                 | WA    | USA     |
| DC Field | David      | Mandrus    | University of Tennessee, Knoxville       | TN    | USA     |
| DC Field | Michael    | Manfra     | Nokia Bell Labs                          | NJ    | USA     |
| DC Field | Efstratios | Manousakis | Florida State University                 | FL    | USA     |
| DC Field | Jamie      | Manson     | Eastern Washington University            | WA    | USA     |
| DC Field | Zhiqiang   | Мао        | Pennsylvania State University            | PA    | USA     |
| DC Field | Brian      | Maple      | University of California, San Diego      | СА    | USA     |
| DC Field | Jonathan   | Marbey     | NHMFL                                    | FL    | USA     |
| DC Field | Ross       | McDonald   | NHMFL                                    | NM    | USA     |

| Facility | First Name | Last Name | Organization                               | State | Country |
|----------|------------|-----------|--------------------------------------------|-------|---------|
| DC Field | Tony       | McFadden  | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | Stephen    | McGill    | NHMFL                                      | FL    | USA     |
| DC Field | Tyrel      | McQueen   | Johns Hopkins University                   | MD    | USA     |
| DC Field | Dmitri     | Mihaliov  | University of Michigan                     | MI    | USA     |
| DC Field | Lujin      | Min       | Pennsylvania State University              | PA    | USA     |
| DC Field | Kimberly   | Modic     | NHMFL                                      | NM    | USA     |
| DC Field | Seongphill | Moon      | NHMFL                                      | FL    | USA     |
| DC Field | Emilia     | Morosan   | Rice University                            | TX    | USA     |
| DC Field | Duncan     | Moseley   | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Navid      | Mottaghi  | West Virginia University                   | WV    | USA     |
| DC Field | Shirin     | Mozaffari | NHMFL                                      | FL    | USA     |
| DC Field | Riffat     | Munir     | University of Central Florida              | FL    | USA     |
| DC Field | Tim        | Murphy    | NHMFL                                      | FL    | USA     |
| DC Field | Janice     | Musfeldt  | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Joshua     | Mutch     | University of Washington                   | WA    | USA     |
| DC Field | Stephen    | Nagler    | Oak Ridge National Laboratory              | TN    | USA     |
| DC Field | Yasuyuki   | Nakajima  | University of Central Florida              | FL    | USA     |
| DC Field | Sarah      | Nelson    | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Martin     | Nikolo    | Saint Louis University                     | МО    | USA     |
| DC Field | Wei        | Ning      | Pennsylvania State University              | PA    | USA     |
| DC Field | Kyle       | Noordhoek | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Robert     | Nowell    | NHMFL                                      | FL    | USA     |
| DC Field | Jong Mok   | Ok        | Oak Ridge National Laboratory              | TN    | USA     |
| DC Field | Olatunde   | Oladehin  | Florida State University                   | FL    | USA     |
| DC Field | Andrew     | Ozarowski | NHMFL                                      | FL    | USA     |
| DC Field | Mykhaylo   | Ozerov    | NHMFL                                      | FL    | USA     |
| DC Field | Chris      | Palmstrom | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | Joon Young | Park      | Harvard University                         | MA    | USA     |
| DC Field | Ju-Hyun    | Park      | NHMFL                                      | FL    | USA     |

| Facility | First Name  | Last Name   | Organization                               | State | Country |
|----------|-------------|-------------|--------------------------------------------|-------|---------|
| DC Field | Nawaraj     | Paudel      | Florida State University                   | FL    | USA     |
| DC Field | Joana       | Paulino     | NHMFL                                      | FL    | USA     |
| DC Field | Loren       | Pfeiffer    | Princeton University                       | NЈ    | USA     |
| DC Field | Joel        | Piotrowski  | NHMFL                                      | FL    | USA     |
| DC Field | Kateryna    | Pistunova   | Stanford University                        | CA    | USA     |
| DC Field | Christopher | Pocs        | University of Colorado, Boulder            | СО    | USA     |
| DC Field | Bal         | Pokharel    | NHMFL                                      | FL    | USA     |
| DC Field | Dragana     | Popovic     | NHMFL                                      | FL    | USA     |
| DC Field | Andy        | Powell      | NHMFL                                      | FL    | USA     |
| DC Field | Vlad        | Pribiag     | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Huajun      | Qin         | Florida State University                   | FL    | USA     |
| DC Field | Ayyalusamy  | Ramamoorthy | University of Michigan                     | MI    | USA     |
| DC Field | Arun        | Ramanathan  | Georgia Institute of Technology            | GA    | USA     |
| DC Field | Brad        | Ramshaw     | Cornell University                         | NY    | USA     |
| DC Field | Sheng       | Ran         | Washington University in St. Louis         | мо    | USA     |
| DC Field | Thirupathi  | Ravula      | University of Michigan                     | MI    | USA     |
| DC Field | Dan         | Read        | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | Arneil      | Reyes       | NHMFL                                      | FL    | USA     |
| DC Field | Natalie     | Rice        | Georgia Institute of Technology            | GA    | USA     |
| DC Field | Jeffrey     | Rinehart    | University of California, San Diego        | СА    | USA     |
| DC Field | Jacob       | Rochester   | Ohio State University                      | ОН    | USA     |
| DC Field | Efrain      | Rodriguez   | University of Maryland, College<br>Park    | MD    | USA     |
| DC Field | Yuval       | Ronen       | Harvard University                         | MA    | USA     |
| DC Field | Tom         | Rosenbaum   | University of Chicago                      | IL    | USA     |
| DC Field | Aaron       | Rossini     | Iowa State University                      | IA    | USA     |
| DC Field | Shanta      | Saha        | University of Maryland, College<br>Park    | MD    | USA     |
| DC Field | Jeffrey     | Schiano     | Pennsylvania State University              | PA    | USA     |
| DC Field | Giovanni    | Scuri       | Harvard University                         | MA    | USA     |

| Facility | First Name      | Last Name     | Organization                     | State | Country |
|----------|-----------------|---------------|----------------------------------|-------|---------|
| DC Field | Venkat          | Selvamanickam | University of Houston            | TX    | USA     |
| DC Field | Dmitry          | Semenov       | NHMFL                            | FL    | USA     |
| DC Field | Sabyasachi      | Sen           | University of California, Davis  | CA    | USA     |
| DC Field | Jie             | Shan          | Pennsylvania State University    | PA    | USA     |
| DC Field | Yinming         | Shao          | Columbia University              | NY    | USA     |
| DC Field | Qing            | Shao          | Northwestern University          | IL    | USA     |
| DC Field | Shivani         | Sharma        | NHMFL                            | FL    | USA     |
| DC Field | Mansour         | Shayegan      | Princeton University             | NJ    | USA     |
| DC Field | Dmitry          | Shcherbakov   | Ohio State University            | OH    | USA     |
| DC Field | Arkady          | Shehter       | NHMFL                            | FL    | USA     |
| DC Field | Zhenzhong       | Shi           | Duke University                  | NC    | USA     |
| DC Field | Sufei           | Shi           | Rensselaer Polytechnic Institute | NY    | USA     |
| DC Field | Yiseul          | Shin          | Florida State University         | FL    | USA     |
| DC Field | Keshav          | Shrestha      | Texas A&M University             | TX    | USA     |
| DC Field | K A M Hasan     | Siddiquee     | University of Central Florida    | FL    | USA     |
| DC Field | Peter           | Siegfried     | University of Colorado, Boulder  | СО    | USA     |
| DC Field | Theo            | Siegrist      | NHMFL                            | FL    | USA     |
| DC Field | Daniel          | Silevitch     | University of Chicago            | IL    | USA     |
| DC Field | Siddharth Kumar | Singh         | Princeton University             | NJ    | USA     |
| DC Field | John            | Singleton     | NHMFL                            | NM    | USA     |
| DC Field | Dmitry          | Smirnov       | NHMFL                            | FL    | USA     |
| DC Field | Julia           | Smith         | NHMFL                            | FL    | USA     |
| DC Field | Egon            | Sohn          | Cornell University               | NY    | USA     |
| DC Field | Maddury         | Somayazulu    | Argonne National Laboratory      | IL    | USA     |
| DC Field | Tiancheng       | Song          | University of Washington         | WA    | USA     |
| DC Field | Lily            | Stanley       | NHMFL                            | FL    | USA     |
| DC Field | Benjamin        | Stein         | Los Alamos National Laboratory   | NM    | USA     |
| DC Field | William         | Steinhardt    | Duke University                  | NC    | USA     |
| DC Field | Sebastian       | Stoian        | University of Idaho              | ID    | USA     |
| DC Field | Mas             | Subramanian   | Oregon State University          | OR    | USA     |

| Facility | First Name   | Last Name        | Organization                               | State | Country |
|----------|--------------|------------------|--------------------------------------------|-------|---------|
| DC Field | Mike         | Sumption         | Ohio State University                      | ОН    | USA     |
| DC Field | Jiho         | Sung             | Harvard University                         | MA    | USA     |
| DC Field | Andrey       | Sushko           | Harvard University                         | MA    | USA     |
| DC Field | Alexey       | Suslov           | NHMFL                                      | FL    | USA     |
| DC Field | Takehito     | Suzuki           | Massachusetts Institute of<br>Technology   | МА    | USA     |
| DC Field | Fazel        | Tafti            | Boston College                             | MA    | USA     |
| DC Field | Chiara       | Tarantini        | NHMFL                                      | FL    | USA     |
| DC Field | Joshua       | Taylor           | Florida State University                   | FL    | USA     |
| DC Field | Joshua       | Telser           | Roosevelt University                       | IL    | USA     |
| DC Field | Jasminka     | Terzic           | NHMFL                                      | FL    | USA     |
| DC Field | Pranav       | Thekke Madathil  | Princeton University                       | NJ    | USA     |
| DC Field | Christie     | Thompson         | Florida State University                   | FL    | USA     |
| DC Field | Haidong      | Tian             | Ohio State University                      | ОН    | USA     |
| DC Field | Pagnareach   | Tin              | University of Tennessee, Knoxville         | TN    | USA     |
| DC Field | Colin        | Tinsman          | University of Michigan                     | MI    | USA     |
| DC Field | Jacob        | Tosado           | University of Maryland, College<br>Park    | MD    | USA     |
| DC Field | Jack         | Toth             | NHMFL                                      | FL    | USA     |
| DC Field | Stan         | Tozer            | NHMFL                                      | FL    | USA     |
| DC Field | Ahmad Ikhwan | Us Saleheen      | Louisiana State University                 | LA    | USA     |
| DC Field | Jeremiah     | van Baren        | University of California, Riverside        | СА    | USA     |
| DC Field | Gianluigi    | Veglia           | University of Minnesota, Twin Cities       | MN    | USA     |
| DC Field | Kevin        | Villegas Rosales | Princeton University                       | NJ    | USA     |
| DC Field | Joshua       | Wakefield        | Massachusetts Institute of<br>Technology   | МА    | USA     |
| DC Field | Zhi          | Wang             | Brown University                           | RI    | USA     |
| DC Field | Yuxin        | Wang             | Florida State University                   | FL    | USA     |
| DC Field | Ке           | Wang             | Harvard University                         | MA    | USA     |
| DC Field | Xiaoling     | Wang             | University of California, Santa<br>Barbara | СА    | USA     |
| DC Field | Songlin      | Wang             | University of Minnesota, Twin Cities       | MN    | USA     |

| Facility | First Name | Last Name   | Organization                             | State | Country |
|----------|------------|-------------|------------------------------------------|-------|---------|
| DC Field | Кауа       | Wei         | NHMFL                                    | FL    | USA     |
| DC Field | Dagmar     | Weickert    | NHMFL                                    | NM    | USA     |
| DC Field | Thomas     | Werkmeister | Harvard University                       | MA    | USA     |
| DC Field | Ken        | West        | Princeton University                     | NJ    | USA     |
| DC Field | Chelsea    | Widener     | University of Tennessee, Knoxville       | TN    | USA     |
| DC Field | Matthew    | Wilson      | University of California, Riverside      | CA    | USA     |
| DC Field | Marshall   | Wood        | NHMFL                                    | FL    | USA     |
| DC Field | Liang      | Wu          | University of Pennsylvania               | PA    | USA     |
| DC Field | Yiqing     | Xia         | University of California, Davis          | CA    | USA     |
| DC Field | Ziji       | Xiang       | University of Michigan                   | MI    | USA     |
| DC Field | Chengkun   | Xing        | University of Tennessee, Knoxville       | TN    | USA     |
| DC Field | Xingchen   | Χυ          | Fermi National Accelerator<br>Laboratory | IL    | USA     |
| DC Field | Xiaodong   | Xu          | University of Washington                 | WA    | USA     |
| DC Field | Ziling     | Xue         | University of Tennessee, Knoxville       | TN    | USA     |
| DC Field | Lalit      | Yadav       | Duke University                          | NC    | USA     |
| DC Field | Hung-Yu    | Yang        | Boston College                           | MA    | USA     |
| DC Field | Jiawei     | Yang        | University of California, Riverside      | CA    | USA     |
| DC Field | Matthew    | Yankowitz   | University of Washington                 | WA    | USA     |
| DC Field | Linda      | Ye          | Massachusetts Institute of<br>Technology | MA    | USA     |
| DC Field | Hyobin     | Yoo         | Harvard University                       | MA    | USA     |
| DC Field | Vivien     | Zapf        | NHMFL                                    | NM    | USA     |
| DC Field | Jonathan   | Zauberman   | Harvard University                       | MA    | USA     |
| DC Field | Biwen      | Zhang       | Florida State University                 | FL    | USA     |
| DC Field | Rongfu     | Zhang       | NHMFL                                    | FL    | USA     |
| DC Field | Han        | Zhang       | University of Tennessee                  | TN    | USA     |
| DC Field | Qi         | Zhang       | University of Washington                 | WA    | USA     |
| DC Field | Tianhao    | Zhao        | Georgia Institute of Technology          | GA    | USA     |
| DC Field | WenKai     | Zheng       | NHMFL                                    | FL    | USA     |
| DC Field | Xilin      | Zhou        | Harvard University                       | MA    | USA     |

| Facility | First Name | Last Name | Organization                             | State | Country |
|----------|------------|-----------|------------------------------------------|-------|---------|
| DC Field | Υου        | Zhou      | Harvard University                       | MA    | USA     |
| DC Field | Haidong    | Zhou      | University of Tennessee, Knoxville       | TN    | USA     |
| DC Field | Jiacheng   | Zhu       | Cornell University                       | NY    | USA     |
| DC Field | Junbo      | Zhu       | Massachusetts Institute of<br>Technology | MA    | USA     |
| DC Field | Jun        | Zhu       | Pennsylvania State University            | PA    | USA     |
| DC Field | Yanglin    | Zhu       | Tulane University                        | LA    | USA     |
| DC Field | Weidi      | Zhu       | University of California, Davis          | CA    | USA     |
| DC Field | Michael    | Zudov     | University of Minnesota, Twin Cities     | MN    | USA     |

EMR - National Users

| Facility | First Name  | Last Name        | Organization                       | State | Country |
|----------|-------------|------------------|------------------------------------|-------|---------|
| EMR      | Adewale     | Akinfaderin      | Florida State University           | FL    | USA     |
| EMR      | Thomas      | Albrecht-Schmitt | Florida State University           | FL    | USA     |
| EMR      | Adam        | Altenhof         | Florida State University           | FL    | USA     |
| EMR      | John        | Berry            | University of Wisconsin, Madison   | WI    | USA     |
| EMR      | Christoph   | Boehme           | University of Utah                 | UT    | USA     |
| EMR      | Alexandria  | Bone             | University of Tennessee, Knoxville | TN    | USA     |
| EMR      | Clifford    | Bowers           | University of Florida              | FL    | USA     |
| EMR      | ChristiAnna | Brantley         | University of Florida              | FL    | USA     |
| EMR      | Nhat Nguyen | Bui              | NHMFL                              | FL    | USA     |
| EMR      | Shalinee    | Chikara          | NHMFL                              | FL    | USA     |
| EMR      | George      | Christou         | University of Florida              | FL    | USA     |
| EMR      | Carl        | Conti            | Florida State University           | FL    | USA     |
| EMR      | Naresh      | Dalal            | NHMFL                              | FL    | USA     |
| EMR      | Enrique     | del Barco        | University of Central Florida      | FL    | USA     |
| EMR      | Linda       | Doerrer          | Boston University                  | MA    | USA     |
| EMR      | Thierry     | Dubroca          | NHMFL                              | FL    | USA     |
| EMR      | Jessica     | Elinburg         | Boston University                  | MA    | USA     |
| EMR      | Alec        | Esper            | University of Florida              | FL    | USA     |
| EMR      | Adam        | Fiedler          | Marquette University               | WI    | USA     |
| EMR      | Lucio       | Frydman          | NHMFL                              | FL    | USA     |
| EMR      | Riqiang     | Fu               | NHMFL                              | FL    | USA     |
| EMR      | Miguel      | Gakiya           | Florida State University           | FL    | USA     |
| EMR      | Eranga      | Gamage           | Iowa State University              | IA    | USA     |
| EMR      | Zhehong     | Gan              | NHMFL                              | FL    | USA     |
| EMR      | Tuhin       | Ghosh            | University of Florida              | FL    | USA     |
| EMR      | Thaige      | Gompa            | Georgia Institute of Technology    | GA    | USA     |
| EMR      | Samuel      | Greer            | Los Alamos National Laboratory     | NM    | USA     |
| EMR      | Brittany    | Grimm            | Florida State University           | FL    | USA     |
| EMR      | Adam        | Hand             | University of Tennessee, Knoxville | TN    | USA     |

| Facility | First Name | Last Name   | Organization                                      | State | Country |
|----------|------------|-------------|---------------------------------------------------|-------|---------|
| EMR      | Marta      | Hatzell     | Georgia Institute of Technology                   | GA    | USA     |
| EMR      | Stephen    | Hill        | NHMFL                                             | FL    | USA     |
| emr      | Ivan       | Hung        | NHMFL                                             | FL    | USA     |
| EMR      | Cassidy    | Jackson     | Colorado State University                         | СО    | USA     |
| EMR      | Brian      | Kettell     | University of Tennessee Space<br>Institute        | TN    | USA     |
| EMR      | Gyan       | Khatri      | University of Central Florida                     | FL    | USA     |
| emr      | Kirill     | Kovnir      | Iowa State University                             | IA    | USA     |
| EMR      | Stosh      | Kozimor     | Los Alamos National Laboratory                    | NM    | USA     |
| EMR      | Jurek      | Krzystek    | NHMFL                                             | FL    | USA     |
| EMR      | Krishnendu | Kundu       | NHMFL                                             | FL    | USA     |
| EMR      | Jason      | Kuszynski   | Florida State University                          | FL    | USA     |
| EMR      | Jaesuk     | Kwon        | University of Central Florida                     | FL    | USA     |
| EMR      | Henry      | La Pierre   | Georgia Institute of Technology                   | GA    | USA     |
| EMR      | Trevor     | Latendresse | Texas A&M University                              | TX    | USA     |
| EMR      | David      | Lederman    | University of California, Santa Cruz              | СА    | USA     |
| EMR      | Russell    | Maier       | National Institute of Standards and<br>Technology | MD    | USA     |
| EMR      | Hans       | Malissa     | University of Utah                                | UT    | USA     |
| EMR      | Jamie      | Manson      | Eastern Washington University                     | WA    | USA     |
| EMR      | Jonathan   | Marbey      | NHMFL                                             | FL    | USA     |
| EMR      | Frederic   | Mentink     | NHMFL                                             | FL    | USA     |
| EMR      | Zhihui     | Miao        | University of Florida                             | FL    | USA     |
| EMR      | Clay       | Mings       | University of Tennessee, Knoxville                | TN    | USA     |
| EMR      | lan        | Moseley     | Colorado State University                         | СО    | USA     |
| EMR      | Duncan     | Moseley     | University of Tennessee, Knoxville                | TN    | USA     |
| EMR      | Michael    | Nippe       | Texas A&M University                              | TX    | USA     |
| EMR      | Andrew     | Ozarowski   | NHMFL                                             | FL    | USA     |
| EMR      | Mykhaylo   | Ozerov      | NHMFL                                             | FL    | USA     |
| EMR      | Jianjun    | Pan         | University of South Florida                       | FL    | USA     |
| EMR      | Nathan     | Peek        | Florida State University                          | FL    | USA     |

| Facility | First Name    | Last Name     | Organization                               | State | Country |
|----------|---------------|---------------|--------------------------------------------|-------|---------|
| EMR      | Sanath Kumar  | Rama Krishna  | Florida State University                   | FL    | USA     |
| EMR      | Arun          | Ramanathan    | Georgia Institute of Technology            | GA    | USA     |
| EMR      | Ellis         | Reinherz      | Dana-Farber Cancer Institute               | MA    | USA     |
| EMR      | Natalie       | Rice          | Georgia Institute of Technology            | GA    | USA     |
| EMR      | Robert        | Schurko       | Florida State University                   | FL    | USA     |
| EMR      | Susannah      | Scott         | University of California, Santa<br>Barbara | СА    | USA     |
| EMR      | Michael       | Shatruk       | NHMFL                                      | FL    | USA     |
| EMR      | Srinivasa Rao | Singamaneni   | University of Texas, El Paso               | TX    | USA     |
| EMR      | John          | Singleton     | NHMFL                                      | NM    | USA     |
| EMR      | Likai         | Song          | NHMFL                                      | FL    | USA     |
| EMR      | Murari        | Soundararajan | NHMFL                                      | FL    | USA     |
| EMR      | Benjamin      | Stein         | Los Alamos National Laboratory             | NM    | USA     |
| EMR      | Albert        | Stiegman      | Florida State University                   | FL    | USA     |
| EMR      | Geoffrey      | Strouse       | NHMFL                                      | FL    | USA     |
| EMR      | Mas           | Subramanian   | Oregon State University                    | OR    | USA     |
| EMR      | Brent         | Sumerlin      | University of Florida                      | FL    | USA     |
| EMR      | Joshua        | Telser        | Roosevelt University                       | IL    | USA     |
| EMR      | Pagnareach    | Tin           | University of Tennessee, Knoxville         | TN    | USA     |
| EMR      | Aaron         | Tondreau      | Los Alamos National Laboratory             | NM    | USA     |
| EMR      | Priyanka      | Vaidya        | University of Central Florida              | FL    | USA     |
| EMR      | Johan         | van Tol       | NHMFL                                      | FL    | USA     |
| EMR      | Adam          | Veige         | University of Florida                      | FL    | USA     |
| EMR      | Sungsool      | Wi            | NHMFL                                      | FL    | USA     |
| EMR      | Chelsea       | Widener       | University of Tennessee, Knoxville         | TN    | USA     |
| EMR      | Ziling        | Xue           | University of Tennessee, Knoxville         | TN    | USA     |
| EMR      | Fengyuan      | Yang          | Ohio State University                      | ОН    | USA     |
| EMR      | Joseph        | Zadrozny      | Colorado State University                  | СО    | USA     |
| EMR      | Vivien        | Zapf          | NHMFL                                      | NM    | USA     |
| EMR      | Jianyuan      | Zhang         | Rutgers University                         | NJ    | USA     |
| EMR      | Tommy         | Zhao          | University of Florida                      | FL    | USA     |

| Facility | First Name | Last Name | Organization                      | State | Country |
|----------|------------|-----------|-----------------------------------|-------|---------|
| EMR      | Mary Ellen | Zvanut    | University of Alabama, Birmingham | AL    | USA     |

## High B/T - National Users

| Facility | First Name | Last Name | Organization                | State | Country |
|----------|------------|-----------|-----------------------------|-------|---------|
| High B/T | Johnny     | Adams     | University of Florida       | FL    | USA     |
| High B/T | Donald     | Candela   | University of Massachusetts | MA    | USA     |
| High B/T | Keegan     | Gunther   | University of Florida       | FL    | USA     |
| High B/T | Chao       | Huan      | University of Florida       | FL    | USA     |
| High B/T | Yoonseok   | Lee       | University of Florida       | FL    | USA     |
| High B/T | Marc       | Lewkowitz | University of Florida       | FL    | USA     |
| High B/T | Lucia      | Steinke   | University of Florida       | FL    | USA     |
| High B/T | Neil       | Sullivan  | University of Florida       | FL    | USA     |
| High B/T | Andrew     | Woods     | University of Florida       | FL    | USA     |

ICR- National Users

| Facility | First Name | Last Name     | Organization                                | State | Country |
|----------|------------|---------------|---------------------------------------------|-------|---------|
| ICR      | Jeramie    | Adams         | University of Wyoming                       | WY    | USA     |
| ICR      | Archana    | Agarwal       | University of Utah                          | UT    | USA     |
| ICR      | Lissa      | Anderson      | NHMFL                                       | FL    | USA     |
| ICR      | William    | Bahureksa     | Colorado State University                   | СО    | USA     |
| ICR      | Megan      | Behnke        | Florida State University                    | FL    | USA     |
| ICR      | Barbara    | Bekins        | U.S. Geological Survey                      | СА    | USA     |
| ICR      | Greg       | Blakney       | NHMFL                                       | FL    | USA     |
| ICR      | Jens       | Blotevogel    | Colorado State University                   | СО    | USA     |
| ICR      | Thomas     | Borch         | Colorado State University                   | СО    | USA     |
| ICR      | Brian      | Bothner       | Montana State University                    | MT    | USA     |
| ICR      | Catherine  | Brewer        | New Mexico State University                 | NM    | USA     |
| ICR      | David      | Butcher       | NHMFL                                       | FL    | USA     |
| ICR      | Kenneth    | Carroll       | New Mexico State University                 | NM    | USA     |
| ICR      | Renato     | Castelao      | University of Georgia                       | GA    | USA     |
| ICR      | Núria      | Catalán       | U.S. Geological Survey                      | СО    | USA     |
| ICR      | Jose       | Cerrato       | University of New Mexico                    | NM    | USA     |
| ICR      | Martha     | Chacon        | NHMFL                                       | FL    | USA     |
| ICR      | Romy       | Chakraborty   | Lawrence Berkeley National<br>Laboratory    | СА    | USA     |
| ICR      | Huan       | Chen          | NHMFL                                       | FL    | USA     |
| ICR      | Feng       | Cheng         | Worcester Polytechnic Institute             | MA    | USA     |
| ICR      | Nicole     | Coffey        | University of Delaware                      | DE    | USA     |
| ICR      | Katrina    | Counihan      | Alaska SeaLife Center                       | AK    | USA     |
| ICR      | Isabelle   | Cozzarelli    | U.S. Geological Survey                      | VA    | USA     |
| ICR      | Than       | Dam           | Univesity of Wyoming                        | WY    | USA     |
| ICR      | Juliana    | D'Andrilli    | Louisiana Universities Marine<br>Consortium | LA    | USA     |
| ICR      | Cameron    | Davis         | NHMFL                                       | FL    | USA     |
| ICR      | Caroline   | DeHart        | Northwestern University                     | IL    | USA     |
| ICR      | Mostafa    | Dehghanizadeh | New Mexico State University                 | NM    | USA     |

| Facility | First Name | Last Name      | Organization                             | State | Country |
|----------|------------|----------------|------------------------------------------|-------|---------|
| ICR      | Benjamin   | DesSoye        | Northwestern University                  | IL    | USA     |
| ICR      | Ermias     | Dheressa       | National Renewable Energy<br>Laboratory  | со    | USA     |
| ICR      | Greg       | Dooley         | Colorado State University                | СО    | USA     |
| ICR      | Elizabeth  | Duselis        | University of Virginia                   | VA    | USA     |
| ICR      | Nimisha    | Edayilam       | Clemson University (Clemson)             | SC    | USA     |
| ICR      | Ekanayaka  | Ellepola       | New Mexico Tech                          | NM    | USA     |
| ICR      | Jason      | Fellman        | University of Alaska Southeast           | AK    | USA     |
| ICR      | Sarah      | Fischer        | University of Colorado, Boulder          | СО    | USA     |
| ICR      | William    | Fitt           | University of Georgia                    | GA    | USA     |
| ICR      | Daniela    | Fraga Alvarez  | Worcester Polytechnic Institute          | MA    | USA     |
| ICR      | Danielle   | Freeman        | Woods Hole Oceanographic<br>Institution  | MA    | USA     |
| ICR      | Joseph     | Frye           | NHMFL                                    | FL    | USA     |
| ICR      | Claudia    | Galvan         | New Mexico State University              | NM    | USA     |
| ICR      | Valier     | Galy           | Woods Hole Oceanographic<br>Institution  | MA    | USA     |
| ICR      | Valerie    | Garcia-Negron  | University of Tennessee, Knoxville       | TN    | USA     |
| ICR      | Rana       | Ghannam        | University of New Orleans                | LA    | USA     |
| ICR      | Taylor     | Glattke        | Florida State University                 | FL    | USA     |
| ICR      | Sophia     | Gomez          | Florida State University                 | FL    | USA     |
| ICR      | Sergio     | Granados-Focil | Clark University                         | MA    | USA     |
| ICR      | David      | Griffith       | Willamette University                    | OR    | USA     |
| ICR      | Sara       | Gushgari-Doyle | Lawrence Berkeley National<br>Laboratory | СА    | USA     |
| ICR      | Andrea     | Hanson         | Colorado State University                | СО    | USA     |
| ICR      | David      | Harper         | University of Tennessee, Knoxville       | TN    | USA     |
| ICR      | Maxwell    | Harsha         | University of New Orleans                | LA    | USA     |
| ICR      | Jon        | Hawkings       | Florida State University                 | FL    | USA     |
| ICR      | Lidong     | Не             | NHMFL                                    | FL    | USA     |
| ICR      | Deja       | Hebert         | University of New Orleans                | LA    | USA     |
| ICR      | Chris      | Hendrickson    | NHMFL                                    | FL    | USA     |

| Facility | First Name | Last Name  | Organization                                   | State | Country |
|----------|------------|------------|------------------------------------------------|-------|---------|
| ICR      | David      | Herold     | University of California, San Diego            | СА    | USA     |
| ICR      | Leslie     | Hicks      | University of North Carolina at<br>Chapel Hill | NC    | USA     |
| ICR      | Daisuke    | Higo       | Thermo Fisher Scientific                       | VA    | USA     |
| ICR      | William    | Hockaday   | Baylor University                              | TX    | USA     |
| ICR      | F. Omar    | Holguin    | New Mexico State University                    | NM    | USA     |
| ICR      | Amy        | Holt       | Florida State University                       | FL    | USA     |
| ICR      | Eran       | Hood       | University of Alaska Southeast                 | AK    | USA     |
| ICR      | Brian      | Hopkinson  | University of Georgia                          | GA    | USA     |
| ICR      | Aixin      | Нои        | Louisiana State University                     | LA    | USA     |
| ICR      | Zhen       | Hu         | University of Wyoming                          | WY    | USA     |
| ICR      | Katherine  | Humpal     | University of New Orleans                      | LA    | USA     |
| ICR      | Donald     | Hunt       | University of Virginia                         | VA    | USA     |
| ICR      | Carolyn    | Hutchinson | Iowa State University                          | IA    | USA     |
| ICR      | Kristiina  | lisa       | National Renewable Energy<br>Laboratory        | СО    | USA     |
| ICR      | Jackie     | Jarvis     | New Mexico State University                    | NM    | USA     |
| ICR      | Wenbin     | Jiang      | New Mexico State University                    | NM    | USA     |
| ICR      | Alexander  | Johs       | Oak Ridge National Laboratory                  | TN    | USA     |
| ICR      | Samantha   | Joye       | University of Georgia                          | GA    | USA     |
| ICR      | David      | Keffer     | University of Tennessee, Knoxville             | TN    | USA     |
| ICR      | Neil       | Kelleher   | Northwestern University                        | IL    | USA     |
| ICR      | Anne       | Kellerman  | Florida State University                       | FL    | USA     |
| ICR      | Eugene     | Kelly      | Colorado State University                      | СО    | USA     |
| ICR      | Naima      | Khan       | New Mexico State University                    | NM    | USA     |
| ICR      | Dana       | Kolpin     | U.S. Geological Survey                         | IA    | USA     |
| ICR      | John       | Kominoski  | Florida International University               | FL    | USA     |
| ICR      | Logan      | Krajewski  | NHMFL                                          | FL    | USA     |
| ICR      | Elizabeth  | Kujawinski | Woods Hole Oceanographic<br>Institution        | MA    | USA     |
| ICR      | Martin     | Kurek      | Florida State University                       | FL    | USA     |

| Facility | First Name | Last Name     | Organization                                      | State | Country |
|----------|------------|---------------|---------------------------------------------------|-------|---------|
| ICR      | lurii      | Kurerov       | University of New Orleans                         | LA    | USA     |
| ICR      | Boris      | Lau           | University of Massachusetts                       | MA    | USA     |
| ICR      | Maria      | Letourneau    | University of Georgia                             | GA    | USA     |
| ICR      | Liang      | Li            | Florida Department of<br>Environmental Protection | FL    | USA     |
| ICR      | Wenbo      | Li            | Florida State University                          | FL    | USA     |
| ICR      | Runwei     | Li            | FSU-FAMU College of Engineering                   | FL    | USA     |
| ICR      | Yuan       | Lin           | Florida State University                          | FL    | USA     |
| ICR      | Qianxin    | Lin           | Louisiana State University                        | LA    | USA     |
| ICR      | Peilu      | Liu           | Florida State University                          | FL    | USA     |
| ICR      | Omics      | LLC           | Omics, LLC                                        | FL    | USA     |
| ICR      | Merritt    | Logan         | Colorado State University                         | СО    | USA     |
| ICR      | Jonathan   | Long          | Advanced Magnet Lab, Inc.                         | LA    | USA     |
| ICR      | Joseph     | Loo           | University of California, Los Angeles             | СА    | USA     |
| ICR      | Christian  | Lopes         | Florida International University                  | FL    | USA     |
| ICR      | Francisco  | Lopez Linares | Chevron, Richmond                                 | СА    | USA     |
| ICR      | Lu         | Lu            | University of Colorado, Boulder                   | СО    | USA     |
| ICR      | Thomas     | Manning       | Valdosta State University                         | GA    | USA     |
| ICR      | Hairuo     | Мао           | University of Wyoming                             | WY    | USA     |
| ICR      | Zachary    | Marinelli     | University of Georgia                             | GA    | USA     |
| ICR      | Alan       | Marshall      | NHMFL                                             | FL    | USA     |
| ICR      | Rachel     | Martineac     | University of Georgia                             | GA    | USA     |
| ICR      | Jason      | Masoner       | U.S. Geological Survey                            | OK    | USA     |
| ICR      | Amy        | McKenna       | NHMFL                                             | FL    | USA     |
| ICR      | Colleen    | McMahan       | U.S. Department of Agriculture                    | СА    | USA     |
| ICR      | Patricia   | Medeiros      | University of Georgia                             | GA    | USA     |
| ICR      | Rafael     | Melani        | Northwestern university                           | IL    | USA     |
| ICR      | Amin       | Mirkouei      | University of Idaho                               | ID    | USA     |
| ICR      | John       | Moses         | CF Technologies, Inc.                             | MA    | USA     |
| ICR      | Remi       | Moulian       | NHMFL                                             | FL    | USA     |

| Facility | First Name  | Last Name     | Organization                            | State | Country |
|----------|-------------|---------------|-----------------------------------------|-------|---------|
| ICR      | Calvin      | Mukarakate    | National Renewable Energy<br>Laboratory | со    | USA     |
| ICR      | Robert      | Nelson        | Woods Hole Oceanographic<br>Institution | МА    | USA     |
| ICR      | Taylor F    | Nelson        | Woods Hole Oceanographic<br>Institution | MA    | USA     |
| ICR      | Christopher | Nevitt        | University of Louisville                | KY    | USA     |
| ICR      | Sydney      | Niles         | NHMFL                                   | FL    | USA     |
| ICR      | Mark        | Nimlos        | National Renewable Energy<br>Laboratory | со    | USA     |
| ICR      | Rachel      | Ogorzalek Loo | University of California, Los Angeles   | СА    | USA     |
| ICR      | Chris       | Osburn        | North Carolina State University         | NC    | USA     |
| ICR      | Cesar       | Ovalles       | Chevron Energy Tech. Comp.              | СА    | USA     |
| ICR      | Alex        | Paulsen       | Mainstream Engineering Corp             | FL    | USA     |
| ICR      | Jesse       | Peach         | Montana State University                | MT    | USA     |
| ICR      | Nasim       | Pica          | Colorado State University               | СО    | USA     |
| ICR      | Dante       | Placido       | U.S. Department of Agriculture          | СА    | USA     |
| ICR      | David       | Podgorski     | University of New Orleans               | LA    | USA     |
| ICR      | Zeljka      | Popovic       | Florida State University                | FL    | USA     |
| ICR      | Brett       | Poulin        | U.S. Geological Survey                  | СО    | USA     |
| ICR      | Jonathan    | Putman        | NHMFL                                   | FL    | USA     |
| ICR      | Chris       | Reddy         | Woods Hole Oceanographic<br>Institution | МА    | USA     |
| ICR      | Zachary     | Redman        | University of Alaska, Anchorage         | AK    | USA     |
| ICR      | Zhiyong     | Ren           | University of Colorado, Boulder         | СО    | USA     |
| ICR      | Charles     | Rhoades       | U.S. Department of Agriculture          | СО    | USA     |
| ICR      | Orlando     | Rios          | Oak Ridge National Laboratory           | TN    | USA     |
| ICR      | Alan        | Rockwood      | University of Utah                      | UT    | USA     |
| ICR      | Ryan        | Rodgers       | NHMFL                                   | FL    | USA     |
| ICR      | Estrella    | Rogel         | Chevron ETC                             | СА    | USA     |
| ICR      | Jennifer    | Rogers        | Florida State University                | FL    | USA     |
| ICR      | Carla       | Roma          | Worcester Polytechnic Institute         | MA    | USA     |

| Facility | First Name | Last Name      | Organization                                   | State | Country |
|----------|------------|----------------|------------------------------------------------|-------|---------|
| ICR      | Fernando   | Rosario-Ortiz  | University of Colorado, Boulder                | СО    | USA     |
| ICR      | Holly      | Roth           | Colorado State University                      | СО    | USA     |
| ICR      | Steven     | Rowland        | National Renewable Energy<br>Laboratory        | со    | USA     |
| ICR      | Gayan      | Rubasinghege   | New Mexico Tech                                | NM    | USA     |
| ICR      | Christine  | Schaner Tooley | SUNY Buffalo                                   | NY    | USA     |
| ICR      | Kendhl     | Seabright      | University of Tennessee, Knoxville             | TN    | USA     |
| ICR      | Jeffrey    | Shabanowitz    | University of Virginia                         | VA    | USA     |
| ICR      | Sergei     | Shalygin       | New Mexico State University                    | NM    | USA     |
| ICR      | Hamidreza  | Sharifan       | Colorado State University                      | СО    | USA     |
| ICR      | Kavita     | Sharma         | Idaho State University                         | ID    | USA     |
| ICR      | Ryan       | Sibert         | University of Georgia                          | GA    | USA     |
| ICR      | Donald     | Smith          | NHMFL                                          | FL    | USA     |
| ICR      | Ashley     | Smyth          | University of Florida                          | FL    | USA     |
| ICR      | Amanda     | Smythers       | University of North Carolina at<br>Chapel Hill | NC    | USA     |
| ICR      | Robert     | Spencer        | Florida State University                       | FL    | USA     |
| ICR      | Kristina   | Srzentic       | Northwestern University                        | IL    | USA     |
| ICR      | Ethan      | Struhs         | University of Idaho                            | ID    | USA     |
| ICR      | Aron       | Stubbins       | Northeastern University                        | MA    | USA     |
| ICR      | Jessica    | Sweeney        | CF Technologies, Inc.                          | MA    | USA     |
| ICR      | Youneng    | Tang           | Florida State University                       | FL    | USA     |
| ICR      | Nishanth   | Tharayil       | Clemson University                             | SC    | USA     |
| ICR      | Paul       | Thomas         | Northwestern University                        | IL    | USA     |
| ICR      | Michael    | Timko          | Worcester Polytechnic Institute                | MA    | USA     |
| ICR      | Patrick    | Tomco          | University of Alaska Anchorage                 | AK    | USA     |
| ICR      | Geoffrey   | Tompsett       | Worcester Polytechnic Institute                | MA    | USA     |
| ICR      | Richard    | Vachet         | University of Massachusetts<br>Amherst         | MA    | USA     |
| ICR      | Dave       | Valentine      | University of California, Santa<br>Barbara     | СА    | USA     |
| ICR      | Carmen     | Velasco        | University of New Mexico                       | NM    | USA     |

| Facility | First Name | Last Name | Organization                             | State | Country |
|----------|------------|-----------|------------------------------------------|-------|---------|
| ICR      | Radisav    | Vidic     | University of Pittsburgh                 | PA    | USA     |
| ICR      | Jana       | Voriskova | Lawrence Berkeley National<br>Laboratory | СА    | USA     |
| ICR      | Sasha      | Wagner    | University of Georgia                    | GA    | USA     |
| ICR      | Anna       | Walsh     | Woods Hole Oceanographic<br>Institution  | MA    | USA     |
| ICR      | Huan       | Wang      | University of Colorado, Boulder          | СО    | USA     |
| ICR      | Collin     | Ward      | Woods Hole Oceanographic<br>Institution  | MA    | USA     |
| ICR      | Chad       | Weisbrod  | NHMFL                                    | FL    | USA     |
| ICR      | Helen      | White     | Haverford College                        | PA    | USA     |
| ICR      | Kimberly   | Wickland  | U.S. Geological Survey                   | СО    | USA     |
| ICR      | Mike       | Wilkins   | Colorado State University                | СО    | USA     |
| ICR      | Nolan      | Wilson    | National Renewable Energy<br>Laboratory  | со    | USA     |
| ICR      | Andrew     | Wozniak   | University of Delaware                   | DE    | USA     |
| ICR      | Xiaoqin    | Wu        | Lawrence Berkeley National<br>Laboratory | СА    | USA     |
| ICR      | Mengxue    | Xia       | Clemson University                       | SC    | USA     |
| ICR      | Pei        | Xu        | New Mexico State University              | NM    | USA     |
| ICR      | Robert     | Young     | Colorado State University                | СО    | USA     |
| ICR      | Lu         | Yu        | University of Tennessee, Knoxville       | TN    | USA     |
| ICR      | Zhiming    | Zhang     | NHMFL                                    | FL    | USA     |
| ICR      | Jianchao   | Zhang     | University of Wyoming                    | WY    | USA     |
| ICR      | Ruihan     | Zhang     | Worcester Polytechnic Institute          | MA    | USA     |
| ICR      | Mengqiang  | Zhu       | University of Wyoming                    | WY    | USA     |
| ICR      | Phoebe     | Zito      | University of New Orleans                | LA    | USA     |
| ICR      | Yi         | Ζυο       | Chevron, San Ramon                       | СА    | USA     |

NMR - National Users

| Facility | First Name  | Last Name    | Organization                                      | State | Country |
|----------|-------------|--------------|---------------------------------------------------|-------|---------|
| NMR      | Christer    | Aakeroy      | Kansas State University                           | KS    | USA     |
| NMR      | Nastaren    | Abad         | Florida State University                          | FL    | USA     |
| NMR      | Maryam      | Abdolrahmani | Oklahoma State University                         | OK    | USA     |
| NMR      | Waseem      | Afzaal       | Florida State University                          | FL    | USA     |
| NMR      | Adewale     | Akinfaderin  | Florida State University                          | FL    | USA     |
| NMR      | Omar        | Al-Danoon    | Oklahoma State University                         | OK    | USA     |
| NMR      | Hannah      | Alderson     | Florida State University                          | FL    | USA     |
| NMR      | Adam        | Altenhof     | Florida State University                          | FL    | USA     |
| NMR      | Dan         | Au           | University of Colorado, Denver                    | СО    | USA     |
| NMR      | Frederick   | Bagdasarian  | Florida State University                          | FL    | USA     |
| NMR      | Jasleen     | Bindra       | National Institute of Standards and<br>Technology | MD    | USA     |
| NMR      | Ashley      | Blue         | NHMFL                                             | FL    | USA     |
| NMR      | Cesario     | Borlongan    | University of South Florida                       | FL    | USA     |
| NMR      | Clifford    | Bowers       | University of Florida                             | FL    | USA     |
| NMR      | William     | Brey         | NHMFL                                             | FL    | USA     |
| NMR      | Nhat Nguyen | Bui          | NHMFL                                             | FL    | USA     |
| NMR      | Bruce       | Bunnell      | Tulane University                                 | LA    | USA     |
| NMR      | Thach       | Can          | Salk Institute for Biological Studies             | СА    | USA     |
| NMR      | Silvia      | Centeno      | The Metropolitan Museum of Art                    | NY    | USA     |
| NMR      | Arnab       | Chakraborty  | Louisiana State University                        | LA    | USA     |
| NMR      | Kevin       | Chalek       | University of California, Riverside               | СА    | USA     |
| NMR      | Bharat      | Chaudhary    | Oklahoma State University                         | ОК    | USA     |
| NMR      | Banghao     | CHen         | Florida State University                          | FL    | USA     |
| NMR      | Kuizhi      | Chen         | NHMFL                                             | FL    | USA     |
| NMR      | Во          | Chen         | University of Central Florida                     | FL    | USA     |
| NMR      | Po-Hsiu     | Chien        | Florida State University                          | FL    | USA     |
| NMR      | Carl        | Conti        | Florida State University                          | FL    | USA     |
| NMR      | Whitney     | Costello     | University of Texas, Southwestern                 | TX    | USA     |
| NMR      | Myriam      | Cotten       | College of William and Mary                       | VA    | USA     |

| Facility | First Name            | Last Name          | Organization                               | State | Country |
|----------|-----------------------|--------------------|--------------------------------------------|-------|---------|
| NMR      | Tim                   | Cross              | NHMFL                                      | FL    | USA     |
| NMR      | Salik                 | Dahal              | Oklahoma State University                  | OK    | USA     |
| NMR      | Naresh                | Dalal              | NHMFL                                      | FL    | USA     |
| NMR      | Anvesh Kumar<br>Reddy | Dasari             | East Carolina University                   | NC    | USA     |
| NMR      | Mark                  | Davis              | California Institute of Technology         | CA    | USA     |
| NMR      | Valeria               | Di Tullio          | The Metropolitan Museum of Art             | NY    | USA     |
| NMR      | Malitha               | Dickwella Widanage | Louisiana State University                 | LA    | USA     |
| NMR      | Rick                  | Dorn               | Iowa State University                      | IA    | USA     |
| NMR      | Justin                | Douglas            | University of Kansas                       | KS    | USA     |
| NMR      | Zach                  | Dowdell            | Florida State University                   | FL    | USA     |
| NMR      | Zachary               | Dowdell            | Florida State University                   | FL    | USA     |
| NMR      | Thierry               | Dubroca            | NHMFL                                      | FL    | USA     |
| NMR      | Cecil                 | Dybowski           | University of Delaware                     | DE    | USA     |
| NMR      | Elan                  | Eisenmesser        | University of Colorado, Denver             | СО    | USA     |
| NMR      | Cristian              | Escobar            | NHMFL                                      | FL    | USA     |
| NMR      | Alec                  | Esper              | University of Florida                      | FL    | USA     |
| NMR      | Xuyong                | Feng               | Florida State University                   | FL    | USA     |
| NMR      | David                 | Fenning            | University of California, San Diego        | CA    | USA     |
| NMR      | Emily                 | Foley              | University of California, Santa<br>Barbara | СА    | USA     |
| NMR      | Kendra                | Frederick          | University of Texas, Southwestern          | TX    | USA     |
| NMR      | Lucio                 | Frydman            | NHMFL                                      | FL    | USA     |
| NMR      | Riqiang               | Fu                 | NHMFL                                      | FL    | USA     |
| NMR      | Zhehong               | Gan                | NHMFL                                      | FL    | USA     |
| NMR      | Lina                  | Gao                | Florida State University                   | FL    | USA     |
| NMR      | Yuan                  | Gao                | Georgia Institute of Technology            | GA    | USA     |
| NMR      | Carlos                | Garcia             | Clemson University                         | SC    | USA     |
| NMR      | Tata                  | Gopinath           | University of Minnesota, Twin Cities       | MN    | USA     |
| NMR      | Petr                  | Gor'kov            | NHMFL                                      | FL    | USA     |
| NMR      | Samuel                | Grant              | NHMFL                                      | FL    | USA     |

| Facility | First Name | Last Name  | Organization                              | State | Country |
|----------|------------|------------|-------------------------------------------|-------|---------|
| NMR      | Robert     | Griffin    | Massachusetts Institute of<br>Technology  | ма    | USA     |
| NMR      | Cong       | Guo        | NHMFL                                     | FL    | USA     |
| NMR      | Sossina    | Haile      | Northwestern University                   | IL    | USA     |
| NMR      | James      | Harper     | Brigham Young University                  | UT    | USA     |
| NMR      | Michael    | Harrington | Huntington Medical Research<br>Institutes | СА    | USA     |
| NMR      | Shannon    | Helsper    | NHMFL                                     | FL    | USA     |
| NMR      | Stephen    | Hill       | NHMFL                                     | FL    | USA     |
| NMR      | Samuel     | Holder     | Florida State University                  | FL    | USA     |
| NMR      | Sean       | Holmes     | Florida State University                  | FL    | USA     |
| NMR      | Sarah      | Horstmeier | Oklahoma State University                 | ОК    | USA     |
| NMR      | Yan-Yan    | Hu         | Florida State University                  | FL    | USA     |
| NMR      | Danting    | Huang      | Florida State University                  | FL    | USA     |
| NMR      | Ivan       | Hung       | NHMFL                                     | FL    | USA     |
| NMR      | Sonjong    | Hwang      | California Institute of Technology        | СА    | USA     |
| NMR      | Robbie     | Iuliucci   | Washington and Jefferson College          | PA    | USA     |
| NMR      | Taylor     | Johnston   | Florida State University                  | FL    | USA     |
| NMR      | Mercouri   | Kanatzidis | Northwestern University                   | IL    | USA     |
| NMR      | Jessica    | Kelz       | University of California, Irvine          | СА    | USA     |
| NMR      | Alex       | Kirui      | Louisiana State University                | LA    | USA     |
| NMR      | Jason      | Kitchen    | NHMFL                                     | FL    | USA     |
| NMR      | Jaka       | Kragelj    | University of Texas, Southwestern         | ТХ    | USA     |
| NMR      | Krishnendu | Kundu      | NHMFL                                     | FL    | USA     |
| NMR      | Jason      | Kuszynski  | Florida State University                  | FL    | USA     |
| NMR      | Erik       | Larsen     | University of Minnesota, Twin Cities      | MN    | USA     |
| NMR      | Kwang Hun  | Lim        | East Carolina University                  | NC    | USA     |
| NMR      | Jin        | Liming     | Florida State University                  | FL    | USA     |
| NMR      | llya       | Litvak     | NHMFL                                     | FL    | USA     |
| NMR      | Наоуи      | Liu        | Florida State University                  | FL    | USA     |
| NMR      | Joanna     | Long       | University of Florida                     | FL    | USA     |

| Facility | First Name   | Last Name         | Organization                                   | State | Country |
|----------|--------------|-------------------|------------------------------------------------|-------|---------|
| NMR      | Teng         | Ма                | Florida State University                       | FL    | USA     |
| NMR      | Benito       | Marinas           | University of Illinois at Urbana-<br>Champaign | IL    | USA     |
| NMR      | Tobin        | Marks             | Northwestern University                        | IL    | USA     |
| NMR      | Steven       | McKnight          | University of Texas, Southwestern              | TX    | USA     |
| NMR      | Frederic     | Mentink           | NHMFL                                          | FL    | USA     |
| NMR      | Kilsia       | Mercedes          | University of Colorado, Denver                 | СО    | USA     |
| NMR      | Matthew      | Merritt           | University of Florida                          | FL    | USA     |
| NMR      | Yimin        | Miao              | Florida State University                       | FL    | USA     |
| NMR      | Zhihui       | Miao              | University of Florida                          | FL    | USA     |
| NMR      | Hadi         | Mohamma-digoushki | Florida State University                       | FL    | USA     |
| NMR      | Smita        | Mohanty           | Oklahoma State University                      | OK    | USA     |
| NMR      | Daniel       | Mosiman           | University of Illinois at Urbana-<br>Champaign | IL    | USA     |
| NMR      | Leonard      | Mueller           | University of California, Riverside            | CA    | USA     |
| NMR      | Dylan        | Murray            | University of California Davis                 | CA    | USA     |
| NMR      | Lakshmi Bhai | N Vidyadharan     | Ohio State University                          | ОН    | USA     |
| NMR      | Karthik      | Nagapudi          | Genentech Inc.                                 | CA    | USA     |
| NMR      | Sarah        | Nelson            | University of Minnesota, Twin Cities           | MN    | USA     |
| NMR      | Bradley      | Nilsson           | University of Rochester                        | NY    | USA     |
| NMR      | Joseph       | Noel              | Salk Institute for Biological Studies          | CA    | USA     |
| NMR      | Lauren       | O'Donnell         | Hunter College of CUNY                         | NY    | USA     |
| NMR      | Dmitry       | Ostrovsky         | University of Alaska, Anchorage                | AK    | USA     |
| NMR      | Anant        | Paravastu         | Georgia Institute of Technology                | GA    | USA     |
| NMR      | Sawankumar   | Patel             | Florida State University                       | FL    | USA     |
| NMR      | Joana        | Paulino           | NHMFL                                          | FL    | USA     |
| NMR      | Austin       | Peach             | Florida State University                       | FL    | USA     |
| NMR      | Linda        | Petzold           | University of California, Santa<br>Barbara     | СА    | USA     |
| NMR      | Kenneth      | Poeppelmeier      | Northwestern University                        | IL    | USA     |
| NMR      | Huajun       | Qin               | Florida State University                       | FL    | USA     |

| Facility | First Name   | Last Name     | Organization                             | State | Country |
|----------|--------------|---------------|------------------------------------------|-------|---------|
| NMR      | Elena        | Quigley       | University of Rochester                  | NY    | USA     |
| NMR      | Sanath Kumar | Rama Krishna  | Florida State University                 | FL    | USA     |
| NMR      | Ayyalusamy   | Ramamoorthy   | University of Michigan                   | MI    | USA     |
| NMR      | Thirupathi   | Ravula        | University of Michigan                   | MI    | USA     |
| NMR      | Jens         | Rosenberg     | NHMFL                                    | FL    | USA     |
| NMR      | Terrone      | Rosenberry    | Mayo Clinic, Jacksonville                | FL    | USA     |
| NMR      | Aaron        | Rossini       | Iowa State University                    | IA    | USA     |
| NMR      | Varun        | Sakhrani      | University of California, Riverside      | CA    | USA     |
| NMR      | Edward       | Saliba        | Massachusetts Institute of<br>Technology | MA    | USA     |
| NMR      | Victor       | Schepkin      | NHMFL                                    | FL    | USA     |
| NMR      | Jeffrey      | Schiano       | Pennsylvania State University            | PA    | USA     |
| NMR      | Joseph       | Schlenoff     | Florida State University                 | FL    | USA     |
| NMR      | Robert       | Schurko       | Florida State University                 | FL    | USA     |
| NMR      | Sabyasachi   | Sen           | University of California, Davis          | CA    | USA     |
| NMR      | Yiseul       | Shin          | Florida State University                 | FL    | USA     |
| NMR      | Ansgar       | Siemer        | University of Southern California        | CA    | USA     |
| NMR      | Robert       | Silvers       | Florida State University                 | FL    | USA     |
| NMR      | Likai        | Song          | NHMFL                                    | FL    | USA     |
| NMR      | Murari       | Soundararajan | NHMFL                                    | FL    | USA     |
| NMR      | Geoffrey     | Strouse       | NHMFL                                    | FL    | USA     |
| NMR      | Brent        | Sumerlin      | University of Florida                    | FL    | USA     |
| NMR      | Hillary      | Sutton        | University of California, Davis          | CA    | USA     |
| NMR      | Jennifer     | Swift         | Georgetown University                    | DC    | USA     |
| NMR      | Vasily       | Sysoev        | University of Texas, Southwestern        | TX    | USA     |
| NMR      | Kan          | Tagami        | University of California, San Diego      | CA    | USA     |
| NMR      | Joshua       | Taylor        | Florida State University                 | FL    | USA     |
| NMR      | Suzanne      | Thomas        | Salk Institute for Biological Studies    | СА    | USA     |
| NMR      | Fang         | Tian          | Pennsylvania State University            | PA    | USA     |
| NMR      | Johan        | van Tol       | NHMFL                                    | FL    | USA     |
| NMR      | Gianluigi    | Veglia        | University of Minnesota, Twin Cities     | MN    | USA     |

| Facility | First Name | Last Name   | Organization                                      | State | Country |
|----------|------------|-------------|---------------------------------------------------|-------|---------|
| NMR      | Adam       | Veige       | University of Florida                             | FL    | USA     |
| NMR      | Amrit      | Venkatesh   | Iowa State University                             | IA    | USA     |
| NMR      | Cameron    | Vojvodin    | Florida State University                          | FL    | USA     |
| NMR      | Liliya     | Vugmeyster  | University of Colorado, Denver                    | СО    | USA     |
| NMR      | Pengbo     | Wang        | Florida State University                          | FL    | USA     |
| NMR      | Тио        | Wang        | Louisiana State University                        | LA    | USA     |
| NMR      | Xiaoling   | Wang        | University of California, Santa<br>Barbara        | СА    | USA     |
| NMR      | Songlin    | Wang        | University of Minnesota, Twin Cities              | MN    | USA     |
| NMR      | Taylor     | Watts       | Georgetown University                             | WA    | USA     |
| NMR      | Jens       | Watzlawik   | Mayo Clinic, Jacksonville                         | FL    | USA     |
| NMR      | Jeffery    | White       | Oklahoma State University                         | ОК    | USA     |
| NMR      | Tanya      | Whitmer     | Ohio State University                             | ОН    | USA     |
| NMR      | Sungsool   | Wi          | NHMFL                                             | FL    | USA     |
| NMR      | Yuuki      | Wittmer     | University of California, Davis                   | CA    | USA     |
| NMR      | Qiong      | Wu          | University of Texas, Southwestern                 | TX    | USA     |
| NMR      | Yiqing     | Xia         | University of California, Davis                   | CA    | USA     |
| NMR      | Yiling     | Xiao        | University of Texas, Southwestern                 | TX    | USA     |
| NMR      | Xuegang    | Yuan        | Florida State University                          | FL    | USA     |
| NMR      | Bing       | Yuan        | University of California, Davis                   | CA    | USA     |
| NMR      | Rongfu     | Zhang       | NHMFL                                             | FL    | USA     |
| NMR      | Xiangwu    | Zhang       | North Carolina State University                   | NC    | USA     |
| NMR      | Jim        | Zheng       | Florida Agricultural and<br>Mechanical University | FL    | USA     |
| NMR      | Jin        | Zheng       | Florida State University                          | FL    | USA     |
| NMR      | Huan-Xiang | Zhou        | University of Illinois at Chicago                 | IL    | USA     |
| NMR      | Weidi      | Zhu         | University of California, Davis                   | CA    | USA     |
| NMR      | Nicholas   | Zumbulyadis | Independent Scholar and<br>Consultant             | NY    | USA     |

PFF - National Users

| Facility | First Name | Last Name             | Organization                               | State | Country |
|----------|------------|-----------------------|--------------------------------------------|-------|---------|
| PFF      | James      | Analytis              | University of California, Berkeley         | СА    | USA     |
| PFF      | Fedor      | Balakirev             | NHMFL                                      | NM    | USA     |
| PFF      | Luis       | Balicas               | NHMFL                                      | FL    | USA     |
| PFF      | Alimamy    | Bangura               | NHMFL                                      | FL    | USA     |
| PFF      | Eric       | Bauer                 | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Ryan       | Baumbach              | NHMFL                                      | FL    | USA     |
| PFF      | Jonathan   | Betts                 | NHMFL                                      | NM    | USA     |
| PFF      | Avery      | Blockmon              | University of Tennessee, Knoxville         | TN    | USA     |
| PFF      | Greg       | Boebinger             | NHMFL                                      | FL    | USA     |
| PFF      | Paul       | Canfield              | Ames Laboratory                            | IA    | USA     |
| PFF      | Gang       | Сао                   | University of Colorado, Boulder            | СО    | USA     |
| PFF      | Mun        | Chan                  | NHMFL                                      | NM    | USA     |
| PFF      | Joseph     | Checkelsky            | Massachusetts Institute of<br>Technology   | MA    | USA     |
| PFF      | Kuan-Wen   | Chen                  | University of Michigan                     | MI    | USA     |
| PFF      | Lu         | Chen                  | University of Michigan                     | MI    | USA     |
| PFF      | Sang Wook  | Cheong                | Rutgers University, New Brunswick          | NJ    | USA     |
| PFF      | Amanda     | Clune                 | University of Tennessee, Knoxville         | TN    | USA     |
| PFF      | Carolina   | Corvalan Moya         | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Scott      | Crooker               | NHMFL                                      | NM    | USA     |
| PFF      | Aravind    | Devarakonda           | Massachusetts Institute of<br>Technology   | МА    | USA     |
| PFF      | Xiaxin     | Ding                  | Idaho National Laboratory                  | ID    | USA     |
| PFF      | Priscila   | Ferrari Silveira Rosa | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Zachary    | Fisk                  | University of California, Irvine           | СА    | USA     |
| PFF      | Krzysztof  | Gofryk                | Idaho National Laboratory                  | ID    | USA     |
| PFF      | Laura      | Greene                | NHMFL                                      | FL    | USA     |
| PFF      | Binghao    | Guo                   | University of California, Santa<br>Barbara | СА    | USA     |
| PFF      | Minyong    | Han                   | Massachusetts Institute of<br>Technology   | MA    | USA     |

| Facility | First Name | Last Name  | Organization                               | State | Country |
|----------|------------|------------|--------------------------------------------|-------|---------|
| PFF      | Neil       | Harrison   | NHMFL                                      | NM    | USA     |
| PFF      | Pei-Chun   | Но         | California State University, Fresno        | CA    | USA     |
| PFF      | Kendall    | Hughey     | University of Tennessee, Knoxville         | TN    | USA     |
| PFF      | Daniel     | Jackson    | NHMFL                                      | NM    | USA     |
| PFF      | Marcelo    | Jaime      | NHMFL                                      | NM    | USA     |
| PFF      | Na Hyun    | ol         | Ames Laboratory                            | IA    | USA     |
| PFF      | David      | Kealhofer  | University of California, Santa<br>Barbara | СА    | USA     |
| PFF      | Takashi    | Kurumaji   | Massachusetts Institute of<br>Technology   | MA    | USA     |
| PFF      | Satya      | Kushwaha   | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Brinda     | Kuthanazhi | Ames Laboratory                            | IA    | USA     |
| PFF      | Υου        | Lai        | NHMFL                                      | NM    | USA     |
| PFF      | lan        | Leahy      | University of Colorado, Boulder            | СО    | USA     |
| PFF      | Minseong   | Lee        | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Minhyea    | Lee        | University of Colorado, Boulder            | СО    | USA     |
| PFF      | Jing       | Li         | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Lu         | Li         | University of Michigan                     | MA    | USA     |
| PFF      | Nikola     | Maksimovic | University of California, Berkeley         | СА    | USA     |
| PFF      | David      | Mandrus    | University of Tennessee, Knoxville         | TN    | USA     |
| PFF      | Jamie      | Manson     | Eastern Washington University              | WA    | USA     |
| PFF      | Zhiqiang   | Мао        | Pennsylvania State University              | PA    | USA     |
| PFF      | Brian      | Maple      | University of California, San Diego        | CA    | USA     |
| PFF      | Ross       | McDonald   | NHMFL                                      | NM    | USA     |
| PFF      | Robert     | McQueeney  | Ames Laboratory                            | IA    | USA     |
| PFF      | Lujin      | Min        | Pennsylvania State University              | PA    | USA     |
| PFF      | Kimberly   | Modic      | NHMFL                                      | NM    | USA     |
| PFF      | Shirin     | Mozaffari  | NHMFL                                      | FL    | USA     |
| PFF      | Janice     | Musfeldt   | University of Tennessee, Knoxville         | TN    | USA     |
| PFF      | Stephen    | Nagler     | Oak Ridge National Laboratory              | TN    | USA     |
| PFF      | Wanyi      | Nie        | Los Alamos National Laboratory             | NM    | USA     |

| Facility | First Name  | Last Name   | Organization                               | State | Country |
|----------|-------------|-------------|--------------------------------------------|-------|---------|
| PFF      | Wei         | Ning        | Pennsylvania State University              | PA    | USA     |
| PFF      | Magdalena   | Owczarek    | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Johanna     | Palmstrom   | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Christopher | Pocs        | University of Colorado, Boulder            | СО    | USA     |
| PFF      | Narayan     | Poudel      | Idaho National Laboratory                  | ID    | USA     |
| PFF      | Brad        | Ramshaw     | Cornell University                         | NY    | USA     |
| PFF      | Myron       | Salamon     | University of Texas, Dallas                | IL    | USA     |
| PFF      | Rico        | Schoenemann | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Katherine   | Schreiber   | NHMFL                                      | NM    | USA     |
| PFF      | Timo        | Schumann    | University of California, Santa<br>Barbara | СА    | USA     |
| PFF      | Arkady      | Shehter     | NHMFL                                      | FL    | USA     |
| PFF      | Peter       | Siegfried   | University of Colorado, Boulder            | СО    | USA     |
| PFF      | John        | Singleton   | NHMFL                                      | NM    | USA     |
| PFF      | Susanne     | Stemmer     | University of California, Santa<br>Barbara | СА    | USA     |
| PFF      | Andreas     | Stier       | NHMFL                                      | NM    | USA     |
| PFF      | Dan         | Sun         | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Takehito    | Suzuki      | Massachusetts Institute of<br>Technology   | MA    | USA     |
| PFF      | Yasu        | Takano      | University of Florida                      | FL    | USA     |
| PFF      | Colin       | Tinsman     | University of Michigan                     | MI    | USA     |
| PFF      | Paul        | Tobash      | NHMFL                                      | NM    | USA     |
| PFF      | Hsinhan     | Tsai        | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Joshua      | Wakefield   | Massachusetts Institute of<br>Technology   | MA    | USA     |
| PFF      | Mark        | Wartenbe    | Los Alamos National Laboratory             | NM    | USA     |
| PFF      | Dagmar      | Weickert    | NHMFL                                      | NM    | USA     |
| PFF      | Nathan      | Wilson      | University of Washington                   | WA    | USA     |
| PFF      | Laurel      | Winter      | NHMFL                                      | NM    | USA     |
| PFF      | Ziji        | Xiang       | University of Michigan                     | MI    | USA     |
| PFF      | Xiaodong    | Xu          | University of Washington                   | WA    | USA     |

| Facility | First Name | Last Name | Organization                             | State | Country |
|----------|------------|-----------|------------------------------------------|-------|---------|
| PFF      | Dmitry     | Yarotski  | Los Alamos National Laboratory           | NM    | USA     |
| PFF      | Linda      | Ye        | Massachusetts Institute of<br>Technology | MA    | USA     |
| PFF      | Vivien     | Zapf      | NHMFL                                    | NM    | USA     |
| PFF      | Dechen     | Zhang     | University of Michigan                   | MI    | USA     |
| PFF      | Guoxin     | Zheng     | University of Michigan                   | MI    | USA     |
| PFF      | Haidong    | Zhou      | University of Tennessee, Knoxville       | TN    | USA     |
| PFF      | Junbo      | Zhu       | Massachusetts Institute of<br>Technology | MA    | USA     |
| PFF      | Yanglin    | Zhu       | Tulane University                        | LA    | USA     |

AMRIS - International Users

| Facility | First Name | Last Name  | Organization Name                            | Country    |
|----------|------------|------------|----------------------------------------------|------------|
| AMRIS    | Celine     | Baligand   | Leiden University Medical Center             | Netherland |
| AMRIS    | Pascal     | Bernatchez | University of British Columbia               | Canada     |
| AMRIS    | Christian  | Chmelik    | Leipzig University                           | Germany    |
| AMRIS    | John       | Jones      | Center for Neurosciences and Cell<br>Biology | Portugal   |
| AMRIS    | Ahmad      | Mostafa    | Al-Azhar University                          | Egypt      |

DC Field - International Users

| Facility | First Name | Last Name      | Organization Name                                                        | Country     |  |
|----------|------------|----------------|--------------------------------------------------------------------------|-------------|--|
| DC Field | Jordan     | Baglo          | University of Sherbrooke                                                 | Canada      |  |
| DC Field | Somak      | Basistha       | Tata Institute of Fundamental<br>Research                                | India       |  |
| DC Field | Alina      | Bienko         | University of Wroclaw                                                    | Poland      |  |
| DC Field | Joan       | Cano           | University of Valencia                                                   | Spain       |  |
| DC Field | David      | Cardwell       | University of Cambridge                                                  | UK          |  |
| DC Field | Kwang Yong | Choi           | Chung Ang University                                                     | South Korea |  |
| DC Field | Joonyoung  | Choi           | Kyungpook National University                                            | South Korea |  |
| DC Field | Min Hyuk   | Choi           | Pohang University of Science and<br>Technology                           | South Korea |  |
| DC Field | Matthew    | Coak           | University of Warwick                                                    | UK          |  |
| DC Field | Enrique    | Colacio        | University of Granada                                                    | Spain       |  |
| DC Field | Amalia     | Coldea         | University of Oxford                                                     | UK          |  |
| DC Field | Sam        | Curley         | University of Warwick                                                    | UK          |  |
| DC Field | Yoram      | Dagan          | Tel-Aviv University                                                      | Israel      |  |
| DC Field | Tony       | Dennis         | University of Cambridge                                                  | UK          |  |
| DC Field | Nicolas    | Doiron-Leyraud | University of Sherbrooke                                                 | Canada      |  |
| DC Field | Irina      | Drichko        | loffe Physical-Technical Institute of<br>the Russian Academy of Sciences | Russia      |  |
| DC Field | Feng       | Du             | Zhejiang University                                                      | China       |  |
| DC Field | John       | Durrell        | University of Cambridge                                                  | UK          |  |
| DC Field | Surajit    | Dutta          | Tata Institute of Fund. Research                                         | India       |  |
| DC Field | Paul       | Goddard        | University of Warwick                                                    | UK          |  |
| DC Field | Kathrin    | Gotze          | University of Warwick                                                    | UK          |  |
| DC Field | Adrien     | Gourgout       | University of Sherbrooke                                                 | Canada      |  |
| DC Field | Gaël       | Grissonnanche  | University of Sherbrooke                                                 | Canada      |  |
| DC Field | Hanxi      | Guan           | Zhejiang University                                                      | China       |  |
| DC Field | Toni       | Helm           | Max Planck Institute for Chemical<br>Physics of Solids, Dresden          | Germany     |  |
| DC Field | Hishiro    | Hirose         | National Institute for Materials<br>Science                              | Japan       |  |

| Facility | First Name | Last Name  | Organization Name                                           | Country     |  |
|----------|------------|------------|-------------------------------------------------------------|-------------|--|
| DC Field | Hua-Fen    | Hsu        | National Cheng Kung University                              | Taiwan      |  |
| DC Field | Yining     | Huang      | University of Western Ontario                               | Canada      |  |
| DC Field | Dmytry     | Inosov     | Technische Universität Dresden                              | Germany     |  |
| DC Field | Ho Seong   | Jeon       | Pohang University of Science and<br>Technology              | South Korea |  |
| DC Field | John       | Jesudasan  | Tata Institute of Fundamental<br>Research                   | India       |  |
| DC Field | YounJung   | ol         | Kyungpook National University                               | South Korea |  |
| DC Field | Miguel     | Julve      | University of Valencia                                      | Spain       |  |
| DC Field | Woun       | Kang       | Ewha Womans University                                      | South Korea |  |
| DC Field | Bernhard   | Keimer     | Max Planck Institute for Solid State<br>Research, Stuttgart | Germany     |  |
| DC Field | Naoki      | Kikugawa   | National Institute for Materials<br>Science                 | Japan       |  |
| DC Field | Hoil       | Kim        | Pohang University of Science and<br>Technology              | South Korea |  |
| DC Field | Jun Sung   | Kim        | Pohang University of Science and<br>Technology              | South Korea |  |
| DC Field | Xueqian    | Kong       | Zhejiang University                                         | China       |  |
| DC Field | Etienne    | Lefrançois | University of Sherbrooke                                    | Canada      |  |
| DC Field | Jiangxiazi | Lin        | Hong Kong University of Science<br>and Technology           | China       |  |
| DC Field | Joosep     | Link       | National Institute of Chemical<br>Physics and Biophysics    | Estonia     |  |
| DC Field | Francesc   | Lloret     | University of Valencia                                      | Spain       |  |
| DC Field | Fernando   | Machado    | Federal University of Pernambuco                            | Brazil      |  |
| DC Field | Vinicius   | Martins    | University of Western Ontario                               | Canada      |  |
| DC Field | Devendra   | Namburi    | University of Cambridge                                     | UK          |  |
| DC Field | Shimpei    | Ono        | Central Research Institute of<br>Electric Power Industry    | Japan       |  |
| DC Field | Mattia     | Ortino     | Technical University of Wien                                | Austria     |  |
| DC Field | Je-Geun    | Park       | Seoul National University                                   | South Korea |  |
| DC Field | Silke      | Paschen    | Vienna University of Technology                             | Austria     |  |
| DC Field | Matthew    | Pearce     | University of Warwick                                       | UK          |  |

| Facility | First Name | Last Name         | Organization Name                                                        | Country |
|----------|------------|-------------------|--------------------------------------------------------------------------|---------|
| DC Field | Pavlo      | Portnichenko      | Technische Universität Dresden                                           | Germany |
| DC Field | Helene     | Raffy             | University of Paris-Sud                                                  | France  |
| DC Field | Danilo     | Ratkovski         | Federal University of Pernambuco                                         | Brazil  |
| DC Field | Pratap     | Raychaudhuri      | Tata Institute of Fund. Research                                         | India   |
| DC Field | Andreas    | Rydh              | Stockholm University                                                     | Sweden  |
| DC Field | Shay       | Sandik            | Tel-Aviv University                                                      | Israel  |
| DC Field | Takao      | Sasagawa          | Tokyo Institute of Technology                                            | Japan   |
| DC Field | Bin        | Shen              | Zhejiang University                                                      | China   |
| DC Field | Natalya Yu | Shitsevalova      | Institute for Problems of Material<br>Sciences                           | Ukraine |
| DC Field | Itai       | Silber            | Tel-Aviv University                                                      | Israel  |
| DC Field | Michael    | Smidman           | Zhejiang University                                                      | China   |
| DC Field | Ivan       | Smirnov           | loffe Physical-Technical Institute of<br>the Russian Academy of Sciences | Russia  |
| DC Field | Chaoyu     | Song              | Fudan University                                                         | China   |
| DC Field | Jan        | Srpcic            | University of Cambridge                                                  | UK      |
| DC Field | Raivo      | Stern             | National Institute of Chemical<br>Physics and Biophysics                 | Estonia |
| DC Field | Louis      | Taillefer         | University of Sherbrooke                                                 | Canada  |
| DC Field | Hidekazu   | Tanaka            | Tokyo Institute of Technology                                            | Japan   |
| DC Field | Taichi     | Terashima         | National Institute for Materials<br>Science                              | Japan   |
| DC Field | Shinnosuke | Tokuta            | Tokyo University of Agriculture and<br>Technology                        | Japan   |
| DC Field | Alexander  | Tsirlin           | National Institute of Chemical<br>Physics and Biophysics                 | Estonia |
| DC Field | Julia      | Vallejo           | University of Valencia                                                   | Spain   |
| DC Field | Marta      | Viciano-Chumillas | University of Valencia                                                   | Spain   |
| DC Field | An         | Wang              | Zhejiang University                                                      | China   |
| DC Field | Robert     | Williams          | University of Warwick                                                    | UK      |
| DC Field | Gang       | Wu                | Queen's University at Kingston                                           | Canada  |
| DC Field | Akiyasu    | Yamamoto          | Tokyo University of Agriculture and<br>Technology                        | Japan   |

| Facility | First Name | Last Name | Organization Name                        | Country |
|----------|------------|-----------|------------------------------------------|---------|
| DC Field | Hugen      | Yan       | Fudan University                         | China   |
| DC Field | Yunkun     | Yang      | Fudan University                         | China   |
| DC Field | Huiqiu     | Yuan      | Zhejiang University                      | China   |
| DC Field | Zachary    | Zajicek   | University of Oxford                     | UK      |
| DC Field | Qi         | Zhang     | Nanjing University                       | China   |
| DC Field | Minhao     | Zhao      | Fudan University                         | China   |
| DC Field | Sergei     | Zvyagin   | Helmholtz-Zentrum Dresden-<br>Rossendorf | Germany |

EMR - International Users

| Facility | First Name | Last Name      | Organization Name                               | Country  |
|----------|------------|----------------|-------------------------------------------------|----------|
| EMR      | Alina      | Bienko         | University of Wroclaw                           | Poland   |
| EMR      | Christian  | Buch           | University of Copenhagen                        | Denmark  |
| EMR      | Enrique    | Colacio        | University of Granada                           | Spain    |
| EMR      | Sam        | Curley         | University of Warwick                           | UK       |
| EMR      | Markus     | Enders         | Heidelberg University                           | Germany  |
| EMR      | Igor       | Fritsky        | Taras Shevchenko National<br>University of Kyiv | Ukraine  |
| EMR      | Paul       | Goddard        | University of Warwick                           | UK       |
| EMR      | Vibe       | Jakobsen       | University College Dublin                       | Ireland  |
| EMR      | Zofia      | Janas          | University of Wroclaw                           | Poland   |
| EMR      | Daniel     | Jardón Álvarez | Weizmann Institute of Science                   | Israel   |
| EMR      | Julia      | Jezierska      | University of Wroclaw                           | Poland   |
| EMR      | Kinga      | Kaniewska      | Gdansk University of Technology                 | Poland   |
| EMR      | Anna       | Katafias       | N Copernicus University Torun                   | Poland   |
| EMR      | Anna       | Kozakiewicz    | Nicolaus Copernicus University in<br>Torun      | Poland   |
| EMR      | Irina      | Kuehne         | University College Dublin                       | Ireland  |
| EMR      | Michal     | Leskes         | Weizmann Institute of Science                   | Israel   |
| EMR      | Daphné     | Lubert-Perquel | Imperial College London                         | UK       |
| EMR      | Grace      | Morgan         | University College Dublin                       | Ireland  |
| EMR      | Dmytro     | Nesterov       | Technical University of Lisbon                  | Portugal |
| EMR      | Stergios   | Piligkos       | University of Copenhagen                        | Denmark  |
| EMR      | Snorri     | Sigurdsson     | University of Iceland                           | Iceland  |
| EMR      | Rudi       | van Eldik      | University of Erlangen-Nuremberg,<br>Germany    | Germany  |
| EMR      | Grzegorz   | Wrzeszcz       | Nicolaus Copernicus University in<br>Torun      | Poland   |

High B/T - International Users

| Facility | First Name | Last Name | Organization Name             | Country |
|----------|------------|-----------|-------------------------------|---------|
| High B/T | Ryuji      | Nomura    | Tokyo Institute of Technology | Japan   |

ICR - International Users

| Facility | First Name   | Last Name   | Organization Name                                 | Country     |  |
|----------|--------------|-------------|---------------------------------------------------|-------------|--|
| ICR      | Nelson       | Acevedo     | Université de pau et des Pays de<br>l'Adour       | France      |  |
| ICR      | Nelson       | Acevedo     | University of Pau and Pays de<br>l'Adour          | France      |  |
| ICR      | Carlos       | Afonso      | Normandy University                               | France      |  |
| ICR      | Martin       | Andersen    | University of New South Wales                     | Australia   |  |
| ICR      | Andy         | Baker       | University of New South Wales                     | Australia   |  |
| ICR      | Tom          | Battin      | Ecole Polytechnique Federale de<br>Lausanne       | Switzerland |  |
| ICR      | Robert       | Beynon      | University of Liverpool                           | UK          |  |
| ICR      | Brice        | Bouyssiere  | University of Pau and Pays de<br>l'Adour          | France      |  |
| ICR      | Philip       | Brownridge  | University of Liverpool                           | UK          |  |
| ICR      | Clément      | Brügger     | UNSW Sydney                                       | Australia   |  |
| ICR      | Casey        | Bryce       | University of Tuebingen                           | Germany     |  |
| ICR      | Herve        | Carrier     | University of Pau and Pays de<br>l'Adour          | France      |  |
| ICR      | Jimmy        | Castillo    | Central University of Venezuela                   | Venezuela   |  |
| ICR      | Rohana       | Chandrajith | University of Peradeniya                          | Sri Lanka   |  |
| ICR      | Jean-Luc     | Daridon     | University of Pau and Pays de<br>l'Adour          | France      |  |
| ICR      | Pierre       | Giusti      | Total                                             | France      |  |
| ICR      | Didia Coelho | Graca       | Hôpitaux Universitaires de Genève                 | Switzerland |  |
| ICR      | Bertrand     | Guenet      | French National Center for<br>Scientific Research | France      |  |
| ICR      | Huang        | Hanxue      | UNSW Sydney                                       | Australia   |  |
| ICR      | Victoria     | Harman      | University of Liverpool                           | UK          |  |
| ICR      | Hitoshi      | Hasegawa    | Ehime University                                  | Japan       |  |
| ICR      | John         | Headley     | Environment and Climate Change<br>Canada          | Canada      |  |
| ICR      | Nicole       | Heshka      | Natural Resources Canada                          | Canada      |  |
| ICR      | Jun          | Ishizaki    | Ehime University                                  | Japan       |  |

ICR - International Users

| Facility | First Name      | Last Name  | Organization Name                                                          | Country     |  |
|----------|-----------------|------------|----------------------------------------------------------------------------|-------------|--|
| ICR      | Peng            | Jiang      | Xiamen University                                                          | China       |  |
| ICR      | Andreas         | Kappler    | Eberhard Karls University of<br>Tübingen                                   | Germany     |  |
| ICR      | Jorge           | León-Muñoz | Universidad Católica de la<br>Santísima Concepción Facultad<br>de Ciencias | Chile       |  |
| ICR      | Pierre          | Lescuyer   | Universitaires de Gene`ve                                                  | Switzerland |  |
| ICR      | Xiaolin         | Li         | Xiamen University                                                          | China       |  |
| ICR      | Caroline        | Mangote    | Total                                                                      | France      |  |
| ICR      | Christopher     | Marjo      | University of New South Wales                                              | Australia   |  |
| ICR      | Matthew         | Marshall   | University of Bristol                                                      | UK          |  |
| ICR      | Liza            | McDonough  | University of New South Wales                                              | Australia   |  |
| ICR      | Aurora          | Mejia      | University of Pau and Pays de<br>l'Adour                                   | France      |  |
| ICR      | Karina          | Meredith   | Australia's Nuclear Science and<br>Technology Organisation                 | Australia   |  |
| ICR      | Toshihiro       | Miyajima   | The University of Tokyo,<br>Atmosphere and Ocean Research<br>Institute     | Japan       |  |
| ICR      | Sandra          | Mounicou   | University of Pau and Pays de<br>l'Adour                                   | France      |  |
| ICR      | Anika           | Neumann    | University of Rostock                                                      | Germany     |  |
| ICR      | Denis           | O'Carroll  | University of New South Wales                                              | Australia   |  |
| ICR      | Phetdala        | Oudone     | University of New South Wales                                              | Australia   |  |
| ICR      | Ada             | Pastor     | Aarhus University                                                          | Denmark     |  |
| ICR      | Monique Sézanne | Patzner    | University Tuebingen                                                       | Germany     |  |
| ICR      | Kerry           | Peru       | Environment and Climate Change<br>Canada                                   | Canada      |  |
| ICR      | Vincent         | Piscitelli | Central University of Venezuela                                            | Peru        |  |
| ICR      | Sadia           | Radji      | University of Pau and Pays de<br>l'Adour                                   | France      |  |
| ICR      | Raghab          | Ray        | University of Tokyo, Atmosphere<br>and Ocean Research Institute            | Japan       |  |
| ICR      | Helen           | Rutlidge   | University of New South Wales                                              | Australia   |  |
| ICR      | Keisuke         | Shima      | Shimadzu Corporation                                                       | Japan       |  |

| Facility | First Name | Last Name     | Organization Name                                       | Country |
|----------|------------|---------------|---------------------------------------------------------|---------|
| ICR      | Junpei     | Suzuki        | Ehime University                                        | Japan   |
| ICR      | Ayako      | Takemori      | Ehime University                                        | Japan   |
| ICR      | Nobuaki    | Takemori      | Ehime University                                        | Japan   |
| ICR      | Bryce      | Van Dam       | Helmholtz-Zentrum Geesthacht                            | Germany |
| ICR      | lan        | Vander Meulen | Environment and Climate Change<br>Canada                | Canada  |
| ICR      | Jemma      | Wadham        | University of Bristol                                   | UK      |
| ICR      | Masakatsu  | Yamashita     | Ehime University                                        | Japan   |
| ICR      | Mary       | Zeller        | Leibniz Institute for Baltic Sea<br>Research Warnemünde | Germany |
| ICR      | Хиереі     | Zhang         | Karolinska Institutet                                   | Sweden  |
| ICR      | Ralf       | Zimmermann    | University of Rostock                                   | Germany |
| ICR      | Roman      | Zubarev       | Karolinska Institute                                    | Sweden  |

NMR - International Users

| Facility | First Name | Last Name  | Organization Name                                               | Country     |
|----------|------------|------------|-----------------------------------------------------------------|-------------|
| NMR      | Alexandre  | Arnold     | University of Quebec at Montreal                                | Canada      |
| NMR      | Ana Rita   | Bastos     | Universidade de Aveiro                                          | Portugal    |
| NMR      | Diana      | Bernin     | Chalmers University of Technology                               | Sweden      |
| NMR      | Henrik     | Bildsoe    | Aarhus University                                               | Denmark     |
| NMR      | Christian  | Bonhomme   | Pierre and Marie Curie University                               | France      |
| NMR      | Michael    | Brorson    | Haldor Topsoe                                                   | Denmark     |
| NMR      | David      | Bryce      | University of Ottawa                                            | Canada      |
| NMR      | Shuhui     | Cai        | Xiamen University                                               | China       |
| NMR      | Quentin    | Chappuis   | École normale supérieure de Lyon                                | France      |
| NMR      | Huixin     | Chen       | Chinese Academy of Sciences                                     | China       |
| NMR      | Chia-Hsin  | Chen       | French National Center for<br>Scientific Research               | France      |
| NMR      | Zhong      | Chen       | Xiamen University                                               | China       |
| NMR      | Elisabete  | Coelho     | Universidade de Aveiro                                          | Portugal    |
| NMR      | Manuel A.  | Coimbra    | Universidade de Aveiro                                          | Portugal    |
| NMR      | Rivera     | de la Rosa | Autonomous University of Nuevo<br>León                          | Mexico      |
| NMR      | Gael       | De Paepe   | The French Alternative Energies<br>and Atomic Energy Commission | France      |
| NMR      | Ulrich     | Fekl       | University of Toronto (Mississauga)                             | Canada      |
| NMR      | Tomislav   | Friscic    | McGill University                                               | Canada      |
| NMR      | Christel   | Gervais    | Sorbonne University                                             | France      |
| NMR      | leva       | Goldberga  | French National Center for<br>Scientific Research               | France      |
| NMR      | Eric       | Gottwald   | Karlsruhe Institute of Technology                               | Germany     |
| NMR      | Hanxi      | Guan       | Zhejiang University                                             | China       |
| NMR      | James      | Hook       | University of New South Wales                                   | Australia   |
| NMR      | Yining     | Huang      | University of Western Ontario                                   | Canada      |
| NMR      | Yuqing     | Huang      | Xiamen University                                               | China       |
| NMR      | lgor       | Huskic     | McGill University                                               | Canada      |
| NMR      | Jin Pyo    | Hwang      | Dankook University                                              | South Korea |

NMR - International Users

| Facility | First Name     | Last Name        | Organization Name                                                  | Country     |
|----------|----------------|------------------|--------------------------------------------------------------------|-------------|
| NMR      | Hans           | Jakobsen         | Aarhus University                                                  | Denmark     |
| NMR      | Sami           | Jannin           | École normale supérieure de Lyon                                   | France      |
| NMR      | Michael        | Jaroszewicz      | University of Windsor                                              | Canada      |
| NMR      | Woo Young      | Kim              | Dankook University                                                 | South Korea |
| NMR      | Xueqian        | Kong             | Zhejiang University                                                | China       |
| NMR      | Adam           | Lange            | Leibniz-Forschungsinstitut für<br>Molekulare Pharmakologie, Berlin | Germany     |
| NMR      | Danielle       | Laurencin        | University of Montpellier                                          | France      |
| NMR      | Chang Hyun     | Lee              | Dankook University                                                 | South Korea |
| NMR      | Józef          | Lewandowski      | University of Warwick                                              | UK          |
| NMR      | Luís           | Mafra            | Universidade de Aveiro                                             | Portugal    |
| NMR      | Isabelle       | Marcotte         | University of Quebec at Montreal                                   | Canada      |
| NMR      | lldefonso      | Marin-Montesinos | Universidade de Aveiro                                             | Portugal    |
| NMR      | Vinicius       | Martins          | University of Western Ontario                                      | Canada      |
| NMR      | Francisco José | Morales-Leal     | Autonomous University of Nuevo<br>León                             | Mexico      |
| NMR      | Chang Hoon     | Oh               | Dankook University                                                 | South Korea |
| NMR      | Sarah          | Overall          | Swiss Federal Institute of<br>Technology in Zurich                 | Switzerland |
| NMR      | In Kee         | Park             | Dankook University                                                 | South Korea |
| NMR      | Alexandre      | Poulhazan        | University of Quebec at Montreal                                   | Canada      |
| NMR      | Ernest         | Prack            | University of Toronto (Mississauga)                                | Canada      |
| NMR      | Se Youn        | Руо              | Dankook University                                                 | South Korea |
| NMR      | Jan            | Rainey           | Dalhousie University                                               | Canada      |
| NMR      | Luke           | Reynolds         | University of British Columbia                                     | Canada      |
| NMR      | Mariana        | Sardo            | Universidade de Aveiro                                             | Portugal    |
| NMR      | Lothar         | Schad            | Heidelberg University                                              | Germany     |
| NMR      | Snorri         | Sigurdsson       | University of Iceland                                              | Iceland     |
| NMR      | Jeffrey        | Simmons          | Simmons Dalhousie University                                       |             |
| NMR      | Neeraj         | Sinha            | Centre of Bio-Medical Research                                     | India       |
| NMR      | Carolina       | Solis Maldonado  | Veracruzan University                                              | Mexico      |

| Facility | First Name | Last Name   | Organization Name                                 | Country |
|----------|------------|-------------|---------------------------------------------------|---------|
| NMR      | Anamika    | Sulekha     | Dalhousie University                              | Canada  |
| NMR      | Pingchuan  | Sun         | Nankai University                                 | China   |
| NMR      | Chunhua    | Tan         | Xiamen University                                 | China   |
| NMR      | Daniel     | Topgaard    | University of Lund                                | Sweden  |
| NMR      | Fenfen     | Wang        | Nankai University                                 | China   |
| NMR      | Dror       | Warschawski | French National Center for<br>Scientific Research | France  |
| NMR      | Gang       | Wu          | Queen's University at Kingston                    | Canada  |
| NMR      | Guiming    | Zhong       | Chinese Academy of Sciences                       | China   |

## PFF - International Users

| Facility | First Name | Last Name                                                                        | Organization Name                                    | Country   |
|----------|------------|----------------------------------------------------------------------------------|------------------------------------------------------|-----------|
| PFF      | Yuen Chung | Chan                                                                             | Chinese University of Hong Kong                      | Hong Kong |
| PFF      | Sam        | Curley                                                                           | University of Warwick                                | UK        |
| PFF      | Mijkhail   | Eremets                                                                          | Max Planck Institute for Chemistry,<br>Mainz         | Germany   |
| PFF      | Paul       | Goddard                                                                          | University of Warwick                                | UK        |
| PFF      | Swee       | Goh                                                                              | Chinese University of Hong Kong                      | Hong Kong |
| PFF      | Mateusz    | Goryca                                                                           | University of Warsaw                                 | Poland    |
| PFF      | Kathrin    | Gotze                                                                            | University of Warwick                                | UK        |
| PFF      | Shusaku    | Imajo                                                                            | University of Tokyo                                  | Japan     |
| PFF      | Taehwan    | Shusaku     Imajo     University of Tokyo       Robana University of Science and |                                                      |           |
| PFF      | Kwing To   | Lai                                                                              | Chinese University of Hong Kong                      | Hong Kong |
| PFF      | Xavier     | Marie                                                                            | National Institute for Applied<br>Sciences, Toulouse | France    |
| PFF      | Yuji       | Matsuda                                                                          | Kyoto University                                     | Japan     |
| PFF      | Joonbum    | Park                                                                             | Helmholtz-Zentrum Dresden-<br>Rossendorf             | Germany   |
| PFF      | Andres     | Saul                                                                             | Aix-Marseille University                             | France    |
| PFF      | Hidekazu   | Tanaka                                                                           | Tokyo Institute of Technology                        | Japan     |
| PFF      | Bernhard   | Urbaszek                                                                         | National Institute for Applied<br>Sciences, Toulouse | France    |
| PFF      | Jianyu     | Xie                                                                              | Chinese University of Hong Kong                      | Hong Kong |
| PFF      | Wei        | Zhang                                                                            | Chinese University of Hong Kong                      | Hong Kong |

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## Appendix 5 – User Proposals

## 1. AMRIS Facility

|                                                  |         | Participants<br>(Name, Role, Org., Dept                             | )                                                                               | (Funding                                                          | Funding Sources<br>Agency, Division, Awarc                                                         | d #)                      | Proposal # | Proposal Title                                                                                                                                                                   | Discipline                              | Exp.<br># | Days<br>Used |
|--------------------------------------------------|---------|---------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Yousong Ding (S)<br>Guangde Jiang (G)            | PI<br>C | University of Florida<br>University of Florida                      | Medicinal Chemistry<br>Medicinal Chemistry                                      | University of<br>Florida, startup<br>package<br>Air Force, Office | US College and University<br>Other US Federal Agency                                               |                           | P16310     | Discovery of bioactive microbial<br>metabolites via synthetic biology<br>approaches                                                                                              | Biology,<br>Biochemistry,<br>Biophysics | 1         | 1.5          |
| Guangue Jiang (G)                                | C       | University of Florida                                               |                                                                                 | of Scientific<br>Research                                         | Other OS rederal Agency                                                                            |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Peilan Zhang (G)                                 | С       | University of Florida                                               | Medicinal Chemistry                                                             |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Yi Zhang (G)                                     | С       | University of Florida                                               | Medicinal Chemistry                                                             |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Ran Zuo (P)                                      | С       | University of Florida                                               | Medicinal Chemistry                                                             |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Robert Huigens (G)                               | PI      | University of Florida                                               | Medicinal Chemistry                                                             | University of<br>Florida, College<br>of Pharmacy<br>startup       | US College and University                                                                          |                           | P17386     | Development of Halogenated Phenazine<br>Prodrugs and Antibiotic Conjugates as<br>Antibacterial Therapeutics                                                                      | Chemistry                               | 1         | 3            |
| Hongfen Yang (G)                                 | С       | University of Florida                                               | college of pharmacy medicinal chemistry                                         |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Anastasios Angelopoulos (S)<br>Samuel Berens (G) | РІ<br>С | University of Cincinnati<br>University of Florida                   | Department of Chemical and Environmental<br>Engineering<br>Chemical Engineering | NSF                                                               | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems<br>CBET - Chemical, | CBET18<br>36551<br>CBET18 | P17443     | Diffusion-mediated exchange of small<br>organic molecules between different<br>types of local environments in<br>perfluorosulfonic acid (PSA) membranes<br>by high field PFG NMR | Engineering                             | 1         | 52.33        |
|                                                  |         |                                                                     |                                                                                 |                                                                   | Bioengineering,<br>Environmental, and<br>Transport Systems                                         | 36556                     |            |                                                                                                                                                                                  |                                         |           |              |
| Taylor Col (G)                                   | С       | Vasenkov Lab                                                        | Chemical Engineering                                                            |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Sergey Vasenkov (S)                              | С       | University of Florida                                               | Chemical Engineering                                                            |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Ryan Lively (S)                                  | PI      | Georgia Institute of<br>Technology                                  | School of Chemical & Biomolecular<br>Engineering,                               | NSF                                                               | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems                     | CBET15<br>10411           | P17444     | The role of the framework flexibility in<br>gas transport inside zeolitic imidazolate<br>frameworks by pulsed field gradient NMR                                                 | Engineering                             | 1         | 41           |
| Amineh Baniani (G)                               | С       | University of Florida                                               | Chemical Engineering                                                            | NSF                                                               | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems                     | CBET15<br>10442           |            |                                                                                                                                                                                  |                                         |           |              |
| Christian Chmelik (P)                            | С       | Leipzig University                                                  | Physics                                                                         |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Lei Fan (G)                                      | С       | University of Florida                                               | Chemical Engineering                                                            |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Evan Forman (G)                                  | С       | University of Florida                                               | Chemical Engineering                                                            |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Sergey Vasenkov (S)<br>Fengli Zhang (S)          | C<br>C  | University of Florida<br>National High Magnetic Field<br>Laboratory | Chemical Engineering<br>CIMAR                                                   |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Erkang Zhou (G)                                  | С       | Georgia Institute of<br>Technology                                  | School of Chemical & Biomolecular<br>Engineering,                               |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Joanna Long (S)<br>James H.P. Collins (P)        | PI<br>C | University of Florida<br>University of Florida                      | Biochemistry & Molecular Biology<br>Biochemistry & Molecular Biology            | No other support<br>NIH                                           | NIGMS - National Institute<br>of General Medical Sciences                                          | GM122<br>698              | P17539     | New<br>equipment/upgrades/troubleshooting on<br>verticals (formerly P09507)                                                                                                      | Biology,<br>Biochemistry,<br>Biophysics | 1         | 218.75       |
| Malathy Elumalai (T)                             | С       | University of Florida                                               | AMRIS, McKnight Brain Institute                                                 |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Anil Mehta (O)                                   | С       | University of Florida                                               | AMRIS                                                                           |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| James Rocca (S)                                  | С       | University of Florida                                               | AMRIS Affiliated Faculty & Staff                                                |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Joshua Slade (T)                                 | С       | University of Florida                                               | AMRIS                                                                           |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Joanna Long (S)                                  | PI      | University of Florida                                               | Biochemistry & Molecular Biology                                                | No other support                                                  |                                                                                                    |                           | P17540     | New                                                                                                                                                                              | Biology,                                | 1         | 49.5         |
| Malathy Elumalai (T)                             | С       | University of Florida                                               | AMRIS, McKnight Brain Institute                                                 |                                                                   |                                                                                                    |                           |            | equipment/upgrades/troubleshooting on                                                                                                                                            | Biochemistry,                           |           |              |
| Kelly Jenkins (T)                                | С       | University of Florida                                               | AMRIS Affiliated Faculty & Staff                                                |                                                                   |                                                                                                    |                           |            | horizontals (formerly P09509)                                                                                                                                                    | Biophysics                              | I         |              |
| Joshua Slade (T)                                 | С       | University of Florida                                               | AMRIS                                                                           |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
| Huadong Zeng (S)                                 | С       | University of Florida                                               | AMRIS Affiliated Faculty & Staff                                                |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |
|                                                  |         |                                                                     |                                                                                 |                                                                   |                                                                                                    |                           |            |                                                                                                                                                                                  |                                         |           |              |

|                                    |      | Participants<br>(Name, Role, Org., Dept        | .)                                          | (Funding                                     | Funding Sources<br>Agency, Division, Award #)                                  | Proposal # | Proposal Title                                                                                                                  | Discipline                              | Exp.<br># | Days<br>Used |
|------------------------------------|------|------------------------------------------------|---------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Joanna Long (S)                    | PI   | University of Florida                          | Biochemistry & Molecular Biology            | No other support                             |                                                                                | P17541     | Routine maintenance of existing                                                                                                 | Biology,                                | 1         | 346.42       |
| Shane Chatfield (T)                | С    | University of Florida                          | AMRIS, McKnight Brain Institute             |                                              |                                                                                |            | equipment (formerly P09510)                                                                                                     | Biochemistry,                           |           |              |
| James H.P. Collins (P)             | С    | University of Florida                          | Biochemistry & Molecular Biology            |                                              |                                                                                |            |                                                                                                                                 | Biophysics                              |           |              |
| Malathy Elumalai (T)               | С    | University of Florida                          | AMRIS, McKnight Brain Institute             |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Kelly Jenkins (T)                  | С    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Thomas Mareci (S)                  | c    | University of Florida                          | Biochemistry and Molecular Biology          |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Anil Mehta (O)                     | C    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Tammy Nicholson (T)                | c    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
|                                    |      | -                                              |                                             |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| James Rocca (S)                    | C    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Jens Rosenberg (S)                 | C    | National High Magnetic Field<br>Laboratory     | NMR                                         |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Joshua Slade (T)                   | С    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Judith Steadman (T)                | С    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Christi Swiers (T)                 | С    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Huadong Zeng (S)                   | c    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
|                                    | PI   |                                                |                                             | No other support                             |                                                                                | P17542     | New year training (formarky DOOF 11)                                                                                            | Dielegy                                 | 1         | 53           |
| Joanna Long (S)<br>Guita Banan (G) | C    | University of Florida<br>University of Florida | Biochemistry & Molecular Biology            | No other support                             |                                                                                | F1/342     | New user training (formerly P09511)                                                                                             | Biology,<br>Biochemistry,               | 1 I       | 55           |
|                                    |      |                                                | Biology                                     |                                              |                                                                                |            |                                                                                                                                 | Biophysics                              |           | 1            |
| James H.P. Collins (P)             | C    | University of Florida                          | Biochemistry & Molecular Biology            |                                              |                                                                                |            |                                                                                                                                 |                                         |           | 1            |
| Malathy Elumalai (T)               | С    | University of Florida                          | AMRIS, McKnight Brain Institute             |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Thomas Mareci (S)                  | С    | University of Florida                          | Biochemistry and Molecular Biology          |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Anil Mehta (O)                     | С    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| James Rocca (S)                    | С    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Joshua Slade (T)                   | С    | University of Florida                          | AMRIS                                       |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Huadong Zeng (S)                   | С    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Ahmad Mostafa (P)                  | PI   | Al-Azhar University                            | Pharmacognosy                               | Egyptian<br>government                       | Other                                                                          | P17558     | Study on Chemical Constituents, and<br>anticancer activities of certain natural                                                 | Biology,<br>Biochemistry,               | 1         | 3            |
| Hendrik Luesch (S)                 | С    | University of Florida                          | College of Pharmacy                         |                                              |                                                                                |            | products isolated from plants or marine                                                                                         | Biophysics                              |           |              |
| James Rocca (S)                    | С    | University of Florida                          | AMRIS Affiliated Faculty & Staff            |                                              |                                                                                |            | drugs                                                                                                                           |                                         |           |              |
| Benjamin Philmus (S)               | PI   | Oregon State University                        | College of Pharmacy                         | No other support                             |                                                                                | P17583     | Understanding the chemical diversity,<br>and biosynthesis triazine-containing<br>secondary metabolites                          | Chemistry                               | 1         | 3.5          |
| Joanna Long (S)                    | PI   | University of Florida                          | Biochemistry & Molecular Biology            | University of<br>Florida matching<br>support | US College and University                                                      | P17621     | [Independently-funded Research<br>Proposal]                                                                                     | Biology,<br>Biochemistry,<br>Biophysics | 1         | 66.67        |
| James H.P. Collins (P)             | С    | University of Florida                          | Biochemistry & Molecular Biology            |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Chongyang Huang (P)                | С    | university of florida                          | Biochem/Molecular Biology                   |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Jeanine Brady (S)                  | PI   | University of Florida                          | Oral Biology                                | NIH                                          | NIDCR - National Institute of DE0217<br>Dental and Craniofacial 89<br>Research | P17623     | Structural studies of adhesion protein P1<br>of Streptococcus mutans, its quaternary<br>structure, and its formation of amyloid | Biology,<br>Biochemistry,<br>Biophysics | 1         | 15.67        |
| Mavis Agbandje-McKenna (S)         | С    | University of Florida                          | Biochemistry and Molecular Biology          |                                              |                                                                                |            | fibrils                                                                                                                         |                                         | 1         | 1            |
| Ana Barran-Berdon (P)              | С    | University of Florida                          | Oral Biology                                |                                              |                                                                                |            |                                                                                                                                 |                                         | 1         | 1            |
| Matthew Burg (G)                   | c    | University of Florida                          | Chemistry                                   |                                              |                                                                                |            |                                                                                                                                 |                                         | 1         | 1            |
| Joanna Long (S)                    | c    | University of Florida                          | Biochemistry & Molecular Biology            |                                              |                                                                                |            |                                                                                                                                 |                                         | 1         | 1            |
| Leronne Perera (G)                 | C    | University of Florida                          | Oral Biology                                |                                              |                                                                                |            |                                                                                                                                 |                                         |           | 1            |
| Gwladys Riviere (P)                | c    | University of Florida                          | Biochemistry and molecular biology          |                                              |                                                                                |            |                                                                                                                                 |                                         |           | 1            |
| John Jones (S)                     | PI   | Center for Neurosciences and                   | Metabolic Control Lab                       | No other support                             |                                                                                | P17827     | High-sensitivity 13C NMR isotopomer                                                                                             | Biology,                                | 1         | 37.5         |
|                                    |      | Cell Biology                                   |                                             |                                              |                                                                                |            | analysis of triglyceride fatty acid                                                                                             | Biochemistry,                           |           |              |
| Ram Khattri (P)                    | С    | University of Florida                          | Biochemistry and molecular biology/medicine |                                              |                                                                                |            | enrichment from [U-13C]fructose                                                                                                 | Biophysics                              | 1         | 1            |
| Rohit Mahar (P)                    | С    | University of Florida                          | Biochemistry and molecular biology          |                                              |                                                                                |            |                                                                                                                                 |                                         | 1         | 1            |
| Marc McLeod (G)                    | С    | University of Florida College<br>of Medicine   | Biochemistry and Molecular Biology          |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Matthew Merritt (S)                | С    | University of Florida                          | Biochemistry and Molecular Biology          |                                              |                                                                                |            |                                                                                                                                 |                                         | 1         | 1            |
| Mukundan Ragavan (P)               | С    | University of Florida                          | Department of Biochemistry and Molecular    |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |
| Peder Larson (S)                   | PI * | University of California - San                 | Biology<br>Radiology and Biomedical Imaging | No other support                             |                                                                                | P17846     | ML-LARSON-001: Hyperpolarized 13C                                                                                               | Biology,                                | 1         | 27.33        |
|                                    |      | Francisco                                      |                                             |                                              |                                                                                |            | Metabolism Studies for Preclinical                                                                                              | Biochemistry,                           |           |              |
| Matthew Merritt (S)                | С    | University of Florida                          | Biochemistry and Molecular Biology          | 1                                            |                                                                                |            | Detection of Hypertrophic<br>Cardiomyopathy                                                                                     | Biophysics                              | 1         |              |
| Mukundan Ragavan (P)               | С    | University of Florida                          | Department of Biochemistry and Molecular    |                                              |                                                                                |            |                                                                                                                                 |                                         |           |              |

|                                        |         | Participants<br>(Name, Role, Org., Dept                              | .)                                                                | (Funding                                     | Funding Sources<br>Agency, Division, Award             | d #)            | Proposal # | Proposal Title                                                                                   | Discipline                              | Exp.<br># | Days<br>Used |
|----------------------------------------|---------|----------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------|-----------------|------------|--------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Daniel R. Talham (S)<br>Pratik Roy (G) | PI<br>C | University of Florida<br>University of Florida                       | Chemistry<br>Chemistry                                            | No other support                             |                                                        |                 | P17951     | Polymer coated lanthanide nanoparticles<br>as PARACEST MRI contrast agents                       | Chemistry                               | 1         | 36.67        |
| Luis Colon-Perez (S)                   | PI      | University of California, Irvine                                     | Neurobiology and Behavior                                         | No other support                             |                                                        |                 | P18050     | Characterization of brain structure at<br>multiple scales in a rodent model early<br>life stress | Biology,<br>Biochemistry,<br>Biophysics | 1         | 16.5         |
| Pascal Bernatchez (S)                  | PI      | University of British<br>Columbia                                    | Anesthesiology, Pharmacology, & Therapeutics                      | No other support                             |                                                        |                 | P18061     | Imaging tissue heterogeneity in a new<br>model of chronic muscle damage with                     | Biology,<br>Biochemistry,               | 1         | 19.17        |
| Elisabeth Barton (S)                   | С       | University of Florida                                                | Applied Physiology and Kinesiology                                |                                              |                                                        |                 |            | fibrofatty infilitration and wasting.                                                            | Biophysics                              |           |              |
| Abhinandan Batra (G)                   | С       | University of Florida                                                | Physical therapy                                                  |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Ram Khattri (P)                        | С       | University of Florida                                                | Biochemistry and molecular biology/medicine                       |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Glenn Walter (S)                       | С       | University of Florida                                                | Physiology and Functional Genomics                                |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Huadong Zeng (S)                       | С       | University of Florida                                                | AMRIS Affiliated Faculty & Staff                                  |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Hae-Kwon Jeong (S)                     | PI      | Texas A&M University                                                 | Chemical Engineering, Materials Science and Engi                  | NSF                                          | CMMI - Civil, Mechanical &<br>Manufacturing Innovation | CMMI1<br>561347 | P18084     | Microscopic gas diffusion in hybrid<br>zeolitic-imidazolate frameworks (ZIFs) by                 | Engineering                             | 1         | 6            |
| Samuel Berens (G)                      | С       | University of Florida                                                | Chemical Engineering                                              |                                              |                                                        |                 |            | high field diffusion NMR                                                                         |                                         |           |              |
| Febrian Hillman (G)                    | С       | Texas A&M University                                                 | Chemical Engineering                                              |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Sergey Vasenkov (S)                    | С       | University of Florida                                                | Chemical Engineering                                              |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Matthew Eddy (S)                       | PI      | University of Florida                                                | Chemistry                                                         | University of<br>Florida<br>(start-up funds) | US College and University                              |                 | P19106     | ML-EDDY-001: Allosteric Regulation of<br>Human Signaling Complexes                               | Biology,<br>Biochemistry,<br>Biophysics | 1         | 76.83        |
| Kara Anazia (G)                        | С       | University of Florida                                                | Chemistry department                                              |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Niloofar Gopal Pour (G)                | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Emma Mulry (G)                         | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Arka Prabha Ray (G)                    | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Naveen Thakur (G)                      | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Andrew Palmer (S)                      | PI      | Florida Institute of<br>Technology                                   | Department of Biomedical and Chemical<br>Engineering and Sciences | No other support                             |                                                        |                 | P19156     | Regulating Bacterial Virulence through<br>Quorum Sensing Modulation                              | Biology,<br>Biochemistry,               | 1         | 18           |
| Anil Mehta (O)                         | С       | University of Florida                                                | AMRIS                                                             |                                              |                                                        |                 |            |                                                                                                  | Biophysics                              |           |              |
| Eric Ziegler (G)                       | С       | Florida Institute of<br>Technology                                   | Biological and Chemical Engineering and<br>Sciences               |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Benjamin Wylie (S)                     | PI      | Texas Tech University<br>Department of Chemistry<br>and Biochemistry | Chemistry and Biochemistry                                        | No other support                             |                                                        | DMR16<br>44779  | P19164     | Determining the dynamic structure of<br>lipid-membrane protein complexes via<br>solid-state NMR  | Biology,<br>Biochemistry,<br>Biophysics | 1         | 37.5         |
| Anil Mehta (O)                         | С       | University of Florida                                                | AMRIS                                                             |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Adam Veige (S)                         | PI      | University of Florida                                                | Chemistry                                                         | NSF                                          | CHE - Chemistry                                        | CHE180<br>8234  | P19170     | Quantification of End Groups in Cyclic vs.<br>Linear Polyacetylenes by Carbon-13                 | Biology,<br>Biochemistry,               | 1         | 7.33         |
| Clifford Bowers (S)                    | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            | Magic Angle Spinning Nuclear Magnetic                                                            | Biophysics                              |           |              |
| Alec Esper (G)                         | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            | Resonance Spectroscopy                                                                           |                                         |           |              |
| Zhihui Miao (G)                        | С       | University of Florida                                                | Department of Chemistry                                           |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Brent Sumerlin (S)                     | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Johnny Figueroa (S)                    | PI *    | Loma Linda University                                                | Center for Health Disparities and Molecular<br>Medicine           | No other support                             |                                                        |                 | P19197     | Microstructural Correlates Of Adolescent<br>Adversity                                            | Biology,<br>Biochemistry,               | 1         | 7.33         |
| Marcelo Febo (S)                       | С       | University of Florida                                                | Psychiatry                                                        |                                              |                                                        |                 |            |                                                                                                  | Biophysics                              |           |              |
| Marjory Pompilus (G)                   | С       | University of Florida                                                | Psychiatry                                                        |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Matthew Eddy (S)                       | PI      | University of Florida                                                | Chemistry                                                         | No other support                             |                                                        |                 | P19419     | ML-EDDY-002: Small molecule fragment                                                             | Biology,                                | 1         | 46.92        |
| James H.P. Collins (P)                 | С       | University of Florida                                                | Biochemistry & Molecular Biology                                  |                                              |                                                        |                 |            | screening with GPCRs in natural<br>membranes by HRMAS NMR                                        | Biochemistry,<br>Biophysics             |           | 1            |
| Guillaume FERRE (P)                    | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            | memoranes by miniAS NIVIN                                                                        | Diopitysics                             |           |              |
| Niloofar Gopal Pour (G)                | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Hala Hachem (G)                        | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Emma Mulry (G)                         | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Arka Prabha Ray (G)                    | С       | University of Florida                                                | Chemistry                                                         |                                              |                                                        |                 |            |                                                                                                  |                                         |           |              |
| Mario Rivera (S)                       | PI *    | Louisiana State University                                           | Chemistry                                                         | No other support                             |                                                        |                 | P19426     | Probing the impact of iron limitation on                                                         | Biology,                                | 1         | 19.5         |
| Leo Fontenot (G)                       | С       | Louisiana State University                                           | Chemistry                                                         |                                              |                                                        |                 |            | the metabolome of P. aeruginosa                                                                  | Biochemistry,<br>Biophysics             |           | 1            |
| Anil Mehta (O)                         | С       | University of Florida                                                | AMRIS                                                             |                                              |                                                        |                 |            |                                                                                                  | BIOPHYSICS                              |           |              |
|                                        | С       | Louisiana State University                                           | Chemistry                                                         |                                              |                                                        |                 | 1          |                                                                                                  | 1                                       | 1         | 1            |

|                        |    | Participants<br>(Name, Role, Org., Dept                 | i.)                                               | (Funding         | Funding Sources<br>Agency, Division, Awa                                       | rd #)           | Proposal # | Proposal Title                                                                                      | Discipline                  | Exp.<br>#       | Days<br>Used      |
|------------------------|----|---------------------------------------------------------|---------------------------------------------------|------------------|--------------------------------------------------------------------------------|-----------------|------------|-----------------------------------------------------------------------------------------------------|-----------------------------|-----------------|-------------------|
| Carsten Sievers (S)    | PI | <ul> <li>Georgia Institute of<br/>Technology</li> </ul> | School of Chemical & Biomolecular Engineering     | No other support |                                                                                |                 | P19432     | Diffusion of a model sugar through Lewis<br>acidic metal oxides in various solvents                 | Engineering                 | 1               | 8.5               |
| James H.P. Collins (P) | С  | University of Florida                                   | Biochemistry & Molecular Biology                  |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Andrew Medford (S)     | С  | Georgia Institute of<br>Technology                      | Chemical Engineering                              |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Sean Najmi (G)         | С  | Georgia Institute of<br>Technology                      | Chemical Engineering                              |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Ryan Lively (S)        | PI | Georgia Institute of<br>Technology                      | School of Chemical & Biomolecular<br>Engineering, | NSF              | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems | CBET18<br>36735 | P19434     | Quantification of liquid diffusion in MOF-<br>based hybrid membranes by high field<br>diffusion NMR | Engineering                 | 1               | 49.5              |
| Amineh Baniani (G)     | С  | University of Florida                                   | Chemical Engineering                              |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Sergey Vasenkov (S)    | С  | University of Florida                                   | Chemical Engineering                              |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Jeffrey Rudolf (S)     | PI | <ul> <li>* University of Florida</li> </ul>             | Chemistry                                         | No other support |                                                                                |                 | P19437     | Bacterial terpenoids and their                                                                      | Biology,                    | 1               | 8.92              |
| Baofu Xu (P)           | С  | University of Florida                                   | Chemistry                                         |                  |                                                                                |                 |            | biosynthesis                                                                                        | Biochemistry,<br>Biophysics |                 |                   |
| Jonathan Judy (S)      | PI | * University of Florida                                 | Soil and Water Sciences                           | No other support |                                                                                |                 | P19466     | Evaluating the Nature of Phosphorus                                                                 | Chemistry                   | 1               | 1.5               |
| A. Buchanan (G)        | С  | University of Florida                                   | Ag - Soil and Water Science                       |                  |                                                                                |                 |            | Entering, Within and Leaving Everglades<br>Stormwater Treatment Areas (STAs)                        |                             |                 |                   |
| Michael Harris (S)     | PI | * University of Florida                                 | Chemistry                                         | No other support |                                                                                |                 | P19469     | ML-HARRIS-001: Analysis of RNA induced                                                              | Biology,                    | 1               | 3                 |
| Matthew Eddy (S)       | С  | University of Florida                                   | Chemistry                                         |                  |                                                                                |                 |            | protein folding during ribonucleoprotein<br>assembly                                                | Biochemistry,<br>Biophysics |                 |                   |
| Joanna Long (S)        | PI | University of Florida                                   | Biochemistry & Molecular Biology                  | No other support |                                                                                |                 | P19543     | Maintenance: Routine maintenance of                                                                 | Biology,                    | 1               | 33.67             |
| James H.P. Collins (P) | С  | University of Florida                                   | Biochemistry & Molecular Biology                  |                  |                                                                                |                 |            | existing equipment (formerly P09510 and                                                             | Biochemistry,               |                 |                   |
| Thomas Mareci (S)      | С  | University of Florida                                   | Biochemistry and Molecular Biology                |                  |                                                                                |                 |            | P17541)                                                                                             | Biophysics                  |                 |                   |
| Anil Mehta (O)         | С  | University of Florida                                   | AMRIS                                             |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| James Rocca (S)        | С  | University of Florida                                   | AMRIS Affiliated Faculty & Staff                  |                  |                                                                                |                 |            |                                                                                                     |                             |                 | 1                 |
| Jens Rosenberg (S)     | С  | National High Magnetic Field<br>Laboratory              | NMR                                               |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
| Huadong Zeng (S)       | С  | University of Florida                                   | AMRIS Affiliated Faculty & Staff                  |                  |                                                                                |                 |            |                                                                                                     |                             |                 |                   |
|                        |    |                                                         |                                                   |                  |                                                                                |                 |            | Total Proposals:<br>31                                                                              | Expe                        | eriments:<br>31 | Days:<br>1,316.00 |

## 2. DC Field Facility

|                            |    | Participants<br>(Name, Role, Org., Dept                  |                                            | (Fu              | Funding Source<br>nding Agency, Divisio |             | Proposal # | Proposal Title                                                         | Discipline                  | Exp.<br># | Days<br>Used |
|----------------------------|----|----------------------------------------------------------|--------------------------------------------|------------------|-----------------------------------------|-------------|------------|------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Dmitry Smirnov (S)         | PI | National High Magnetic Field                             | Instrumentation & Operations               | No other         | nuing Agency, Divisio                   | n, Awara #j | P09593     | Testing new probes and techniques                                      | Magnets,                    | 1         | 7            |
| Yuxuan Jiang (P)           | С  | Laboratory<br>National High Magnetic Field               | CMS                                        | support          |                                         |             |            | for high-field optical<br>magnetospectroscopy                          | Materials                   |           |              |
| Zhengguang Lu (G)          | С  | Laboratory<br>National High Magnetic Field               | Physics                                    |                  |                                         |             |            |                                                                        |                             |           |              |
| Seongphill Moon (G)        | С  | Laboratory<br>National High Magnetic Field               | Physics                                    |                  |                                         |             |            |                                                                        |                             |           |              |
| Mykhaylo Ozerov (S)        | С  | Laboratory<br>National High Magnetic Field<br>Laboratory | Condensed Matter Science, DC Field CMS     |                  |                                         |             |            |                                                                        |                             |           |              |
| Dmitry Semenov (T)         | С  | National High Magnetic Field<br>Laboratory               | DC Field                                   |                  |                                         |             |            |                                                                        |                             |           |              |
| Dmytro Abraimov (S)        | PI | National High Magnetic Field<br>Laboratory               | The Applied Superconductivity Center       | NSF              | DMR - Division of<br>Materials Research | DMR1644779  | P13640     | Angular dependence of Jc for modern<br>ReBCO Coated Conductors at high | Magnets,<br>Materials       | 1         | 4.73         |
| Griffin Bradford (O)       | C  | National High Magnetic Field                             | Applied Superconductivity Center           |                  |                                         |             |            | magnetic fields                                                        |                             |           |              |
| Ashleigh Francis (T)       | С  | Laboratory<br>National High Magnetic Field               | ASC                                        |                  |                                         |             |            |                                                                        |                             |           |              |
| Jan Jaroszynski (S)        | С  | Laboratory<br>National High Magnetic Field               | CMS                                        |                  |                                         |             |            |                                                                        |                             |           |              |
| David Larbalestier (S)     | С  | Laboratory<br>National High Magnetic Field<br>Laboratory | ASC                                        |                  |                                         |             |            |                                                                        |                             |           |              |
| Tim Murphy (S)             | PI | National High Magnetic Field<br>Laboratory               | Operations                                 | No other support |                                         |             | P14838     | Testing of Resistive and Hybrid<br>magnets and power supplies in the   | Magnets,<br>Materials       | 1         | -0.05        |
| Scott Bole (S)             | С  | National High Magnetic Field<br>Laboratory               | MS&T                                       |                  |                                         |             |            | DC Field Facility                                                      |                             |           |              |
| William Brey (S)           | С  | National High Magnetic Field<br>Laboratory               | NMR                                        |                  |                                         |             |            |                                                                        |                             |           |              |
| Bryon Dalton (S)           | С  | National High Magnetic Field<br>Laboratory               | Instrumentation                            |                  |                                         |             |            |                                                                        |                             |           |              |
| Larry Gordon (T)           | С  | National High Magnetic Field<br>Laboratory               | Instrumentation                            |                  |                                         |             |            |                                                                        |                             |           |              |
| Scott Hannahs (S)          | С  | National High Magnetic Field<br>Laboratory               | Instrumentation                            |                  |                                         |             |            |                                                                        |                             |           |              |
| llya Litvak (S)            | С  | National High Magnetic Field<br>Laboratory               | CIMAR/NMR                                  |                  |                                         |             |            |                                                                        |                             |           |              |
| Ju-Hyun Park (S)           | С  | National High Magnetic Field<br>Laboratory               | Instrumentation & Operations, User Support |                  |                                         |             |            |                                                                        |                             |           |              |
| Julia Smith (S)            | C  | National High Magnetic Field<br>Laboratory               | DC Field                                   |                  |                                         |             |            |                                                                        |                             |           |              |
| Jack Toth (S)              | C  | National High Magnetic Field<br>Laboratory               | MS&T                                       |                  |                                         |             |            |                                                                        |                             |           |              |
| Haidong Zhou (S)           | PI | University of Tennessee,<br>Knoxville                    | Physics and Astronomy                      | NSF              | DMR - Division of<br>Materials Research | DMR1350002  | P14982     | Studies on low temperature physical<br>properties of new quantum spin  | Condensed<br>Matter Physics | 1         | 7            |
| Eun Sang Choi (S)          | C  | National High Magnetic Field<br>Laboratory               | Physics Department                         |                  |                                         |             |            | liquid and spin-orbital liquid<br>candidates                           |                             |           |              |
| Qing Huang (G)             | С  | University of Tennessee,<br>Knoxville                    | Physics                                    |                  |                                         |             |            |                                                                        |                             |           |              |
| Kyle Noordhoek (U)         | С  | University of Tennessee,<br>Knoxville                    | Physics and Astronomy                      |                  |                                         |             |            |                                                                        |                             |           |              |
| Chengkun Xing (G)          | C  | University of Tennessee,<br>Knoxville                    | Physics                                    |                  |                                         |             |            |                                                                        |                             |           |              |
| Han Zhang (P)              | С  | University of Tennessee                                  | Physics                                    | 1                |                                         |             |            |                                                                        |                             |           | 1            |
| Chun Ning (Jeanie) Lau (S) | PI | Ohio State University                                    | Department of Physics and Astronomy        | DOE              | OC - BES                                | SC0020187   | P16071     | Symmetry-broken Quantum Hall                                           | Condensed                   | 2         | 13.17        |
| Emilio Codecido (G)        | С  | Ohio State University                                    | Physics                                    | 1                |                                         |             |            | States and Phase Diagrams in 2D                                        | Matter Physics              |           | 1            |
| Xueshi Gao (G)             | c  | Ohio State University                                    | Physics                                    | 1                |                                         |             |            | Materials                                                              |                             |           | 1            |
| Dmitry Shcherbakov (G)     | c  | Ohio State University                                    | Physics                                    | 1                |                                         |             |            |                                                                        |                             |           | 1            |
|                            | c  |                                                          |                                            | 1                |                                         |             |            |                                                                        |                             |           | 1            |
| Dmitry Smirnov (S)         |    | NHMFL<br>Obio State University                           | Instrumentation & Operations               | 1                |                                         |             |            |                                                                        |                             |           | 1            |
| Haidong Tian (G)           | C  | Ohio State University                                    | Physics                                    | 1                |                                         |             |            |                                                                        |                             |           | 1            |
| Jiawei Yang (G)            | С  | University of California,<br>Riverside                   | Physics                                    | 1                |                                         |             |            |                                                                        | 1                           |           | 1            |

|                            | Jiang (P)     C     NHMFL     CMS       Smirnov (S)     C     National High Magnetic Field     Instrumentaboratory       Zhao (G)     C     Georgia Institute of School of F     School of F       Zhao (G)     C     Georgia Institute of School of F     School of F       Zhao (G)     C     Georgia Institute of School of F     Physics of School of F       Chko (S)     PI     Ioffe Physical-Technical Institute of the Russian Academy of Sciences     Physics of Sciences       Feiffer (S)     C     Princeton University     Electrical E       Suslov (S)     C     Ioffe Physical-Technical Physics of Sciences     Physics of Sciences       Suslov (S)     C     National High Magnetic Field Condensed Laboratory     Condensed Laboratory       st (S)     C     Princeton University     Princeton Intersity       Signmov (S)     PI     National High Magnetic Field Instrumentaboratory | .)                                          | (Fund                                                              | Funding Sou<br>ding Agency, Divis |                                                       | Proposal #                                                                                                                 | Proposal Title | Discipline                                                                                                                                                                                                  | Exp.<br>#                   | Days<br>Used |      |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|------|
| Zhigang Jiang (S)          | PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Georgia Institute of                        | School of Physics                                                  | DOE                               | Office of Science -<br>BES – Basic Energy<br>Sciences | DE-FG02-07ER46451                                                                                                          | P16079         | Magneto-infrared Spectroscopy<br>Study of Emerging Topological<br>Materials with Layered Structures                                                                                                         | Condensed<br>Matter Physics | 2            | 17   |
| Yuxuan Jiang (P)           | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NHMFL                                       | CMS                                                                |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Dmitry Smirnov (S)         | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             | Instrumentation & Operations                                       |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Tianhao Zhao (G)           | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             | School of Physics                                                  |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Irina Drichko (S)          | ΡI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Institute of the Russian                    | Physics of Semiconductors and Dielectrics                          | Russian<br>Academy of<br>Sciences | Other                                                 | Program 'Physics and<br>technology of<br>nanostructures,<br>nanoelectronics and<br>diagnostics' of the<br>Presidium of RAS | P16087         | High-frequency magnetotransport in<br>high-mobility n-AlGaAs/GaAs/AlGaAs<br>heterostructures with wide quantum<br>well near the filling factor with even<br>denominators, ½ and others:<br>Acoustic studies | Condensed<br>Matter Physics | 1            | 21   |
| Loren Pfeiffer (S)         | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Princeton University                        | Electrical Engineering                                             |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Ivan Smirnov (S)           | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Institute of the Russian                    | Physics of Semiconductors and Dielectrics                          |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Alexey Suslov (S)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National High Magnetic Field                | Condensed Matter Science                                           |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Ken West (S)               | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Princeton University                        | Princeton Institute for the Science and<br>Technology of Materials |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Dmitry Smirnov (S)         | PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                             | Instrumentation & Operations                                       | DOE                               | Office of Science -<br>BES – Basic Energy<br>Sciences | DE- FG02-07ER46451                                                                                                         | P16234         | Electrical and magnetic field control<br>of optical processes in mono- and<br>few-layer transition metal                                                                                                    | Condensed<br>Matter Physics | 1            | 1.29 |
| Yuxuan Jiang (P)           | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National High Magnetic Field<br>Laboratory  | CMS                                                                |                                   |                                                       |                                                                                                                            |                | dichalcogenides                                                                                                                                                                                             |                             |              |      |
| Zhigang Jiang (S)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Georgia Institute of<br>Technology          | School of Physics                                                  |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Zhengguang Lu (G)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NHMFL                                       | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Taichi Terashima (S)       | PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | National Institute for<br>Materials Science | Quantum Transport Properties Group                                 | NIMS                              | Non US<br>Government Lab                              |                                                                                                                            | P16248         | Fermi surface studies of iron-based<br>superconductors and other exotic                                                                                                                                     | Condensed<br>Matter Physics | 1            | 5    |
| David Graf (S)             | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NHMFL                                       | DC Field CMS                                                       |                                   |                                                       |                                                                                                                            |                | materials                                                                                                                                                                                                   |                             |              |      |
| Hishiro Hirose (P)         | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National Institute for<br>Materials Science | Nano-quantum Transport Group                                       |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Naoki Kikugawa (S)         | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National Institute for<br>Materials Science | Superconducting Properties Unit                                    |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Philip Kim (S)             | PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Harvard University                          | Department of Physics                                              | DOE                               | OS - BES                                              | DOE DE-SC0012260                                                                                                           | P16250         | Unconventional quantum Hall effect                                                                                                                                                                          | Condensed                   | 1            | 7    |
| Laurel Anderson (G)        | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | in 2D material Heterostructures                                                                                                                                                                             | Matter Physics              |              |      |
| Kristiaan De Greve (P)     | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Rebecca Engelke (G)        | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Ryan Gelly (G)             | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Onder Gul (P)              | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Department of Physics                                              |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Danial Haei Najafabadi (U) | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Applied Physics                                                    |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Zeyu Hao (G)               | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Katie Huang (G)            | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Luis Jauregui (P)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | College of Science                                                 |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Andrew Joe (G)             | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             |              |      |
| Jia Li (S)                 | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Brown University                            | Department of Physics                                              |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Xiaomeng Liu (G)           | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Zhengguang Lu (G)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NHMFL                                       | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Joon Young Park (P)        | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Kateryna Pistunova (G)     | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Stanford University                         | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Yuval Ronen (P)            | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Giovanni Scuri (G)         | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Jiho Sung (P)              | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard university                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Andrey Sushko (G)          | С                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Thomas Werkmeister (G)     | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Applied Physics                                                    |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Hyobin Yoo (P)             | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Jonathan Zauberman (G)     | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| Xilin Zhou (U)             | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Physics                                                            |                                   |                                                       |                                                                                                                            |                | 1                                                                                                                                                                                                           |                             |              |      |
| You Zhou (P)               | c                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Harvard University                          | Department of Physics                                              |                                   |                                                       |                                                                                                                            |                |                                                                                                                                                                                                             |                             | I            | 1    |

|                            |    | Participants<br>(Name, Role, Org., Dept.                 | )                                           | (Fu                               | Funding Sourc<br>nding Agency, Divisio              |              | Proposal # | Proposal Title                                                                        | Discipline                              | Exp.<br># | Days<br>Used |
|----------------------------|----|----------------------------------------------------------|---------------------------------------------|-----------------------------------|-----------------------------------------------------|--------------|------------|---------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Joseph Checkelsky (S)      | PI | Massachusetts Institute of<br>Technology                 | Physics                                     | NSF                               | DMR - Division of<br>Materials Research             | DMR1554891   | P16258     | High Field Studies of Magnetic Weyl<br>Semimetals                                     | Condensed<br>Matter Physics             | 2         | 13.94        |
| Aravind Devarakonda (G)    | С  | Massachusetts Institute of                               | Physics                                     | МІТ                               | Other                                               |              |            |                                                                                       | ,                                       |           |              |
| David Graf (S)             | с  | Technology<br>National High Magnetic Field               | DC Field CMS                                |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Minyong Han (G)            | С  | Laboratory<br>Massachusetts Institute of                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
|                            | c  | Technology<br>Massachusetts Institute of                 |                                             |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Hisashi Inoue (P)          |    | Technology                                               | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Takashi Kurumaji (P)       | С  | Massachusetts Institute of<br>Technology                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Takehito Suzuki (P)        | С  | Massachusetts Institute of<br>Technology                 | Department of Physics                       |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Joshua Wakefield (G)       | С  | Massachusetts Institute of<br>Technology                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Linda Ye (G)               | С  | Massachusetts Institute of<br>Technology                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Junbo Zhu (G)              | С  | Massachusetts Institute of<br>Technology                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Fernando Machado (S)       | PI | Federal University of<br>Pernambuco                      | Physics                                     | CNPq                              | Other                                               |              | P16271     | Thermal Conductivity Of Yig At High-<br>Applied Magnetic Fields And Low               | Condensed<br>Matter Physics             | 1         | 5.47         |
| Luis Balicas (S)           | С  | National High Magnetic Field<br>Laboratory               | Condensed Matter Experiment                 |                                   |                                                     |              |            | Temperatures                                                                          |                                         |           |              |
| Alimamy Bangura (S)        | С  | National High Magnetic Field<br>Laboratory               | CMS                                         |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Danilo Ratkovski (G)       | С  | Federal University of<br>Pernambuco                      | Departamento de Fisica                      |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Mike Sumption (S)          | PI | Ohio State University                                    | CSMM, MSE                                   | DOE                               | Office of Science -<br>HEP – High Energy<br>Physics | DE-SC0013849 | P16278     | High Field Transport Properties in<br>ternary and Binary APC type Nb3Sn<br>Conductors | Magnets,<br>Materials                   | 1         | 5.8          |
| Mattia Ortino (G)          | С  | Technical University of Wien                             | Low Temperature and Superconductivity Group | DOE                               | Office of Science -<br>HEP – High Energy<br>Physics | DE-SC0017755 |            |                                                                                       |                                         |           |              |
| Jacob Rochester (G)        | С  | Ohio State University                                    | Materials Science                           |                                   | Flysics                                             |              |            |                                                                                       |                                         |           |              |
| Xingchen Xu (S)            | C  | Fermi National Accelerator<br>Laboratory                 | Magnet System                               |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| David Graf (S)             | PI | National High Magnetic Field<br>Laboratory               | DC Field CMS                                | No other<br>support               |                                                     |              | P16282     | Study of the Electronic Structures of<br>Doped Dirac Metals and Topological           | Condensed<br>Matter Physics             | 1         | 4            |
| Ryan Baumbach (S)          | С  | National High Magnetic Field<br>Laboratory               | CMS                                         |                                   |                                                     |              |            | Insulators                                                                            | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |           |              |
| Theo Siegrist (S)          | С  | National High Magnetic Field                             | Chemical and Biomedical Engineering         |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Kaya Wei (P)               | С  | Laboratory<br>National High Magnetic Field<br>Laboratory | CMS                                         |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Louis Taillefer (S)        | PI | University of Sherbrooke                                 | Physics                                     | CFI, NSERC,<br>Canada<br>Research | Other                                               |              | P16283     | Transport studies of the pseudogap<br>critical point of cuprates                      | Condensed<br>Matter Physics             | 1         | 4.07         |
| Jordan Baglo (P)           | С  | University of Sherbrooke                                 | Department of Physics                       | Chair                             |                                                     |              |            |                                                                                       |                                         |           |              |
| Nicolas Doiron-Leyraud (S) | С  | University of Sherbrooke                                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Adrien Gourgout (P)        | С  | University of Sherbrooke                                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Gaël Grissonnanche (G)     | С  | University of Sherbrooke                                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| Etienne Lefrançois (G)     | С  | University of Sherbrooke                                 | Physics                                     |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
| l                          |    |                                                          |                                             |                                   |                                                     |              |            |                                                                                       |                                         |           |              |
|                            |    |                                                          |                                             |                                   |                                                     |              |            |                                                                                       |                                         |           |              |

| Pranav Thekke Madathil (G)                                                                                                                                        | PI<br>C<br>C<br>C<br>C<br>C<br>C<br>C | (Name, Role, Org., Dept.<br>Princeton University<br>Princeton University<br>National High Magnetic Field<br>Laboratory<br>Princeton University | Department of Electrical Engineering<br>Electrical Engineering | NSF                                     | ling Agency, Divisi                                                  | DMR1157490                             | P16287 | Droking Evotic Dhoses of Interacting                                                             | Condensed                   | 1 | Used |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------|----------------------------------------|--------|--------------------------------------------------------------------------------------------------|-----------------------------|---|------|
| Hao Deng (G)<br>David Graf (S)<br>Md Shafayat Hossain (P)<br>Meng Ma (G)<br>Siddharth Kumar Singh (G)<br>Pranav Thekke Madathil (G)<br>Kevin Villegas Rosales (G) | C<br>C<br>C<br>C<br>C                 | Princeton University<br>National High Magnetic Field<br>Laboratory                                                                             | Electrical Engineering                                         |                                         |                                                                      |                                        | P16287 | Probing Exotic Phases of Interacting                                                             | Condensed                   | 1 | 19   |
| David Graf (S)<br>Md Shafayat Hossain (P)<br>Meng Ma (G)<br>Siddharth Kumar Singh (G)<br>Pranav Thekke Madathil (G)<br>Kevin Villegas Rosales (G)                 | c<br>c<br>c<br>c                      | National High Magnetic Field<br>Laboratory                                                                                                     |                                                                |                                         |                                                                      |                                        |        | Electrons in Low-dimensional                                                                     | Matter Physics              |   | -    |
| Md Shafayat Hossain (P)<br>Meng Ma (G)<br>Siddharth Kumar Singh (G)<br>Pranav Thekke Madathii (G)<br>Kevin Villegas Rosales (G)                                   | c<br>c<br>c                           | Laboratory                                                                                                                                     |                                                                |                                         |                                                                      |                                        |        | Systems                                                                                          |                             |   |      |
| Meng Ma (G)<br>Siddharth Kumar Singh (G)<br>Pranav Thekke Madathil (G)<br>Kevin Villegas Rosales (G)                                                              | C<br>C                                | Princeton University                                                                                                                           | DC Field CMS                                                   |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Siddharth Kumar Singh (G)<br>Pranav Thekke Madathil (G)<br>Kevin Villegas Rosales (G)                                                                             | C                                     |                                                                                                                                                | Physics                                                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Pranav Thekke Madathil (G)<br>Kevin Villegas Rosales (G)                                                                                                          |                                       | Princeton University                                                                                                                           | Electrical Engineering                                         |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Kevin Villegas Rosales (G)                                                                                                                                        | C                                     | Princeton University                                                                                                                           | Electrical Engineering                                         |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   |                                       | Princeton University                                                                                                                           | Electrical Engineering                                         |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Shanti Deemyad (S)                                                                                                                                                | С                                     | Princeton University                                                                                                                           | Electrical Engineer                                            |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   | PI                                    | University of Utah                                                                                                                             | Physics and Astronomy                                          | DOE                                     | Office of Science -<br>EFRC - Energy<br>Frontier Research<br>Centers | DE-SC0020340                           | P17344 | Fermi Surface of Lithium Isotopes                                                                | Condensed<br>Matter Physics | 1 | 4.3  |
| Neil Ashcroft (S)                                                                                                                                                 | С                                     | Cornell University                                                                                                                             | Physics                                                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Tushar Bhowmick (G)                                                                                                                                               | С                                     | University of Utah (UT)                                                                                                                        | Physics and Astronomy                                          |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Stanimir Bonev (S)                                                                                                                                                | С                                     | Lawrence Livermore National<br>Laboratory                                                                                                      | Physics Division                                               |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| William Coniglio (S)                                                                                                                                              | С                                     | National High Magnetic Field<br>Laboratory                                                                                                     | A1                                                             |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Sabri Elatresh (P)                                                                                                                                                | с                                     | Cornell University                                                                                                                             | chemistry                                                      |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Audrey Grockowiak (S)                                                                                                                                             | c                                     | National High Magnetic Field                                                                                                                   | DC Field/CMS                                                   |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   |                                       | Laboratory                                                                                                                                     |                                                                |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Roald Hoffmann (S)                                                                                                                                                | С                                     | Cornell University                                                                                                                             | Dept. of Chemistry and Chemical Biology                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Stan Tozer (S)                                                                                                                                                    | c                                     | National High Magnetic Field                                                                                                                   | Physics                                                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   |                                       | Laboratory                                                                                                                                     | ,                                                              |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Sergei Zvyagin (S)                                                                                                                                                | PI                                    | Helmholtz-Zentrum Dresden-<br>Rossendorf                                                                                                       | EPR                                                            | Deutsche<br>Forschungs-<br>gemeinschaft | Non US Foundation                                                    | ZV 6/2-2                               | P17345 | Spin dynamics and magnetic<br>properties of spin systems with<br>competing magnetic interactions | Condensed<br>Matter Physics | 1 | 7    |
| David Graf (S)                                                                                                                                                    | С                                     | National High Magnetic Field<br>Laboratory                                                                                                     | DC Field CMS                                                   |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Hidekazu Tanaka (S)                                                                                                                                               | с                                     | Tokyo Institute of Technology                                                                                                                  | Physics                                                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Christianne Beekman (S)                                                                                                                                           | PI                                    | National High Magnetic Field<br>Laboratory                                                                                                     | Physics                                                        | NSF                                     | CAREER - Faculty<br>Early Career<br>Development                      | 1847887                                | P17363 | Frustrated magnetism in vanadium<br>oxides                                                       | Condensed<br>Matter Physics | 1 | 7    |
| Canada Kim (C)                                                                                                                                                    | с                                     | Florido Stato University                                                                                                                       | Dhusies                                                        |                                         | Program                                                              |                                        |        |                                                                                                  |                             |   |      |
| Sangsoo Kim (G)<br>Mykhaylo Ozerov (S)                                                                                                                            | с                                     | Florida State University<br>National High Magnetic Field                                                                                       | Physics<br>Condensed Matter Science, DC Field CMS              |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   |                                       | Laboratory                                                                                                                                     |                                                                |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Christie Thompson (G)                                                                                                                                             | С                                     | Florida State University                                                                                                                       | Materials Science and Engineering                              |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Biwen Zhang (G)                                                                                                                                                   | С                                     | Florida State University                                                                                                                       | Physics                                                        |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Mykhaylo Ozerov (S)                                                                                                                                               | PI                                    | National High Magnetic Field<br>Laboratory                                                                                                     | Condensed Matter Science, DC Field CMS                         | No other<br>support                     |                                                                      |                                        | P17373 | FTIR magneto-spectroscopy in the<br>NHMFL DC facility: new                                       | Magnets,<br>Materials       | 1 | 3.61 |
| Dmitry Semenov (T)                                                                                                                                                | С                                     | National High Magnetic Field<br>Laboratory                                                                                                     | DC Field                                                       |                                         |                                                                      |                                        |        | developments, tests and optimization<br>of experimental protocols                                |                             |   |      |
| Dmitry Smirnov (S)                                                                                                                                                | С                                     | National High Magnetic Field<br>Laboratory                                                                                                     | Instrumentation & Operations                                   |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Sara Haravifard (S)                                                                                                                                               | PI                                    | Duke University                                                                                                                                | Department of Physics                                          | NSF                                     | DMR - Division of<br>Materials Research                              | DMR1828348                             | P17377 | New Plateaus in the Doped Spin<br>Dimer System SrCu(2-x)Mgx(BO3)2 at                             | Condensed<br>Matter Physics | 1 | 7    |
| Eun Sang Choi (S)                                                                                                                                                 | с                                     | National High Magnetic Field<br>Laboratory                                                                                                     | Physics Department                                             | Duke<br>University                      | US College and<br>University                                         | William M Fairbank<br>Chair in Physics |        | High Fields                                                                                      |                             |   |      |
| Sachith Dissanayake (P)                                                                                                                                           | С                                     | Duke University                                                                                                                                | Physics                                                        | · ·                                     |                                                                      | •                                      |        |                                                                                                  |                             |   |      |
|                                                                                                                                                                   | C                                     | Duke University                                                                                                                                | Department of Physics                                          |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Joan Cano (S)                                                                                                                                                     | PI                                    | University of Valencia                                                                                                                         | Instituto de Ciencia Molecular                                 | No other                                |                                                                      |                                        | P17379 | Building quantum gates and quantum                                                               | Chemistry                   | 1 | 7    |
| Miguel Julve (S)                                                                                                                                                  | с                                     | University of Valencia                                                                                                                         | Inorganic Chemistry                                            | support                                 |                                                                      |                                        |        | computer by assembling<br>mononuclear single-molecule                                            |                             |   |      |
| Jurek Krzystek (S)                                                                                                                                                | с                                     | National High Magnetic Field                                                                                                                   | Condensed Matter Science                                       |                                         |                                                                      |                                        |        | magnets based on Co(II) and other 3d transition metal ions. In pursuit of                        |                             |   |      |
| Francoss Llorat (S)                                                                                                                                               | c                                     | Laboratory                                                                                                                                     | Institut de Ciència Molecular (ICMOL).                         |                                         |                                                                      |                                        |        | new physics in spintronics                                                                       |                             |   |      |
| Francesc Lloret (S)<br>Mykhaylo Ozerov (S)                                                                                                                        | c<br>c                                | University of Valencia<br>National High Magnetic Field                                                                                         | Condensed Matter Science, DC Field CMS                         |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Julia Vallejo (G)                                                                                                                                                 | С                                     | Laboratory<br>University of Valencia                                                                                                           | Chemistry                                                      |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |
| Marta Viciano-Chumillas (P)                                                                                                                                       | c                                     | University of Valencia                                                                                                                         | Instituto de Ciencia Molecular                                 |                                         |                                                                      |                                        |        |                                                                                                  |                             |   |      |

|                         |      | Participants<br>(Name, Role, Org., Dept.                               | )                                                  | (Fun                | Funding Sour<br>ding Agency, Divisi                          |            | Proposal # | Proposal Title                                                                | Discipline                              | Exp.<br># | Days<br>Used |
|-------------------------|------|------------------------------------------------------------------------|----------------------------------------------------|---------------------|--------------------------------------------------------------|------------|------------|-------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Gianluigi Veglia (S)    | PI   | University of Minnesota, Twin<br>Cities                                | BMBB                                               | NIH                 | NIGMS - National<br>Institute of General<br>Medical Sciences | GM064742   | P17438     | NMR Structural Analysis of<br>Sarcoplasmic Reticulum Proteins in<br>Membranes | Biology,<br>Biochemistry,<br>Biophysics | 1         | 5            |
| Riqiang Fu (S)          | С    | National High Magnetic Field<br>Laboratory                             | NMR                                                |                     |                                                              |            |            |                                                                               | ,                                       |           |              |
| Zhehong Gan (S)         | С    | National High Magnetic Field<br>Laboratory                             | NHMFL                                              |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Tata Gopinath (P)       | С    | University of Minnesota, Twin<br>Cities                                | Biochemistry                                       |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Erik Larsen (G)         | С    | University of Minnesota, Twin<br>Cities                                | Chemistry                                          |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Sarah Nelson (G)        | С    | University of Minnesota, Twin<br>Cities                                | Biochemistry, Molecular Biology, and<br>Biophysics |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Joana Paulino (P)       | С    | National High Magnetic Field<br>Laboratory                             | CIMAR                                              |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Songlin Wang (P)        | С    | University of Minnesota, Twin<br>Cities                                | Biochemistry, Molecular Biology, and<br>Biophysics |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Xiaoling Wang (P)       | С    | University of California, Santa<br>Barbara (UC Santa Barbara,<br>UCSB) | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Rongfu Zhang (P)        | С    | National High Magnetic Field<br>Laboratory                             | NHMFL                                              |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Enrique Colacio (S)     | PI * | University of Granada                                                  | Inorganic Chemistry                                | No other<br>support |                                                              |            | P17454     | High-frequency and -field EPR of 2D<br>Co(II) SMMs with different             | Chemistry                               | 1         | 7            |
| Jurek Krzystek (S)      | С    | National High Magnetic Field<br>Laboratory                             | Condensed Matter Science                           |                     |                                                              |            |            | hexacoordinated Co(II) ions.                                                  |                                         |           |              |
| Mykhaylo Ozerov (S)     | С    | National High Magnetic Field<br>Laboratory                             | Condensed Matter Science, DC Field CMS             |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Lu Li (S)               | PI   | University of Michigan                                                 | Physics                                            | NSF                 | DMR - Division of<br>Materials Research                      | DMR1707620 | P17469     | Spin-orbit-coupled Correlated Metals                                          | Condensed<br>Matter Physics             | 2         | 9            |
| Kuan-Wen Chen (P)       | С    | University of Michigan                                                 | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Lu Chen (G)             | С    | University of Michigan                                                 | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| William Coniglio (S)    | C    | National High Magnetic Field<br>Laboratory                             | A1                                                 |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Bernhard Keimer (S)     | С    | Max Planck Institute for Solid<br>State Research, Stuttgart            | Solid State Spectroscopy                           |                     |                                                              |            |            |                                                                               |                                         |           |              |
| David Mandrus (S)       | С    | University of Tennessee,<br>Knoxville                                  | Materials Science and Engineering                  |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Dmitri Mihaliov (G)     | С    | University of Michigan                                                 | Applied Physics                                    |                     |                                                              |            |            |                                                                               |                                         |           |              |
| John Singleton (S)      | C    | National High Magnetic Field<br>Laboratory                             | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Colin Tinsman (G)       | С    | University of Michigan                                                 | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Ziji Xiang (P)          | С    | University of Michigan                                                 | Physics                                            |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Jun Zhu (S)             | PI   | Pennsylvania State University                                          | Physics                                            | NSF                 | DMR - Division of<br>Materials Research                      | DMR1506212 | P17473     | Probing quasi-particle charge and<br>statistics in the quantum Hall and       | Condensed<br>Matter Physics             | 1         | 7            |
| Hailong Fu (P)          | С    | Pennsylvania State University                                          | Physics                                            |                     |                                                              |            |            | fractional quantum Hall regimes of                                            |                                         |           |              |
| Ke Huang (G)            | С    | Pennsylvania State University                                          | Physics                                            |                     |                                                              |            |            | bilayer graphene                                                              |                                         |           |              |
| Dragana Popovic (S)     | PI   | NHMFL                                                                  | Condensed Matter Science / Experimental            | No other<br>support |                                                              |            | P17479     | Transport Studies of Magnetic-Field-<br>Tuned Phase Transitions in Cuprates   | Condensed<br>Matter Physics             | 4         | 35.65        |
| Paul Baity (G)          | С    | NHMFL                                                                  | Physics                                            | NSF                 | DMR - Division of<br>Materials Research                      | DMR1707785 |            |                                                                               |                                         |           |              |
| Emilia Morosan (S)      | С    | Rice University                                                        | Physics and Astronomy                              |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Shimpei Ono (S)         | С    | Central Research Institute of<br>Electric Power Industry               | Materials Science Research Laboratory              |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Bal Pokharel (G)        | С    | NHMFL                                                                  | Physics                                            |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Helene Raffy (S)        | С    | University of Paris-Sud                                                | Laboratoire de Physique des Solides                |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Pratap Raychaudhuri (S) | С    | Tata Institute of Fund.<br>Research                                    | Condensed Matter Physics and Materials<br>Science  |                     |                                                              |            |            |                                                                               |                                         |           |              |
| Takao Sasagawa (S)      | С    | Tokyo Institute of Technology                                          | Materials and Structures Laboratory                |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Zhenzhong Shi (P)       | С    | Duke University                                                        | Department of Physics                              |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Lily Stanley (G)        | С    | NHMFL                                                                  | Physics and CMS, NHMFL                             |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Jasminka Terzic (P)     | С    | NHMFL                                                                  | CMS                                                |                     |                                                              |            |            | 1                                                                             |                                         |           |              |
| Yuxin Wang (G)          | С    | Florida State University                                               | CMS                                                |                     |                                                              |            |            |                                                                               |                                         |           |              |

|                            |      | Participants<br>(Name, Role, Org., Dept.                        | .)                             | (Fun                                           | Funding Sources<br>ding Agency, Division, Award #)                                            | Proposal # | Proposal Title                                                                                                                        | Discipline                              | Exp.<br># | Days<br>Used |
|----------------------------|------|-----------------------------------------------------------------|--------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Ayyalusamy Ramamoorthy (S) | PI   | University of Michigan                                          | Chemistry & Biophysics         | NIH                                            | NIGMS - National GM084018<br>Institute of General<br>Medical Sciences                         | P17486     | Solid-State NMR Experiments on<br>Magnetically-Aligned Polymer Macro-<br>Nanodiscs                                                    | Biology,<br>Biochemistry,<br>Biophysics | 1         | 4            |
| Riqiang Fu (S)             | С    | National High Magnetic Field<br>Laboratory                      | NMR                            |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Zhehong Gan (S)            | С    | National High Magnetic Field<br>Laboratory                      | NHMFL                          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Thirupathi Ravula (P)      | С    | University of Michigan                                          | Chemistry                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Tim Cross (S)              | PI * | <ul> <li>National High Magnetic Field<br/>Laboratory</li> </ul> | NHMFL/Chemistry & Biochemistry | NIH                                            | NIAID - National Al119178<br>Institute of Allergy<br>and Infectious<br>Diseases               | P17493     | Mycobacterium tuberculosis<br>Divisome: Insights on protein<br>structure and protein-protein<br>interaction of important drug targets | Biology,<br>Biochemistry,<br>Biophysics | 1         | 5            |
| Cristian Escobar (P)       | С    | National High Magnetic Field<br>Laboratory                      | IMB                            |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Joana Paulino (P)          | С    | National High Magnetic Field<br>Laboratory                      | CIMAR                          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Huajun Qin (T)             | С    | Florida State University                                        | Chemistry & Biochemistry       |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Yiseul Shin (G)            | С    | Florida State University                                        | Chemistry                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Joshua Taylor (U)          | С    | Florida State University                                        | Chemistry & Biochemistry       |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Rongfu Zhang (P)           | С    | National High Magnetic Field<br>Laboratory                      | NHMFL                          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Aaron Rossini (S)          | PI * | <ul> <li>Iowa State University</li> </ul>                       | Chemistry                      | NSF                                            | CBET - Chemical, CBET1916809<br>Bioengineering,<br>Environmental,<br>and Transport<br>Systems | P17500     | Enhancing the Resolution of 1H Solid-<br>State NMR Spectra With Fast MAS<br>and High Magnetic Fields                                  | Chemistry                               | 1         | 4            |
| Kuizhi Chen (P)            | С    | National High Magnetic Field<br>Laboratory                      | NMR                            |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Rick Dorn (G)              | С    | Iowa State University                                           | Chemistry                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Zhehong Gan (S)            | С    | National High Magnetic Field                                    | NHMFL                          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Ivan Hung (S)              | С    | Laboratory<br>National High Magnetic Field<br>Laboratory        | CIMAR/NMR                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Yining Huang (S)           | PI   | University of Western Ontario                                   | Chemistry                      | NSERC                                          | Other Non US<br>Federal Agency                                                                | P17504     | O-17 solid-state NMR of metal-<br>organic frameworks                                                                                  | Chemistry                               | 1         | 5            |
| Zhehong Gan (S)            | С    | National High Magnetic Field<br>Laboratory                      | NHMFL                          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Ivan Hung (S)              | С    | National High Magnetic Field<br>Laboratory                      | CIMAR/NMR                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Vinicius Martins (G)       | с    | University of Western Ontario                                   | Chemistry                      |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Jun Sung Kim (S)           | PI   | Pohang University of Science<br>and Technology                  | Physics                        | National<br>Research<br>Foundation<br>of Korea | Non US Foundation                                                                             | P17521     | Exotic topological transport induced<br>by spin/pseudospin texture at high<br>magnetic fields                                         | Condensed<br>Matter Physics             | 1         | 5.46         |
| Joonyoung Choi (G)         | С    | Kyungpook National<br>University                                | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Min Hyuk Choi (G)          | С    | Pohang University of Science<br>and Technology                  | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Ho Seong Jeon (G)          | С    | Pohang University of Science<br>and Technology                  | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| YounJung Jo (S)            | С    | Kyungpook National<br>University                                | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Woun Kang (S)              | С    | Ewha Womans University                                          | Department of Physics          |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Hoil Kim (G)               | С    | Pohang University of Science<br>and Technology                  | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
| Jong Mok Ok (G)            | с    | Oak Ridge National<br>Laboratory                                | Physics                        |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
|                            |      |                                                                 |                                |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |
|                            |      |                                                                 |                                |                                                |                                                                                               |            |                                                                                                                                       |                                         |           |              |

|                                     |    | Participants<br>(Name, Role, Org., Dept.)  |                                        | (5                               | Funding Sourc                                       |              | Proposal # | Proposal Title                                                                                            | Discipline                  | Exp. | Days  |
|-------------------------------------|----|--------------------------------------------|----------------------------------------|----------------------------------|-----------------------------------------------------|--------------|------------|-----------------------------------------------------------------------------------------------------------|-----------------------------|------|-------|
|                                     |    |                                            |                                        | -                                | ding Agency, Divisio                                | on, Award #) |            |                                                                                                           |                             | #    | Used  |
| Julia Smith (S)                     | PI | National High Magnetic Field<br>Laboratory | DC Field                               | No other<br>support              |                                                     |              | P17594     | Enhancement of the Infrastructure &<br>Instrumentation of the DC Field                                    | Magnets,<br>Materials       | 4    | 3.35  |
| Alimamy Bangura (S)                 | С  | National High Magnetic Field<br>Laboratory | CMS                                    | NSF                              | DMR - Division of<br>Materials Research             | DMR1644779   |            | Facility                                                                                                  |                             |      |       |
| William Brey (S)                    | С  | National High Magnetic Field<br>Laboratory | NMR                                    |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| William Coniglio (S)                | С  | National High Magnetic Field<br>Laboratory | A1                                     |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Kevin Gamble (O)                    | С  | National High Magnetic Field<br>Laboratory | Facilities                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Scott Hannahs (S)                   | С  | National High Magnetic Field<br>Laboratory | Instrumentation                        |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Michael Hicks (T)                   | С  | National High Magnetic Field<br>Laboratory | Instrumentation & Operations           |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Tra Hunter (O)                      | С  | National High Magnetic Field<br>Laboratory | Facilities                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| John Kynoch (S)                     | С  | National High Magnetic Field<br>Laboratory | Facilities                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Ilya Litvak (S)                     | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                              |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Tim Murphy (S)                      | С  | National High Magnetic Field<br>Laboratory | Operations                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Joel Piotrowski (T)                 | С  | National High Magnetic Field<br>Laboratory | Instrumentation & Operations           |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Andy Powell (S)                     | С  | National High Magnetic Field<br>Laboratory | Operations                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Eric Stiers (O)                     | С  | National High Magnetic Field<br>Laboratory | DC Field                               |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Sujana Sri Venkat Uppalapati<br>(O) | С  | National High Magnetic Field<br>Laboratory | DC Field Facility                      |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Marshall Wood (S)                   | С  | National High Magnetic Field<br>Laboratory | Facilities                             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Zhehong Gan (S)                     | PI | National High Magnetic Field<br>Laboratory | NHMFL                                  | No other<br>support              |                                                     |              | P17597     | Development of 1.5 GHz NMR using<br>36T Series-Connected-Hybrid (SCH)                                     | Magnets,<br>Materials       | 1    | 5     |
| William Brey (S)                    | С  | National High Magnetic Field<br>Laboratory | NMR                                    |                                  |                                                     |              |            | Magnet                                                                                                    |                             |      |       |
| Kuizhi Chen (P)                     | С  | National High Magnetic Field<br>Laboratory | NMR                                    |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Po-Hsiu Chien (G)                   | С  | Florida State University                   | Chemistry and Biochemistry             |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Tim Cross (S)                       | С  | National High Magnetic Field<br>Laboratory | NHMFL/Chemistry & Biochemistry         |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Ivan Hung (S)                       | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                              |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| llya Litvak (S)                     | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                              |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Joana Paulino (P)                   | С  | National High Magnetic Field<br>Laboratory | CIMAR                                  |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Jeffrey Schiano (S)                 | С  | Pennsylvania State University              | Electrical Engineering                 |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Alina Bienko (S)                    | PI | University of Wroclaw                      | Faculty of Chemistry                   | Wroclaw<br>University,<br>Poland | Non US College<br>and University                    |              | P17642     | Search for New Single-Molecule<br>Magnets: High-Field EPR Studies on<br>High-Spin Complexes of d-Electron | Chemistry                   | 2    | 10    |
| Andrew Ozarowski (S)                | С  | National High Magnetic Field<br>Laboratory | EMR                                    |                                  |                                                     |              |            | Metals – Co(II), Ni(II), Re(IV)                                                                           |                             |      |       |
| Mykhaylo Ozerov (S)                 | С  | National High Magnetic Field<br>Laboratory | Condensed Matter Science, DC Field CMS |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Sebastian Stoian (S)                | С  | University of Idaho                        | Chemistry                              |                                  |                                                     |              |            |                                                                                                           |                             |      |       |
| Chiara Tarantini (S)                | PI | National High Magnetic Field<br>Laboratory | Applied Superconductivity Center       | DOE                              | Office of Science -<br>HEP – High Energy<br>Physics | DE-SC0012083 | P17643     | Characterization of state-of-the-art<br>and experimental Nb3Sn wires                                      | Condensed<br>Matter Physics | 2    | 10.75 |
| Shreyas Balachandran (P)            | С  | Florida State University                   | Applied Superconductivity Center       | CERN                             | Other                                               |              |            |                                                                                                           | 1                           |      | 1     |
| Jan Jaroszynski (S)                 | c  | National High Magnetic Field<br>Laboratory | CMS                                    | CENT                             | Stier                                               |              |            |                                                                                                           |                             |      |       |
| Nawaraj Paudel (G)                  | С  | Florida State University                   | Physics                                |                                  |                                                     |              |            |                                                                                                           |                             |      |       |

|                           |    | Participants<br>(Name, Role, Org., Dept.   | )                                      | (Fun                                 | Funding Sour<br>ling Agency, Divis |                  | Proposal # | Proposal Title                                                         | Discipline                  | Exp.<br># | Days<br>Used |
|---------------------------|----|--------------------------------------------|----------------------------------------|--------------------------------------|------------------------------------|------------------|------------|------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Yasuyuki Nakajima (S)     | PI | University of Central Florida              | Physics                                | University of<br>Central             | US College and<br>University       |                  | P17651     | Magnetic and thermal properties in<br>topological phases of matter     | Condensed<br>Matter Physics | 1         | 5.46         |
| Charuni Dissanayake (G)   | С  | University of Central Florida              | Physics                                | Florida                              |                                    |                  |            |                                                                        |                             |           | 1            |
| Riffat Munir (G)          | С  | University of Central Florida              | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| K A M Hasan Siddiquee (G) | c  | University of Central Florida              | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Chun Hung Lui (S)         | PI | University of California,                  | Physics                                | University of                        | US College and                     |                  | P17665     | Probing the high-order few-body                                        | Condensed                   | 1         | 6            |
| 0 ()                      |    | Riverside                                  |                                        | California,<br>Riverside             | University                         |                  |            | states in two-dimensional materials<br>by magneto-optical spectroscopy | Matter Physics              |           |              |
| Mashael Altaiary (G)      | С  | UC, Riverside                              | Physics and Astronomy                  |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Erfu Liu (P)              | С  | UC, Riverside a, Riverside                 | Astronomy & Physics                    |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Zhengguang Lu (G)         | С  | NHMFL                                      | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Dmitry Smirnov (S)        | С  | NHMFL                                      | Instrumentation & Operations           |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Jeremiah van Baren (G)    | С  | University of California,<br>Riverside     | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Matthew Wilson (G)        | С  | University of California,<br>Riverside     | Physics and Astronomy                  |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Kin Fai Mak (S)           | PI | Pennsylvania State University              | Physics                                | DOD                                  | ONR - Office of<br>Naval Research  | N00014-18-1-2368 | P17668     | Investigating van der Waals<br>superconducting heterostructures in     | Condensed<br>Matter Physics | 3         | 13.8         |
| Kaifei Kang (G)           | С  | Cornell University                         | Applied and engineering physics        |                                      |                                    |                  |            | the high-field, paramagnetic limit                                     | 1                           |           | 1            |
| Tingxin Li (P)            | С  | Cornell University                         | AEP                                    |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Jie Shan (S)              | С  | Pennsylvania State University              | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Dmitry Smirnov (S)        | С  | NHMFL                                      | Instrumentation & Operations           |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Egon Sohn (G)             | С  | Cornell University                         | Applied Engineering and Physics        |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Jiacheng Zhu (G)          | С  | Cornell University                         | Applied and Engineering Physics        |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Huiqiu Yuan (S)           | PI | Zhejiang University                        | Physics Department                     | NSFC                                 | Non US Foundation                  | No. U1632275     | P17765     | Evolution of the electronic structure                                  | Condensed                   | 1         | 4            |
| Feng Du (G)               | С  | Zhejiang University                        | Physics                                |                                      |                                    |                  |            | in novel quantum critical systems                                      | Matter Physics              |           | 1            |
| David Graf (S)            | С  | National High Magnetic Field               | DC Field CMS                           |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| (-)                       | -  | Laboratory                                 |                                        |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Bin Shen (G)              | С  | Zhejiang University                        | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Michael Smidman (P)       | С  | Zhejiang University                        | Center for Correlated Matter /Physics  |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| An Wang (G)               | С  | Zhejiang University                        | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Ziling Xue (S)            | PI | University of Tennessee,<br>Knoxville      | Chemistry                              | NSF                                  | CHE - Chemistry                    | CHE1900296       | P17767     | Investigating Molecular Magnetism<br>by Magneto-Far-IR Spectroscopy    | Chemistry                   | 3         | 21           |
| Alexandria Bone (G)       | С  | University of Tennessee,<br>Knoxville      | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Adam Hand (G)             | С  | University of Tennessee,<br>Knoxville      | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Brian Kettell (G)         | С  | University of Tennessee Space<br>Institute | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Duncan Moseley (G)        | С  | University of Tennessee,<br>Knoxville      | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Mykhaylo Ozerov (S)       | с  | NHMFL                                      | Condensed Matter Science, DC Field CMS |                                      |                                    |                  |            |                                                                        | 1                           |           | 1            |
| Dmitry Smirnov (S)        | c  | NHMFL                                      | Instrumentation & Operations           |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| Pagnareach Tin (G)        | C  | University of Tennessee,<br>Knoxville      | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Chelsea Widener (G)       | С  | University of Tennessee,<br>Knoxville      | Chemistry                              |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Minhyea Lee (S)           | PI | University of Colorado,<br>Boulder         | Physics                                | University of<br>Colorado<br>Boulder | US College and<br>University       |                  | P17772     | Probing novel magnetism in spin-<br>orbit coupled systems              | Condensed<br>Matter Physics | 1         | 7            |
| Gang Cao (S)              | С  | University of Colorado,<br>Boulder         | Department of Physics.                 | Douidei                              |                                    |                  |            |                                                                        |                             |           |              |
| Kwang Yong Choi (S)       | С  | Chung Ang University                       | Department of Physics                  |                                      |                                    |                  |            |                                                                        |                             |           | 1            |
| lan Leahy (G)             | c  | University of Colorado,<br>Boulder         | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Tyrel McQueen (S)         | С  | Johns Hopkins University                   | Chemistry and Physics and Astronomy    |                                      |                                    |                  |            |                                                                        | 1                           |           | 1            |
| Christopher Pocs (G)      | c  | University of Colorado,<br>Boulder         | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           |              |
| Peter Siegfried (G)       | С  | University of Colorado,<br>Boulder         | Physics                                |                                      |                                    |                  |            |                                                                        |                             |           |              |

|                                            |         | Participants<br>(Name, Role, Org., Dept             | .)                                              | (Fun                   | Funding Sour<br>ding Agency, Divis                    |              | Proposal #       | Proposal Title                                                                    | Discipline                  | Exp.<br># | Days<br>Used |
|--------------------------------------------|---------|-----------------------------------------------------|-------------------------------------------------|------------------------|-------------------------------------------------------|--------------|------------------|-----------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Eun Sang Choi (S)                          | PI      | National High Magnetic Field<br>Laboratory          | Physics Department                              | No other<br>support    |                                                       |              | P17780           | Magnetothermal conductivity studies<br>on breathing pyrochlore magnets            | Condensed<br>Matter Physics | 1         | 6            |
| Hongwoo Baek (S)                           | С       | National High Magnetic Field<br>Laboratory          | DC field                                        |                        |                                                       |              |                  | 5                                                                                 |                             |           |              |
| Rabindranath Bag (P)                       | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Sachith Dissanayake (P)                    | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Matthew Ennis (G)                          | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Sara Haravifard (S)                        | С       | Duke University                                     | Department of Physics                           |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Hongcheng Lu (P)                           | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Zhenzhong Shi (P)                          | С       | Duke University                                     | Department of Physics                           |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| William Steinhardt (G)                     | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Lalit Yadav (G)                            | С       | Duke University                                     | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Sabyasachi Sen (S)                         | PI      | University of California, Davis                     | Chemical Engineering and Materials Science      | NSF                    | DMR - Division of<br>Materials Research               | DMR1855176   | P17811           | Investigation of the atomistic basis of<br>structural relaxation and viscous flow | Condensed<br>Matter Physics | 1         | 4            |
| Zhehong Gan (S)                            | С       | National High Magnetic Field<br>Laboratory          | NHMFL                                           |                        |                                                       |              |                  | in supercooled chalcogenide liquids<br>by high field dynamical NMR                |                             |           |              |
| Ivan Hung (S)                              | C       | National High Magnetic Field<br>Laboratory          | CIMAR/NMR                                       |                        |                                                       |              |                  | spectroscopy                                                                      |                             |           |              |
| Yiqing Xia (G)                             | С       | University of California, Davis                     | Materials Science                               | 1                      |                                                       |              |                  |                                                                                   |                             |           |              |
| Weidi Zhu (G)                              | С       | University of California, Davis                     | Materials Science & Engineering                 |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Xiaodong Xu (S)                            | PI      | University of Washington                            | Physics                                         | DOE                    | Office of Science -<br>BES – Basic Energy<br>Sciences | DE-SC0019443 | P17854           | pressure tuning magnetic properties<br>of van der Waals magnets                   | Condensed<br>Matter Physics | 1         | 23.76        |
| Jiun-Haw Chu (S)                           | С       | University of Washington                            | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Zaiyao Fei (P)                             | С       | University of Washington                            | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| David Graf (S)                             | C       | National High Magnetic Field<br>Laboratory          | DC Field CMS                                    |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Tiancheng Song (G)                         | С       | University of Washington                            | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Matthew Yankowitz (S)                      | С       | University of Washington                            | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Qi Zhang (P)                               | С       | University of Washington<br>(UW)                    | Physics and Astronomy                           |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Hugen Yan (S)                              | PI      | Fudan University                                    | Physics                                         | Fudan<br>University    | Non US College<br>and University                      |              | P17878           | Magneto-optical Spectroscopy of<br>topological semimetals in the                  | Condensed<br>Matter Physics | 1         | 8            |
| Chaoyu Song (G)                            | С       | Fudan University                                    | Physics                                         |                        |                                                       |              |                  | quantum limit                                                                     |                             |           |              |
| Yunkun Yang (G)                            | С       | Fudan University                                    | Dept. of Physics                                |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Minhao Zhao (G)                            | C       | Fudan University                                    | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Yoram Dagan (S)                            | PI      | Tel-Aviv University                                 | School of Physics and Astronomy                 | Tel Aviv<br>University | Non US Foundation                                     | 382/17       | P17882           | TaS2 exotic phases of Quantum Spin<br>Liquid and P-wave superconductivity         | Condensed<br>Matter Physics | 1         | 5.93         |
| Shay Sandik (U)                            | С       | Tel-Aviv University                                 | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Itai Silber (G)<br>Christianne Beekman (S) | C<br>PI | Tel-Aviv University<br>National High Magnetic Field | Physics<br>Physics                              | NSF                    | CAREER - Faculty                                      | 184788       | 87 <b>P17889</b> | The effect of strain and confinement                                              | Condensed                   | 1         | 7            |
| David Graf (S)                             | C       | Laboratory<br>National High Magnetic Field          | DC Field CMS                                    | INSF                   | CAREER - Paculty                                      | 104700       | 5/ F1/005        | on spin ice physics in pyrochlore<br>titanate thin films.                         | Matter Physics              | T         | ,            |
| Sangsoo Kim (G)                            | C       | Laboratory<br>Florida State University              | Physics                                         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Ryan Baumbach (S)                          | PI      | National High Magnetic Field                        | CMS                                             | NSF                    | DMR - Division of                                     | DMR1644779   | P17894           | Investigation of dual nature f-                                                   | Condensed                   | 1         | 2.74         |
|                                            |         | Laboratory                                          |                                                 |                        | Materials Research                                    |              |                  | electron intermetallics using high                                                | Matter Physics              |           |              |
| Jorge Galeano Cabral (G)                   | С       | Florida State University                            | College of Engineering                          | 1                      |                                                       |              |                  | magnetic fields                                                                   |                             |           |              |
| David Graf (S)                             | С       | National High Magnetic Field<br>Laboratory          | DC Field CMS                                    |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Eliana Karr (U)<br>Olatunde Oladehin (G)   | C       | Florida State University                            | MagLab                                          |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Clatunde Cladenin (G)<br>Kaya Wei (P)      | C<br>C  | Florida State University<br>NHMFL                   | Physics<br>CMS                                  | 1                      |                                                       |              |                  |                                                                                   |                             |           |              |
| John Durrell (S)                           | PI      | University of Cambridge                             | Engineering Department                          | EPSRC                  | Non US Council                                        |              | P17896           | High Field Trapping in Reinforced                                                 | Magnets,                    | 1         | 4.06         |
|                                            |         |                                                     |                                                 | 2. 5.10                |                                                       |              | . 17050          | Bulk Superconductors                                                              | Materials                   | l İ       | 1.00         |
| David Cardwell (S)                         | C       | University of Cambridge                             | Engineering Department                          | 1                      |                                                       |              |                  |                                                                                   |                             |           |              |
| Tony Dennis (T)                            | C<br>C  | University of Cambridge<br>NHMFL                    | Engineering<br>Applied Superconductivity Center | 1                      |                                                       |              |                  |                                                                                   |                             |           |              |
| Eric Hellstrom (S)<br>Jan Jaroszynski (S)  | c       | NHMFL                                               | Applied Superconductivity Center<br>CMS         |                        |                                                       |              |                  |                                                                                   |                             |           |              |
| Devendra Namburi (P)                       | С       | University of Cambridge                             | Engineering                                     | 1                      |                                                       |              |                  |                                                                                   |                             |           |              |
| sevenuru numburi (r)                       | С       | University of Cambridge                             | Engineering                                     | 1                      |                                                       |              |                  |                                                                                   | I                           | 1         |              |

| DC Field |  |
|----------|--|
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|                                          |        | Participants<br>(Name, Role, Org., Dept                  | )                                                           | (Fur               | Funding Soun<br>Inding Agency, Divis                           |                                  | Proposal # | Proposal Title                                                                                          | Discipline                  | Exp.<br># | Days<br>Used |
|------------------------------------------|--------|----------------------------------------------------------|-------------------------------------------------------------|--------------------|----------------------------------------------------------------|----------------------------------|------------|---------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Seungyong Hahn (S)                       | PI     | National High Magnetic Field<br>Laboratory               | Applied Superconductivity Center, Mechanical<br>Engineering | NSF                | DMR - Division of<br>Materials Research                        | DMR1644779                       | P17900     | No-Insulation Type High Temperature<br>Superconductor Winding Techniques                                | Magnets,<br>Materials       | 1         | 3.61         |
| Dmytro Abraimov (S)                      | С      | National High Magnetic Field                             | The Applied Superconductivity Center                        |                    | Materials Research                                             |                                  |            | for All-Superconducting >30-T DC<br>User Magnets                                                        | Wateriais                   |           |              |
| Griffin Bradford (O)                     | С      | Laboratory<br>National High Magnetic Field               | Applied Superconductivity Center                            |                    |                                                                |                                  |            | oser mugnets                                                                                            |                             |           |              |
| Xinbo Hu (G)                             | С      | Laboratory<br>National High Magnetic Field               | ASC                                                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Jan Jaroszynski (S)                      | с      | Laboratory<br>National High Magnetic Field               | CMS                                                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Kwanglok Kim (O)                         | с      | Laboratory<br>National High Magnetic Field               | Applied Superconductivity Center                            |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Kwangmin Kim (O)                         | С      | Laboratory<br>National High Magnetic Field<br>Laboratory | Applied Superconductivity Center                            |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Krzysztof Gofryk (S)                     | PI     | Idaho National Laboratory                                | Fuel Performance & Design                                   | DOE                | Office of Science -<br>ECRP - Early Career<br>Research Program | K.Gofryk's early career<br>award | P17910     | High Field Static & Dynamic Crystal<br>Lattice Studies of Piezomagnetic UO2<br>and related compounds    | Condensed<br>Matter Physics | 1         | 3.94         |
| Carolina Corvalan Moya (S)               | С      | Los Alamos National<br>Laboratory                        | MPA-MAG                                                     |                    | -                                                              |                                  |            |                                                                                                         |                             |           |              |
| Xiaxin Ding (P)                          | С      | Idaho National Laboratory                                | NST                                                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Marcelo Jaime (S)                        | С      | National High Magnetic Field<br>Laboratory               | Physics                                                     |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| alexey kovalev (S)                       | С      | National High Magnetic Field<br>Laboratory               | CMS                                                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Shivani Sharma (P)                       | С      | National High Magnetic Field<br>Laboratory               | CMS                                                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Theo Siegrist (S)                        | С      | National High Magnetic Field<br>Laboratory               | Chemical and Biomedical Engineering                         |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Julia Smith (S)                          | С      | National High Magnetic Field<br>Laboratory               | DC Field                                                    |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Alexey Suslov (S)                        | С      | National High Magnetic Field<br>Laboratory               | Condensed Matter Science                                    |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Venkat Selvamanickam (S)                 | PI     | University of Houston                                    | Mechanical Engineering                                      | DOE                | Office of Science -<br>HEP – High Energy<br>Physics            | DE-SC0015983                     | P17917     | Critical current characterization of<br>Symmetric Tape Round (STAR)<br>REBa2Cu3Ox wires at 4 K and very | Magnets,<br>Materials       | 1         | 5.91         |
| Eduard Galstyan (S)                      | С      | University of Houston                                    | Texas Center for Superconductivity                          |                    |                                                                |                                  |            | high magnetic fields                                                                                    |                             |           |              |
| Soumen Kar (S)                           | С      | University of Houston                                    | Mechanical Engineering                                      |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Mehdi Kochat (G)                         | С      | University of Houston                                    | Mechanical engineering                                      |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Liang Wu (S)                             | PI     | University of Pennsylvania                               | Physics and Astronomy                                       | VSP                |                                                                |                                  | P17918     | Identify a possible quantum spin                                                                        | Condensed                   | 3         | 14.7         |
| Xingyue Han (G)                          | С      | University of Pennsylvania                               | Physics and Astronomy                                       |                    |                                                                |                                  |            | liquid phase in RuCl3 above 7 Tesla                                                                     | Matter Physics              |           |              |
| Yuxuan Jiang (P)<br>David Mandrus (S)    | C<br>C | NHMFL<br>University of Tennessee,                        | CMS<br>Materials Science and Engineering                    |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Stanban MaCill (S)                       | С      | Knoxville<br>NHMFL                                       | Condensed Matter Science                                    |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Stephen McGill (S)<br>Stephen Nagler (S) | С      | Oak Ridge National                                       | condensed Matter Science                                    |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Mykhaylo Ozerov (S)                      | С      | Laboratory<br>NHMFL                                      | Condensed Matter Science, DC Field CMS                      |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Gang Wu (S)                              | PI     | Queen's University at<br>Kingston                        | Chemistry                                                   | NSERC of<br>Canada | Non US Council                                                 |                                  | P17926     | Probing the hydrogen nuclear<br>wavefunction in OHO low-barrier                                         | Chemistry                   | 1         | 5            |
| Zhehong Gan (S)                          | с      | NHMFL                                                    | NHMFL                                                       |                    |                                                                |                                  |            | hydrogen bonds by 1H-17O double                                                                         |                             |           | 1            |
| Ivan Hung (S)                            | с      | NHMFL                                                    | CIMAR/NMR                                                   |                    |                                                                |                                  |            | resonance NMR                                                                                           |                             |           | 1            |
| Nicholas Butch (S)                       | PI     | National Institute of<br>Standards and Technology        | NIST Center for Neutron Research                            | NIST               | US Government<br>Lab                                           |                                  | P17928     | Physical properties of spin triplet<br>superconductor UTe2 in high                                      | Condensed<br>Matter Physics | 2         | 9            |
| David Graf (S)                           | С      | NHMFL                                                    | DC Field CMS                                                |                    |                                                                |                                  |            | magnetic field                                                                                          |                             |           | 1            |
| I-LIn Liu (G)                            | C      | University of Maryland,                                  | Chemical Physics                                            |                    |                                                                |                                  |            |                                                                                                         |                             |           | 1            |
| Sheng Ran (S)                            | С      | College Park<br>Washington University in St.             | Physics                                                     |                    |                                                                |                                  |            |                                                                                                         |                             |           |              |
| Shanta Saha (P)                          | с      | Louis<br>University of Maryland,                         | Physics                                                     |                    |                                                                |                                  |            |                                                                                                         |                             |           | 1            |
|                                          | 2      | College Park                                             |                                                             | 1                  |                                                                |                                  |            |                                                                                                         |                             |           | 1            |

|                             |      | Participants                                   |                                             |                                                          | Funding Sour                                          | ces                   | Droposal # | Dreperal Title                                                                                                | Dissipling                  | Exp. | Days |
|-----------------------------|------|------------------------------------------------|---------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|-----------------------|------------|---------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|
|                             |      | (Name, Role, Org., Dept                        | .)                                          | (Fund                                                    | ling Agency, Divisi                                   | ion, Award #)         | Proposal # | Proposal Title                                                                                                | Discipline                  | #    | Used |
| Fazel Tafti (S)             | PI   | Boston College                                 | Physics                                     | NSF                                                      | DMR - Division of                                     | DMR1708929            | P17991     | Revealing the Weyl-Kondo physics in                                                                           | Condensed                   | 1    | 3    |
| Luis Balicas (S)            | С    | National High Magnetic Field<br>Laboratory     | Condensed Matter Experiment                 |                                                          | Materials Research                                    |                       |            | a new semimetal                                                                                               | Matter Physics              |      |      |
| Hung-Yu Yang (G)            | С    | Boston College                                 | Physics                                     |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Paul Goddard (S)            | PI   | University of Warwick                          | Department of Physics                       | European<br>Research<br>Council<br>Consolidator<br>Grant | Non US Council                                        | 681260                | P17992     | Molecule-based quantum magnets in<br>applied pressures                                                        | Condensed<br>Matter Physics | 1    | 5.56 |
| Matthew Coak (P)            | С    | University of Warwick                          | Department of Physics                       |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Sam Curley (G)              | С    | University of Warwick                          | Physics and Astronomy                       |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| David Graf (S)              | С    | National High Magnetic Field<br>Laboratory     | DC Field CMS                                |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Jamie Manson (S)            | С    | Eastern Washington<br>University               | Chemistry and Biochemistry                  |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Robert Williams (P)         | С    | University of Warwick                          | Dept of Physics                             |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Matthew Grayson (S)         | PI   | Northwestern University                        | Electrical Engineering & Computer Science   | NSF                                                      | DMR - Division of<br>Materials Research               | DMR1729016            | P17998     | Weak localization as tunneling<br>signature in In2O3/MoO3                                                     | Condensed<br>Matter Physics | 1    | 7    |
| Can Aygen (G)               | С    | Northwestern University                        | Electrical and Computer Engineering         |                                                          |                                                       |                       |            | polymorphic superlattice                                                                                      |                             |      |      |
| Robert Chang (S)            | С    | Northwestern University                        | Materials Science and Engineering           |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Qing Shao (G)               | С    | Northwestern University                        | Electrical Engineering and Computer Science |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Martin Nikolo (S)           | PI   | Saint Louis University                         | Physics                                     | Saint Louis<br>University                                | US College and<br>University                          |                       | P18000     | Low-temperature, angle-dependent<br>magnetic properties of Ce3Pd20Si6,                                        | Condensed<br>Matter Physics | 3    | 21   |
| Eun Sang Choi (S)           | С    | National High Magnetic Field<br>Laboratory     | Physics Department                          |                                                          |                                                       |                       |            | Ce3Pd20Ge6, and CeB6 crystals                                                                                 |                             |      |      |
| Dmytry Inosov (S)           | С    | Technische Universität<br>Dresden              | Physics                                     |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Silke Paschen (S)           | С    | Vienna University of<br>Technology             | Physics                                     |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Pavlo Portnichenko (P)      | С    | Technische Universität<br>Dresden              | Physics                                     |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Natalya Yu Shitsevalova (S) | С    | Institute for Problems of<br>Material Sciences | Materials Science                           |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Efrain Rodriguez (S)        | PI * | University of Maryland,<br>College Park        | Chemistry and Biochemistry                  | DOE                                                      | Office of Science -<br>BES – Basic Energy<br>Sciences | DESC0016434           | P18006     | Spin Flop Evolution in LiFe_x Mn_{1-<br>x} PO_4                                                               | Condensed<br>Matter Physics | 1    | 5.28 |
| Timothy Diethrich (G)       | С    | University of Maryland,<br>College Park        | Chemistry & Biochemistry                    |                                                          | buches                                                |                       |            |                                                                                                               |                             |      |      |
| Stephanie Gnewuch (G)       | С    | University of Maryland,<br>College Park        | Chemistry and Biochemistry                  |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Jacob Tosado (P)            | С    | University of Maryland,<br>College Park        | Chemistry & Biochemistry                    |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Chris Palmstrom (S)         | PI   | University of California, Santa<br>Barbara     | ECE-Material Science                        | DOE                                                      | MSE - Materials<br>Science and<br>Engineering         | DE-SC0014388          | P18013     | Revealing topological properties of<br>Heusler compounds via magneto-<br>transport under high magnetic field. | Condensed<br>Matter Physics | 1    | 4    |
| Shouvik Chatterjee (P)      | С    | University of California Santa<br>Barbara      | Electrical & Computer Engineering           |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Connor Dempsey (G)          | С    | University of California, Santa<br>Barbara     | ECE                                         |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Aranya Goswami (G)          | С    | University of California, Santa<br>Barbara     | ECE                                         |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Hadass Inbar (G)            | С    | University of California, Santa<br>Barbara     | Materials                                   |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Tony McFadden (G)           | С    | University of California, Santa<br>Barbara     | ECE                                         |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Dan Read (S)                | С    | University of California, Santa<br>Barbara     | Materials                                   |                                                          |                                                       |                       |            |                                                                                                               |                             |      |      |
| Jia Li (S)                  | PI   | Brown University                               | Department of Physics                       | Brown                                                    | US College and                                        | Li lab start up grant | P18016     | Studying correlated electron states in                                                                        | Condensed                   | 1    | 7    |
| Jiangxiazi Lin (G)          | С    | Hong Kong University of                        | Center for Quantum materials                | University                                               | University                                            |                       |            | two-dimensional material in high<br>magnetic field with microwave<br>techniques                               | Matter Physics              |      |      |
|                             | С    | Science and Technology<br>Brown University     | Physics department                          |                                                          |                                                       |                       |            | teeninques                                                                                                    |                             |      |      |
| Xiaoxue Liu (P)             |      |                                                | FUVSIUS DEDALITIETT                         |                                                          |                                                       |                       |            |                                                                                                               | 1                           |      |      |

|                                               |         | Participants<br>(Name, Role, Org., Dept                              | .)                                                                                              | (Fund                                                    | Funding Sour<br>ding Agency, Divisi       |                  | Proposal # | Proposal Title                                                                                        | Discipline                  | Exp.<br># | Days<br>Used |
|-----------------------------------------------|---------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------|------------------|------------|-------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Seng Huat Lee (S)                             | PI      | Pennsylvania State University                                        | Physics                                                                                         | NSF                                                      | MIP - Materials<br>Innovation<br>Platform | DMR1539916       | P18018     | Seeking for Weyl State in Intrinsic<br>Antiferromagnetic Topological<br>Insulator MnBi2Te4 under High | Condensed<br>Matter Physics | 1         | 8.62         |
| David Graf (S)                                | С       | National High Magnetic Field<br>Laboratory                           | DC Field CMS                                                                                    |                                                          |                                           |                  |            | Magnetic Fields                                                                                       |                             |           |              |
| Zhiqiang Mao (S)                              | С       | Pennsylvania State University                                        | Department of Physics                                                                           |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Lujin Min (G)                                 | С       | Pennsylvania State University                                        | Department of Physics                                                                           |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Wei Ning (P)                                  | С       | Pennsylvania State University                                        | Department of Physics                                                                           |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Paul Goddard (S)                              | PI      | University of Warwick                                                | Department of Physics                                                                           | European<br>Research<br>Council<br>Consolidator<br>Grant | Other                                     | 681260           | P18021     | Phase diagram and quantum<br>criticality of MOs4Sb12 skutterudites<br>under pressure                  | Condensed<br>Matter Physics | 2         | 20.02        |
| Kathrin Gotze (P)                             | С       | University of Warwick                                                | Department of Physics, Superconductivity and<br>Magnetism group                                 | European<br>Research<br>Council<br>Consolidator<br>Grant | Non US Council                            | 681260           |            |                                                                                                       |                             |           |              |
| David Graf (S)                                | С       | National High Magnetic Field<br>Laboratory                           | DC Field CMS                                                                                    |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Audrey Grockowiak (S)                         | С       | National High Magnetic Field<br>Laboratory                           | DC Field/CMS                                                                                    |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Pei-Chun Ho (S)                               | С       | California State University,<br>Fresno                               | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Brian Maple (S)                               | С       | University of California, San<br>Diego                               | Inst for Pure & Applied Physical Sciences                                                       |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Matthew Pearce (G)                            | С       | University of Warwick                                                | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| John Singleton (S)                            | С       | National High Magnetic Field<br>Laboratory                           | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Stan Tozer (S)                                | С       | NHMFL                                                                | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Adam Fiedler (S)                              | PI      | Marguette University                                                 | Chemistry                                                                                       | No other                                                 |                                           | CHE1900562       | P18030     | Probing the Magnetic Anisotropy of                                                                    | Chemistry                   | 2         | 12           |
| John Berry (S)                                | С       | University of Wisconsin,                                             | Department of Chemistry                                                                         | support<br>NSF                                           | CHE - Chemistry                           | CHE1900562       |            | Co(II) Complexes Featuring Radical<br>Ligands                                                         | ,                           |           |              |
|                                               |         | Madison                                                              |                                                                                                 |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Jurek Krzystek (S)                            | С       | NHMFL                                                                | Condensed Matter Science                                                                        |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Mykhaylo Ozerov (S)<br>Joshua Telser (S)      | c<br>c  | NHMFL<br>Dessought University                                        | Condensed Matter Science, DC Field CMS<br>Biological, Physical and Health Sciences              |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Jiun-Haw Chu (S)                              | PI      | Roosevelt University<br>University of Washington                     | Physics                                                                                         | DOD                                                      | US Air Force                              | FA9550-17-1-0217 | P18033     | Hc2 of a strained iron-based                                                                          | Condensed                   | 1         | 4.91         |
| Shalinee Chikara (S)                          | С       | NHMFL                                                                | CMS, DC Field Facility                                                                          | Gordon and<br>Betty Moore<br>Foundation                  | US Foundation                             | GBMF6759         |            | superconductor                                                                                        | Matter Physics              |           |              |
| Qianni Jiang (G)                              | С       | University of Washington                                             | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Zhaoyu Liu (P)                                | С       | University of Washington                                             | Department of Physics                                                                           |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Paul Malinowski (G)                           | С       | University of Washington                                             | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Joshua Mutch (G)                              | С       | University of Washington                                             | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Arkady Shehter (S)                            | C       | NHMFL                                                                | NHMFL, DC Field Facility                                                                        | NSF                                                      | DMR - Division of                         | DM01707705       | D10110     | Evaluating quantum control famile                                                                     | Candar                      | -         | 24           |
| Pratap Raychaudhuri (S)<br>Somak Basistha (G) | PI<br>C | Tata Institute of Fund.<br>Research<br>Tata Institute of Fundamental | Condensed Matter Physics and Materials<br>Science<br>Department of Condensed Matter Physics and | INDE                                                     | Materials Research                        | DMR1707785       | P19110     | Exploring quantum vortex liquid<br>phases in very weakly pinned<br>superconducting a-MoGe thin films  | Condensed<br>Matter Physics | 2         | 21           |
|                                               |         | Research                                                             | Materials Science                                                                               |                                                          |                                           |                  |            | at low temperatures and high<br>magnetic fields                                                       |                             |           |              |
| Surajit Dutta (G)                             | c       | Tata Institute of Fund.<br>Research                                  | Condensed Matter Physics and Materials<br>Science                                               |                                                          |                                           |                  |            | · · · · ·                                                                                             |                             |           |              |
| John Jesudasan (T)                            | c       | Tata Institute of Fundamental<br>Research                            | Dept. Of Condensed Matter Physics and<br>Material Science                                       |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Bal Pokharel (G)                              | С       | NHMFL                                                                | Physics                                                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Dragana Popovic (S)                           | С       | NHMFL                                                                | Condensed Matter Science / Experimental                                                         |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Jasminka Terzic (P)                           | С       | NHMFL                                                                | CMS                                                                                             |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |
| Yuxin Wang (G)                                | С       | Florida State University                                             | CMS                                                                                             |                                                          |                                           |                  |            |                                                                                                       |                             |           |              |

|                                    |        | Participants<br>(Name, Role, Org., Dept                  | .)                                                                                           | (Fun                | Funding Sour<br>ding Agency, Divis                                            |                 | Proposal # | Proposal Title                                                                                                | Discipline                  | Exp.<br># | Days<br>Used |
|------------------------------------|--------|----------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------|-----------------|------------|---------------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Rongying Jin (S)                   | PI     | Louisiana State University                               | Department of Physics and Astronomy                                                          | DOE                 | EPSCoR -<br>Established<br>Program to<br>Stimulate<br>Competitive<br>Research | DE-SC0012432    | P19126     | Investigating quantum oscillations in<br>TaSe3 and PtTe2 under high magnetic<br>field                         | Condensed<br>Matter Physics | 1         | 5.37         |
| Ramakanta Chapai (G)               | С      | Louisiana State University                               | Physics and Astronomy                                                                        |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| David Graf (S)                     | С      | National High Magnetic Field<br>Laboratory               | DC Field CMS                                                                                 |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Ahmad Ikhwan Us Saleheen (P)       | С      | Louisiana State University                               | Physics and Astronomy                                                                        |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Michael Zudov (S)                  | PI     | University of Minnesota, Twin<br>Cities                  | School of Physics and Astronomy                                                              | DOE                 | Office of Science -<br>BES – Basic Energy<br>Sciences                         | 46640-SC0002567 | P19127     | Broken-symmetry states in high<br>Landau levels of GaAs/AlGaAs<br>quantum wells                               | Condensed<br>Matter Physics | 1         | 7            |
| Kirk Baldwin (S)                   | С      | Princeton University                                     | Electrical Engineering                                                                       |                     |                                                                               |                 |            | 4                                                                                                             |                             |           |              |
| Xlaojun Fu (G)                     | С      | University of Minnesota, Twin<br>Cities                  | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Brendan King (G)                   | с      | University of Minnesota, Twin<br>Cities                  | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Michael Manfra (S)                 | С      | Nokia Bell Labs                                          | Semiconductor Physics Research                                                               |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Loren Pfeiffer (S)<br>Ken West (S) | C<br>C | Princeton University<br>Princeton University             | Electrical Engineering<br>Princeton Institute for the Science and<br>Technology of Materials |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Hua-Fen Hsu (S)                    | PI *   | National Cheng Kung                                      | Chemistry                                                                                    | No other            |                                                                               |                 | P19128     | Magnetic Studies of                                                                                           | Chemistry                   | 1         | 7            |
| Jurek Krzystek (S)                 | C      | University<br>National High Magnetic Field<br>Laboratory | Condensed Matter Science                                                                     | support             |                                                                               |                 |            | Bis(thiolatophosphineoxide)cobalt(II)<br>Complexes in Pseudo Tetrahedral<br>Geometry by Advanced Magnetic     |                             |           |              |
| Mykhaylo Ozerov (S)                | С      | National High Magnetic Field<br>Laboratory               | Condensed Matter Science, DC Field CMS                                                       |                     |                                                                               |                 |            | Resonance Techniques                                                                                          |                             |           |              |
| Haidong Zhou (S)                   | PI     | University of Tennessee,<br>Knoxville                    | Physics and Astronomy                                                                        | DOE                 | Office of Science -<br>BES – Basic Energy<br>Sciences                         | DE-SC0020254    | P19130     | Manipulating the strong quantum<br>spin fluctuations in new triangular<br>lattice antiferromagnets with spin- | Condensed<br>Matter Physics | 3         | 21           |
| Eun Sang Choi (S)                  | С      | National High Magnetic Field<br>Laboratory               | Physics Department                                                                           | NSF                 | DMR - Division of<br>Materials Research                                       | DMR1350002      |            | 1/2                                                                                                           |                             |           |              |
| Qing Huang (G)                     | С      | University of Tennessee,<br>Knoxville                    | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Kyle Noordhoek (U)                 | С      | University of Tennessee,<br>Knoxville                    | Physics and Astronomy                                                                        |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Chengkun Xing (G)                  | С      | University of Tennessee,<br>Knoxville                    | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Han Zhang (P)                      | С      | University of Tennessee                                  | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Tom Rosenbaum (S)                  | PI     | University of Chicago                                    | Physics                                                                                      | NSF                 | DMR - Division of<br>Materials Research                                       | DMR1606858      | P19132     | Investigation of Pressure Tuned<br>Quantum Phase Transition from                                              | Condensed<br>Matter Physics | 1         | 7            |
| Stephen Armstrong (G)              | С      | Caltech                                                  | Applied Physics and Materials Science                                                        |                     |                                                                               |                 |            | Spinon to Electronic Fermi Surface                                                                            |                             |           |              |
| Joseph Checkelsky (S)              | С      | Massachusetts Institute of<br>Technology                 | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| David Graf (S)                     | С      | National High Magnetic Field<br>Laboratory               | DC Field CMS                                                                                 |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Patrick Lee (S)                    | С      | Massachusetts Institute of<br>Technology                 | Physics Department                                                                           |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Xiang Li (P)                       | С      | California Institute of<br>Technology                    | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Daniel Silevitch (S)               | С      | University of Chicago                                    | Physics, Math, and Astronomy                                                                 |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Linda Ye (G)                       | С      | Massachusetts Institute of<br>Technology                 | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Shalinee Chikara (S)               | PI *   | National High Magnetic Field<br>Laboratory               | CMS, DC Field Facility                                                                       | No other<br>support |                                                                               |                 | P19144     | Multiferroic/magnetoelectric<br>behavior by magnetic-field-induced                                            | Condensed<br>Matter Physics | 2         | 12.14        |
| Janice Musfeldt (S)                | С      | University of Tennessee,<br>Knoxville                    | Department of Chemistry                                                                      | Support             |                                                                               |                 |            | spin-statetransitions in molecular<br>complexes                                                               | indecer rivales             |           |              |
| Mykhaylo Ozerov (S)                | С      | National High Magnetic Field                             | Condensed Matter Science, DC Field CMS                                                       |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |
| Vivien Zapf (S)                    | С      | Laboratory<br>National High Magnetic Field<br>Laboratory | Physics                                                                                      |                     |                                                                               |                 |            |                                                                                                               |                             |           |              |

|                                               |        | Participants<br>(Name, Role, Org., Dept.                   | )                                                            | (Fun                   | Funding Sour<br>ding Agency, Divisi                                  |                          | Proposal # | Proposal Title                                                                                         | Discipline                  | Exp.<br># | Days<br>Used |
|-----------------------------------------------|--------|------------------------------------------------------------|--------------------------------------------------------------|------------------------|----------------------------------------------------------------------|--------------------------|------------|--------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Matthew Yankowitz (S)                         | PI *   | <ul> <li>University of Washington</li> </ul>               | Physics                                                      | DOE                    | Office of Science -<br>EFRC - Energy<br>Frontier Research<br>Centers | DE-SC0019443             | P19146     | Correlations and topology in twisted<br>van der Waals heterostructures                                 | Condensed<br>Matter Physics | 2         | 24           |
| Zaiyao Fei (P)                                | С      | University of Washington                                   | Physics                                                      | NSF                    | MRSEC - Materials<br>Research Science<br>and Engineering<br>Centers  | 1719797                  |            |                                                                                                        |                             |           |              |
| David Graf (S)                                | С      | National High Magnetic Field<br>Laboratory                 | DC Field CMS                                                 |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Minhao He (G)                                 | С      | University of Washington,<br>Seattle                       | Physics                                                      |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Tiancheng Song (G)                            | С      | University of Washington                                   | Physics                                                      |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Xiaodong Xu (S)                               | С      | University of Washington                                   | Physics                                                      |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Benjamin Stein (S)                            | PI *   | * Los Alamos National<br>Laboratory                        | C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY               | No other<br>support    |                                                                      |                          | P19152     | Far-IR Studies of Lanthanide-Based<br>Molecular Materials                                              | Biology,<br>Biochemistry,   | 1         | 7            |
| Samuel Greer (P)                              | С      | Los Alamos National<br>Laboratory                          | C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY               | Support                |                                                                      |                          |            | Wolceard Wetchels                                                                                      | Biophysics                  |           |              |
| Stephen Hill (S)                              | С      | NHMFL                                                      | EMR                                                          |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Jonathan Marbey (G)                           | С      | NHMFL                                                      | EMR                                                          |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Eun Sang Choi (S)                             | PI     | NHMFL                                                      | Physics Department                                           | No other<br>support    |                                                                      |                          | P19217     | Magnetometry instrumentation:<br>calibration and background<br>measurements                            | Condensed<br>Matter Physics | 2         | 14           |
| Irinel Chiorescu (S)                          | PI *   | * National High Magnetic Field<br>Laboratory               | CMT/E                                                        | NSF                    | DMR - Division of<br>Materials Research                              | DMR1644779               | P19218     | Instrument Development: use of<br>niobium thin films for spin sensitive                                | Condensed<br>Matter Physics | 1         | 6            |
| Josiah Cochran (G)                            | С      | National High Magnetic Field<br>Laboratory                 | CMS                                                          |                        |                                                                      |                          |            | devices                                                                                                |                             |           |              |
| Giovanni Franco-Rivera (U)                    | С      | National High Magnetic Field<br>Laboratory                 | Physics                                                      |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| David Graf (S)                                | С      | National High Magnetic Field<br>Laboratory                 | DC Field CMS                                                 |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Dimitri Basov (S)                             | PI     | University of California, San<br>Diego                     | Department of Physics                                        | DOD                    | Other                                                                | W911NF1710543            | P19221     | Magneto-infrared study of novel<br>quantum materials                                                   | Condensed<br>Matter Physics | 2         | 14           |
| Zhiqiang Mao (S)                              | С      | Pennsylvania State University                              | Department of Physics                                        | DOE                    | Office of Science -<br>BES – Basic Energy<br>Sciences                | DE-SC0019443             |            |                                                                                                        |                             |           |              |
| Seongphill Moon (G)                           | С      | National High Magnetic Field<br>Laboratory                 | Physics                                                      |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Mykhaylo Ozerov (S)                           | С      | National High Magnetic Field<br>Laboratory                 | Condensed Matter Science, DC Field CMS                       |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Yinming Shao (G)                              | С      | Columbia University                                        | Physics                                                      | 1                      |                                                                      |                          |            |                                                                                                        | 1                           |           |              |
| Dmitry Smirnov (S)                            | С      | National High Magnetic Field<br>Laboratory                 | Instrumentation & Operations                                 |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Yanglin Zhu (G)                               | С      | Tulane University                                          | Department of Physics and Engineering Physics                |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Bing Lv (S)                                   | PI *   | * University of Texas, Dallas                              | Physics                                                      | DOD                    | US Air Force                                                         | FA9550-15-1-0236         | P19227     | Clarifying the nature of the<br>superconducting pairing symmetry in                                    | Condensed<br>Matter Physics | 1         | 14           |
| Luis Balicas (S)                              | С      | NHMFL                                                      | Condensed Matter Experiment                                  | 1                      |                                                                      |                          |            | ß-Bi2Pd                                                                                                | ,                           |           |              |
| Eun Sang Choi (S)                             | С      | NHMFL                                                      | Physics Department                                           | 1                      |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Danilo Ratkovski (G)                          | С      | Federal University of<br>Pernambuco                        | Departamento de Fisica                                       |                        |                                                                      |                          |            |                                                                                                        |                             |           |              |
| Kaya Wei (P)                                  | С      | NHMFL                                                      | CMS                                                          | 1                      |                                                                      |                          |            |                                                                                                        | 1                           |           |              |
| Akiyasu Yamamoto (S)                          | PI *   | * Tokyo University of<br>Agriculture and Technology        | Dept. of Applied Physics                                     | DOE                    | Office of Science -<br>HEP – High Energy<br>Physics                  | DE-SC0018750             | P19232     | Exploring high field transport<br>performance of Ba122 phase iron-<br>based superconductors by lattice | Magnets,<br>Materials       | 1         | 4.39         |
| Chiara Tarantini (S)<br>Shinnosuke Tokuta (G) | C<br>C | NHMFL<br>Tokyo University of<br>Agriculture and Technology | Applied Superconductivity Center<br>Dept. of Applied Physics | JST<br>JSPS            | Non US Foundation<br>Non US Foundation                               | JPMJCR18J4<br>JP18H01699 |            | defect engineering                                                                                     |                             |           |              |
| Xueqian Kong (S)                              | PI *   | * Zhejiang University                                      | Chemistry                                                    | Zhejiang<br>University | Non US College<br>and University                                     |                          | P19235     | Ultrahigh Field NMR Study of the<br>Formation and Decomposition                                        | Magnets,<br>Materials       | 1         | 5            |
| Zhehong Gan (S)                               | С      | NHMFL                                                      | NHMFL                                                        | · ····,                |                                                                      |                          |            | Mechanisms of MOFs                                                                                     |                             |           |              |
| Hanxi Guan (G)                                | c      | Zhejiang University                                        | Chemistry                                                    |                        |                                                                      |                          |            |                                                                                                        |                             | 1         | 1            |

|                                                 |        | Participants<br>(Name, Role, Org., Dept.                                | )                                                        | (Fun                                         | Funding Sour<br>ding Agency, Divisi                                 |                         | Proposal # | Proposal Title                                                                                                                        | Discipline                  | Exp.<br># | Days<br>Used |
|-------------------------------------------------|--------|-------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------|-------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Henry La Pierre (S)                             | PI *   | Georgia Institute of<br>Technology                                      | School of Chemistry and Biochemistry                     | Arnold and<br>Mabel<br>Beckman<br>Foundation | US Foundation                                                       |                         | P19236     | Magnetic Properties Characterization<br>of Kagome Lattice Compounds,<br>(CH3NH3)2MM'3F12 (M = Na+, K+<br>and NH4+, M' = V3+ and Ti3+) | Chemistry                   | 3         | 28           |
| Ryan Baumbach (S)<br>Arun Ramanathan (G)        | c<br>c | NHMFL<br>Georgia Institute of<br>Technology                             | CMS<br>Chemistry                                         |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Luis Balicas (S)                                | PI     | NHMFL                                                                   | Condensed Matter Experiment                              | DOE                                          | Office of Science -<br>BES – Basic Energy<br>Sciences               | DE-SC0002613            | P19238     | Unconventional Topological Fermions<br>in Rh silicides and germanides                                                                 | Condensed<br>Matter Physics | 1         | 5.68         |
| Ryan Baumbach (S)                               | С      | NHMFL                                                                   | CMS                                                      |                                              | Stenees                                                             |                         |            |                                                                                                                                       |                             |           |              |
| Aikaterini Flessa Savvidou (G)                  | С      | NHMFL                                                                   | Condensed Matter                                         |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Shirin Mozaffari (P)                            | С      | NHMFL                                                                   | Condensed Matter Sciences                                |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| WenKai Zheng (G)                                | С      | NHMFL                                                                   | Condensed Matter Sciences                                |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Raivo Stern (S)                                 | PI     | National Institute of Chemical<br>Physics and Biophysics                | Chemical Physics                                         | ETAg/ERC                                     | Non US Ministry                                                     | PRG4 (ENIQMA)           | P19240     | (H,T)-phase diagram of the frustrated<br>spin-1/2 chain system in beta-TeVO4                                                          | Condensed<br>Matter Physics | 1         | 26           |
| Elizabeth Green (S)                             | C<br>C | NHMFL<br>NHMFL                                                          | Condensed Matter Science<br>Physics                      |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Marcelo Jaime (S)<br>Joosep Link (U)            | С      | National Institute of Chemical<br>Physics and Biophysics                | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Arneil Reyes (S)                                | С      | NHMFL                                                                   | Condensed Matter Science                                 |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Alexander Tsirlin (S)                           | C      | National Institute of Chemical<br>Physics and Biophysics                | Chemical physics                                         |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Dagmar Weickert (S)                             | С      | NHMFL                                                                   | MPA-Mag                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Pengcheng Dai (S)                               | PI     | University of Tennessee,<br>Knoxville                                   | Physics                                                  | NSF                                          | DMR - Division of<br>Materials Research                             | DMR1700081              | P19244     | Investigation into Orbital Pairing<br>Mechanism of Superconducting<br>Electrons in Ni doped BaFe2As2                                  | Condensed<br>Matter Physics | 1         | 20.57        |
| Mason Klemm (G)                                 | C *    | Rice University                                                         | Physics                                                  | NSF                                          | DMD Division of                                                     | DMD4004027              | 540353     | · · · · · · · · · · · · · · · · · · ·                                                                                                 | Manada                      | 2         | 14           |
| Jeffrey Rinehart (S)<br>Maximilian Bernbeck (G) | PI *   | University of California, San<br>Diego<br>University of California, San | Chemistry and Biochemistry<br>Chemistry and Biochemistry | NSF                                          | DMR - Division of<br>Materials Research                             | DMR1904937              | P19253     | Magnetospectroscopic study of the<br>modulation of single-ion anisotropy<br>by dipolar and orbital-mediated                           | Magnets,<br>Materials       | 2         | 14           |
|                                                 | 0      | Diego                                                                   |                                                          |                                              |                                                                     |                         |            | exchange in anisotropic lanthanide molecular magnetic clusters                                                                        |                             |           |              |
| Vlad Pribiag (S)                                | PI *   | University of Minnesota, Twin<br>Cities                                 | Physics                                                  | NSF                                          | MRSEC - Materials<br>Research Science<br>and Engineering<br>Centers | DMR-1420013             | P19258     | Anisotropic superconducting<br>properties of few-layer NbSe2                                                                          | Condensed<br>Matter Physics | 1         | 7            |
| Rafael Fernandes (S)                            | С      | University of Minnesota, Twin<br>Cities                                 | School of Physics and Astronomy                          |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Alex Hamill (G)                                 | C      | University of Minnesota, Twin<br>Cities                                 | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Brett Heischmidt (G)                            | С      | University of Minnesota, Twin<br>Cities                                 | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Ke Wang (P)                                     | С      | Harvard University                                                      | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Woun Kang (S)                                   | PI     | Ewha Womans University                                                  | Department of Physics                                    | National<br>Research                         | Non US Foundation                                                   | 2018R1D1A1B0705008<br>7 | P19259     | Study of low-dimensional materials<br>under very high pressure                                                                        | Condensed<br>Matter Physics | 1         | 5.38         |
| Eun Sang Choi (S)                               | С      | NHMFL                                                                   | Physics Department                                       | Foundation<br>of Korea                       |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Joonyoung Choi (G)                              | С      | Kyungpook National<br>University                                        | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Min Hyuk Choi (G)                               | С      | Pohang University of Science<br>and Technology                          | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Ho Seong Jeon (G)                               | С      | Pohang University of Science<br>and Technology                          | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| YounJung Jo (S)                                 | С      | Kyungpook National<br>University                                        | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Hoil Kim (G)                                    | С      | Pohang University of Science<br>and Technology                          | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |
| Jun Sung Kim (S)                                | С      | Pohang University of Science<br>and Technology                          | Physics                                                  |                                              |                                                                     |                         |            |                                                                                                                                       |                             |           |              |

| Amalia Coldea (S)       PI         David Graf (S)       C         Zachary Zajicek (G)       C         Alimamy Bangura (S)       PI         Greg Boebinger (S)       C         Ross McDonald (S)       C         Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Joshua Telser (S)       PI         Joonyoung Choi (G)       C         Je-Geun Park (S)       C         Mikel Holcomb (S)       PI         Ryan Baumbach (S)       C | University of Oxford<br>NHMFL<br>University of Oxford<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Roosevelt University | Clarendon Laboratory<br>DC Field CMS Physics<br>CMS Directors Office Physics<br>PFF Laboratory of Atomic and Solid State Physics Department of Physics NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED SPECTROSCOPY Chemistry<br>School of Chemistry and Biochemistry                                                         | CFAS (Oxford<br>Centre for<br>Applied<br>Superconduct<br>ivity)<br>NSF | Other<br>DMR - Division of<br>Materials Research<br>Office of Science -<br>BES – Basic Energy<br>Sciences | DMR1157490<br>DE-SC0019385   | P19260 P19273 P19275 | Exploring electronic and quantum<br>phenomena in iron-based<br>superconductors under extreme<br>conditions<br>Development of high field<br>calorimetry probe<br>Study of Zero Field Splitting in<br>Molecular Tb4+ Complexes by High<br>Field EPR | Condensed<br>Matter Physics<br>Condensed<br>Matter Physics<br>Biology,<br>Biochemistry,<br>Biophysics | 1   | 4.93  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----|-------|
| Zachary Zajicek (G)       C         Alimamy Bangura (S)       PI         Greg Boebinger (S)       C         Ross McDonald (S)       C         Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Samuel Greer (P)       C         Artun Ramanathan (G)       C         Natalie Rice (G)       C         Joonyoung Choi (G)       C         Je-Geun Park (S)       C                                                                                                                                         | University of Oxford<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>Ornell University<br>Stockholm University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                           | Physics         CMS         Directors Office         Physics         PFF         Laboratory of Atomic and Solid State Physics         Department of Physics         NHMFL, DC Field Facility         School of Chemistry and Biochemistry         CMS         School of Chemistry and Biochemistry         CPCS: PHYSICAL CHEM & APPLIED         SPECTROSCOPY         Chemistry         School of Chemistry and Biochemistry |                                                                        | Materials Research<br>Office of Science -<br>BES – Basic Energy                                           |                              |                      | calorimetry probe<br>Study of Zero Field Splitting in<br>Molecular Tb4+ Complexes by High                                                                                                                                                         | Matter Physics<br>Biology,<br>Biochemistry,                                                           |     |       |
| Alimamy Bangura (S)       PI         Greg Boebinger (S)       C         Ross McDonald (S)       C         Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Artalie Rice (G)       C         Joshua Telser (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                            | National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>NHMFL<br>Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                             | CMS<br>Directors Office<br>Physics<br>PFF<br>Laboratory of Atomic and Solid State Physics<br>Department of Physics<br>NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                 |                                                                        | Materials Research<br>Office of Science -<br>BES – Basic Energy                                           |                              |                      | calorimetry probe<br>Study of Zero Field Splitting in<br>Molecular Tb4+ Complexes by High                                                                                                                                                         | Matter Physics<br>Biology,<br>Biochemistry,                                                           |     |       |
| Greg Boebinger (S)       C         Ross McDonald (S)       C         Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Natalie Rice (G)       C         Joonyoung Choi (G)       C         Je-Geun Park (S)       C         Mikel Holcomb (S)       PI                                                                                                                                               | Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                    | Directors Office Physics PFF Laboratory of Atomic and Solid State Physics Department of Physics NHMFL, DC Field Facility School of Chemistry and Biochemistry CMS School of Chemistry and Biochemistry C-PCS: PHYSICAL CHEM & APPLIED SPECTROSCOPY Chemistry School of Chemistry and Biochemistry                                                                                                                            |                                                                        | Materials Research<br>Office of Science -<br>BES – Basic Energy                                           |                              |                      | calorimetry probe<br>Study of Zero Field Splitting in<br>Molecular Tb4+ Complexes by High                                                                                                                                                         | Matter Physics<br>Biology,<br>Biochemistry,                                                           |     |       |
| Ross McDonald (S)       C         Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Artalie Rice (G)       C         Joshua Telser (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                   | Laboratory<br>National High Magnetic Field<br>Laboratory<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                          | Physics         PFF         Laboratory of Atomic and Solid State Physics         Department of Physics         NHMFL, DC Field Facility         School of Chemistry and Biochemistry         CMS         School of Chemistry and Biochemistry         CPCS: PHYSICAL CHEM & APPLIED         SPECTROSCOPY         Chemistry         School of Chemistry and Biochemistry                                                      | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Kimberly Modic (G)       C         Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Joshua Telser (S)       PI         Joonyoung Choi (G)       C         Je-Geun Park (S)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                                                  | Laboratory<br>National High Magnetic Field<br>Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>NHMFL<br>Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                               | PFF<br>Laboratory of Atomic and Solid State Physics<br>Department of Physics<br>NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemistry<br>School of Chemistry and Biochemistry                                                                                                                       | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Brad Ramshaw (S)       C         Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Joshua Telser (S)       C         YounJung Jo (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                                                                                      | Laboratory<br>Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory<br>* Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                            | Laboratory of Atomic and Solid State Physics<br>Department of Physics<br>NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                              | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Andreas Rydh (S)       C         Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Natalie Rice (G)       C         YounJung Jo (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                                                                                                                        | Cornell University<br>Stockholm University<br>National High Magnetic Field<br>Laboratory * Georgia Institute of<br>Technology<br>NHMFL<br>Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                              | Department of Physics<br>NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                              | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Arkady Shehter (S)       C         Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Natalie Rice (G)       C         YounJung Jo (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                                                                                                                                                         | National High Magnetic Field<br>Laboratory * Georgia Institute of<br>Technology NHMFL Georgia Institute of<br>Technology Los Alamos National<br>Laboratory Georgia Institute of<br>Technology Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                           | NHMFL, DC Field Facility<br>School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                       | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Henry La Pierre (S)       PI         Ryan Baumbach (S)       C         Thaige Gompa (G)       C         Samuel Greer (P)       C         Arun Ramanathan (G)       C         Natalie Rice (G)       C         Joshua Telser (S)       C         YounJung Jo (S)       PI         Joonyoung Choi (G)       C         Mikel Holcomb (S)       PI                                                                                                                                                                                                                                                                                                                          | Laboratory * Georgia Institute of Technology NHMFL Georgia Institute of Technology Los Alamos National Laboratory Georgia Institute of Technology Georgia Institute of Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | School of Chemistry and Biochemistry<br>CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                                                   | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Ryan Baumbach (S)     C       Thaige Gompa (G)     C       Samuel Greer (P)     C       Arun Ramanathan (G)     C       Natalie Rice (G)     C       Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C                                                                                                                                                                                                                                                                                                                                                                                                   | Technology<br>NHMFL<br>Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CMS<br>School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                                                                                           | DOE                                                                    | BES – Basic Energy                                                                                        | DE-SC0019385                 | P19275               | Molecular Tb4+ Complexes by High                                                                                                                                                                                                                  | Biochemistry,                                                                                         | 1   | 7     |
| Thaige Gompa (G)     C       Samuel Greer (P)     C       Arun Ramanathan (G)     C       Natalie Rice (G)     C       Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C                                                                                                                                                                                                                                                                                                                                                                                                                                 | Georgia Institute of<br>Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | School of Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                                                                                                  |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Samuel Greer (P)     C       Arun Ramanathan (G)     C       Natalie Rice (G)     C       Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C       Mikel Holcomb (S)     PI                                                                                                                                                                                                                                                                                                                                                                                                                               | Technology<br>Los Alamos National<br>Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                                                                                                                                          |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Arun Ramanathan (G)     C       Natalie Rice (G)     C       Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C       Mikel Holcomb (S)     PI                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Laboratory<br>Georgia Institute of<br>Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SPECTROSCOPY<br>Chemsitry<br>School of Chemistry and Biochemistry                                                                                                                                                                                                                                                                                                                                                            |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Natalie Rice (G)     C       Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C       Mikel Holcomb (S)     PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Technology<br>Georgia Institute of<br>Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | School of Chemistry and Biochemistry                                                                                                                                                                                                                                                                                                                                                                                         |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Joshua Telser (S)     C       YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C       Mikel Holcomb (S)     PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   | 1                                                                                                     | 4 1 |       |
| YounJung Jo (S)     PI       Joonyoung Choi (G)     C       Je-Geun Park (S)     C       Mikel Holcomb (S)     PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Roosevelt University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Joonyoung Choi (G) C<br>Je-Geun Park (S) C<br>Mikel Holcomb (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | NOUSEVEN UNIVERSILY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Biological, Physical and Health Sciences                                                                                                                                                                                                                                                                                                                                                                                     |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Je-Geun Park (S) C<br>Mikel Holcomb (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Kyungpook National<br>University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Physics                                                                                                                                                                                                                                                                                                                                                                                                                      | 2018K2A9A1<br>A06069211                                                | Non US Foundation                                                                                         |                              | P19278               | Magnetic anisotropy in van der Waals<br>antiferromagnets                                                                                                                                                                                          | Condensed<br>Matter Physics                                                                           | 1   | 14    |
| Mikel Holcomb (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Kyungpook National<br>University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Physics                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Seoul National University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Department of Physics & Astronomy                                                                                                                                                                                                                                                                                                                                                                                            |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Ryan Baumbach (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul> <li>West Virginia University</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Physics & Astronomy                                                                                                                                                                                                                                                                                                                                                                                                          | DOE                                                                    | Office of Science -<br>BES – Basic Energy<br>Sciences                                                     | DE-SC0016176                 | P19291               | Dynamic studies of inhomogeneous<br>magnetic thin films of<br>La0.7Sr0.3MnO3 by ac susceptibility                                                                                                                                                 | Condensed<br>Matter Physics                                                                           | 2   | 14    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | NHMFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CMS                                                                                                                                                                                                                                                                                                                                                                                                                          | NSF                                                                    | DMR - Division of<br>Materials Research                                                                   | DMR1608656                   |                      | measurements to understand the<br>strength of interparticle interactions                                                                                                                                                                          |                                                                                                       |     |       |
| Navid Mottaghi (G) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | West Virginia University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Physics and Astronomy                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                        |                                                                                                           |                              |                      | embedded in the magnetic dead<br>layers                                                                                                                                                                                                           |                                                                                                       |     |       |
| Qi Zhang (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ul> <li>Nanjing University</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Physics and Astronomy                                                                                                                                                                                                                                                                                                                                                                                                        | Nanjing<br>University                                                  | Non US College<br>and University                                                                          | New Faculty Startup<br>Funds | P19349               | Terahertz magnons, phonons and<br>magnetic phase transitions in 2D                                                                                                                                                                                | Condensed<br>Matter Physics                                                                           | 2   | 15.86 |
| Jiun-Haw Chu (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | University of Washington                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Physics                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                        |                                                                                                           |                              |                      | honeycomb antiferromagnets                                                                                                                                                                                                                        |                                                                                                       |     |       |
| Mykhaylo Ozerov (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NHMFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Condensed Matter Science, DC Field CMS                                                                                                                                                                                                                                                                                                                                                                                       |                                                                        |                                                                                                           |                              | 1                    |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Xiaodong Xu (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | University of Washington                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Physics                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |
| Pengcheng Dai (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | University of Tennessee,<br>Knoxville                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Physics                                                                                                                                                                                                                                                                                                                                                                                                                      | NSF                                                                    | DMR - Division of<br>Materials Research                                                                   | DMR1700081                   | P19360               | Investigation into Orbital Pairing<br>Mechanism of Superconducting                                                                                                                                                                                | Condensed<br>Matter Physics                                                                           | 1   | 4.9   |
| Luis Balicas (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | NHMFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Condensed Matter Experiment                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                        |                                                                                                           |                              |                      | Electrons in Ni doped BaFe2As2                                                                                                                                                                                                                    |                                                                                                       |     |       |
| Mas Subramanian (S) PI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | * Oregon State University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                    | NSF                                                                    | DMR - Division of<br>Materials Research                                                                   | DMR1508527                   | P19361               | Frequency- and field-domain<br>magnetic resonance investigation of                                                                                                                                                                                | Magnets,<br>Materials                                                                                 | 1   | 7     |
| Jurek Krzystek (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | NHMFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Condensed Matter Science                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                        |                                                                                                           |                              | 1                    | novel materials based on Mn4+-                                                                                                                                                                                                                    |                                                                                                       |     |       |
| Mykhaylo Ozerov (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NHMFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Condensed Matter Science, DC Field CMS                                                                                                                                                                                                                                                                                                                                                                                       |                                                                        |                                                                                                           |                              | 1                    | doped sillenites.                                                                                                                                                                                                                                 |                                                                                                       |     |       |
| Joshua Telser (S) C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Roosevelt University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Biological, Physical and Health Sciences                                                                                                                                                                                                                                                                                                                                                                                     |                                                                        |                                                                                                           |                              |                      |                                                                                                                                                                                                                                                   |                                                                                                       |     |       |

|                            |      | Participants<br>(Name, Role, Org., Dept                                     | .)                                                                 | (Fun                                           | Funding Sour<br>ding Agency, Divisi                   |                   | Proposal # | Proposal Title                                                                                              | Discipline                  | Exp.<br># | Days<br>Used |
|----------------------------|------|-----------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------|-------------------|------------|-------------------------------------------------------------------------------------------------------------|-----------------------------|-----------|--------------|
| Stan Tozer (S)             | PI   | NHMFL                                                                       | Physics                                                            | DOE                                            | Other                                                 | DE-AC02-06CH11357 | P19362     | Search for and an Understanding of                                                                          | Condensed                   | 1         | 12.37        |
| Muhtar Ahart (S)           | С    | University of Illinois at<br>Chicago                                        | Physics                                                            |                                                |                                                       |                   |            | Room Temperature<br>Superconductivity                                                                       | Matter Physics              |           |              |
| William Coniglio (S)       | С    | NHMFL                                                                       | A1                                                                 |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Audrey Grockowiak (S)      | С    | NHMFL                                                                       | DC Field/CMS                                                       |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Toni Helm (P)              | С    | Max Planck Institute for<br>Chemical Physics of Solids,<br>Dresden          | Physics of Quantum materials                                       |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Russell Hemley (S)         | С    | University of Illinois at<br>Chicago                                        | Physics                                                            |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Maddury Somayazulu (S)     | С    | Argonne National Laboratory                                                 | Advanced Photon Source HPCAT sector 16                             |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Henry La Pierre (S)        | PI * | <ul> <li>Georgia Institute of<br/>Technology</li> </ul>                     | School of Chemistry and Biochemistry                               | Beckman<br>Young                               | Other                                                 |                   | P19365     | Heat capacity measurement of<br>(CH3NH3)2NaV3F12                                                            | Chemistry                   | 1         | 7            |
| Fazel Tafti (S)            | PI   | Boston College                                                              | Physics                                                            | NSF                                            | DMR - Division of<br>Materials Research               | DMR1708929        | P19384     | Hydrodynamic Electron Flow in<br>NbGe2                                                                      | Condensed<br>Matter Physics | 1         | 5.56         |
| Luis Balicas (S)           | С    | National High Magnetic Field<br>Laboratory                                  | Condensed Matter Experiment                                        |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Shirin Mozaffari (P)       | С    | National High Magnetic Field<br>Laboratory                                  | Condensed Matter Sciences                                          |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Hung-Yu Yang (G)           | С    | Boston College                                                              | Physics                                                            |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Shalinee Chikara (S)       | PI * | <ul> <li>National High Magnetic Field<br/>Laboratory</li> </ul>             | CMS, DC Field Facility                                             | No other<br>support                            |                                                       |                   | P19402     | Strange frustration and quantum<br>liquid behavior in an insulating trimer                                  | Condensed<br>Matter Physics | 2         | 28           |
| Gang Cao (S)               | С    | University of Colorado,<br>Boulder                                          | Department of Physics.                                             | NSF                                            | DMR - Division of<br>Materials Research               | DMR1644779        |            | Ba4lr3O10                                                                                                   |                             |           |              |
| Eun Sang Choi (S)          | С    | National High Magnetic Field<br>Laboratory                                  | Physics Department                                                 |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| David Graf (S)             | С    | National High Magnetic Field<br>Laboratory                                  | DC Field CMS                                                       |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Dmitry Smirnov (S)         | PI   | National High Magnetic Field<br>Laboratory                                  | Instrumentation & Operations                                       | DOE                                            | Office of Science -<br>BES – Basic Energy<br>Sciences | DE-FG02-07ER46451 | P19412     | Electrical and magnetic field control<br>of optical processes in atomicallythin<br>layers and van der Waals | Condensed<br>Matter Physics | 1         | 7            |
| Zhigang Jiang (S)          | С    | Georgia Institute of<br>Technology                                          | School of Physics                                                  |                                                |                                                       |                   |            | heterostructures                                                                                            |                             |           |              |
| Chun Ning (Jeanie) Lau (S) | С    | Ohio State University                                                       | Department of Physics and Astronomy                                |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Zhengguang Lu (G)          | С    | National High Magnetic Field<br>Laboratory                                  | Physics                                                            |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Sufei Shi (S)              | С    | Rensselaer Polytechnic<br>Institute                                         | Chemical and Biological Engineering                                |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Luis Balicas (S)           | PI   | National High Magnetic Field<br>Laboratory                                  | Condensed Matter Experiment                                        | DOE                                            | Office of Science -<br>BES – Basic Energy<br>Sciences | DE-SC0002613      | P19425     | Proper magnetization measurements<br>in the Dirac type-II semimetallic<br>candidate NiTe2                   | Condensed<br>Matter Physics | 1         | 7            |
| Efstratios Manousakis (S)  | С    | Florida State University                                                    | Physics                                                            |                                                |                                                       |                   |            |                                                                                                             | 1                           |           | 1            |
| Theo Siegrist (S)          | С    | National High Magnetic Field<br>Laboratory                                  | Chemical and Biomedical Engineering                                |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Kaya Wei (P)               | С    | National High Magnetic Field<br>Laboratory                                  | CMS                                                                |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| WenKai Zheng (G)           | С    | National High Magnetic Field<br>Laboratory                                  | Condensed Matter Sciences                                          |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Irina Drichko (S)          | PI   | Ioffe Physical-Technical<br>Institute of the Russian<br>Academy of Sciences | Physics of Semiconductors and Dielectrics                          | Russian<br>Foundation<br>for Basic<br>Research | Non US Foundation                                     | 19-02-00124       | P19427     | Magnetotransport Properties of<br>High-Mobility p-AlGaAs/GaAs/AlGaAs<br>Structures: Acoustic Studies.       | Condensed<br>Matter Physics | 1         | 17           |
| Loren Pfeiffer (S)         | С    | Princeton University                                                        | Electrical Engineering                                             | nesedicii                                      |                                                       |                   |            |                                                                                                             |                             |           |              |
| Ivan Smirnov (S)           | С    | loffe Physical-Technical<br>Institute of the Russian<br>Academy of Sciences | Physics of Semiconductors and Dielectrics                          |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Alexey Suslov (S)          | С    | NHMFL                                                                       | Condensed Matter Science                                           |                                                |                                                       |                   |            |                                                                                                             |                             |           | 1            |
| Ken West (S)               | С    | Princeton University                                                        | Princeton Institute for the Science and<br>Technology of Materials |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |
| Sara Haravifard (S)        | PI   | Duke University                                                             | Department of Physics                                              | NSF                                            | DMR - Division of<br>Materials Research               | DMR1828348        | P19445     | High Pressure Studies of Frustrated                                                                         | Condensed<br>Matter Physics | 1         | 4.64         |
| David Graf (S)             | С    | NHMFL                                                                       | DC Field CMS                                                       |                                                | watenais Research                                     |                   |            | Magnets                                                                                                     | Matter Physics              |           |              |
| Zhenzhong Shi (P)          | с    | Duke University                                                             | Department of Physics                                              |                                                |                                                       |                   |            |                                                                                                             |                             |           |              |

|                      |      | Participants<br>(Name, Role, Org., Dept    | )                                       | (Fund                           | Funding Sources<br>ing Agency, Division, Award #) | Proposal # | Proposal Title                                                         | Discipline                  | Exp.<br>#       | Days<br>Used     |
|----------------------|------|--------------------------------------------|-----------------------------------------|---------------------------------|---------------------------------------------------|------------|------------------------------------------------------------------------|-----------------------------|-----------------|------------------|
| Jan Jaroszynski (S)  | PI   | National High Magnetic Field<br>Laboratory | CMS                                     | UCGP                            |                                                   | P19446     | Torque acting on REBCO coated<br>conductors in external magnetic field | Magnets,<br>Materials       | 2               | 7.1              |
| Ernesto Bosque (S)   | С    | National High Magnetic Field<br>Laboratory | ASC/MST                                 |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Griffin Bradford (O) | С    | National High Magnetic Field<br>Laboratory | Applied Superconductivity Center        |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Ashleigh Francis (T) | С    | National High Magnetic Field<br>Laboratory | ASC                                     |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Keshav Shrestha (S)  | PI * | Texas A&M University                       | Chemistry and Physics                   | West Texas<br>A&M<br>University | US College and<br>University                      | P19467     | Search of Topological Phases of<br>Materials                           | Condensed<br>Matter Physics | 1               | 7                |
| David Graf (S)       | С    | National High Magnetic Field<br>Laboratory | DC Field CMS                            |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Bal Pokharel (G)     | С    | National High Magnetic Field<br>Laboratory | Physics                                 |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Dragana Popovic (S)  | С    | National High Magnetic Field<br>Laboratory | Condensed Matter Science / Experimental |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Lin Jiao (S)         | PI * | National High Magnetic Field<br>Laboratory | CMS                                     | No other<br>support             |                                                   | P19480     | High Magnetic Field Probe Design<br>and Technique Development          | Condensed<br>Matter Physics | 2               | 16               |
| Alimamy Bangura (S)  | С    | National High Magnetic Field<br>Laboratory | CMS                                     |                                 |                                                   |            |                                                                        |                             |                 |                  |
| Robert Nowell (T)    | С    | National High Magnetic Field<br>Laboratory | DC User Support                         |                                 |                                                   |            |                                                                        |                             |                 |                  |
|                      |      |                                            |                                         |                                 |                                                   |            | Total Proposals:<br>108                                                | Expe                        | riments:<br>146 | Days:<br>1,021.1 |

## 3. EMR Facility

|                                           |         | Participants<br>(Name, Role, Org., Dept.)                     |                                                 |                                                             | ding Sources<br>ncy, Division, A    | ward #)          | Proposal # | Proposal Title                                                                                            | Discipline                              | Exp.<br># | Days<br>Used |
|-------------------------------------------|---------|---------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------|-------------------------------------|------------------|------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Ellis Reinherz (S)                        | PI      | Dana-Farber Cancer Institute                                  | Medicine                                        | No other support                                            |                                     |                  | P16241     | EPR analysis of HIV-1 MPER<br>segment for optimized vaccine<br>design                                     | Biology,<br>Biochemistry,<br>Biophysics | 1         | 9            |
| Enrique del Barco (S)                     | PI      | University of Central Florida                                 | Physics                                         | No other support                                            |                                     |                  | P16298     | Spintronics with Antiferromagnetic                                                                        | Condensed                               | 2         | 21           |
| Gyan Khatri (G)                           | С       | University of Central Florida                                 | Physics                                         | DOD                                                         | US Air Force                        | FA9550-19-1-0307 |            | Insulators                                                                                                | Matter<br>Physics                       |           |              |
| Jaesuk Kwon (P)                           | С       | University of Central Florida                                 | Physics                                         |                                                             |                                     |                  |            |                                                                                                           | Filysics                                |           |              |
| David Lederman (S)                        | С       | University of California, Santa Cruz                          | Physics                                         |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Priyanka Vaidya (G)<br>Johan van Tol (S)  | c<br>c  | University of Central Florida<br>National High Magnetic Field | Physics Department<br>EMR                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
|                                           | C       | Laboratory                                                    | EWIK                                            |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Fengyuan Yang (S)                         | С       | Ohio State University                                         | Physics                                         |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Johan van Tol (S)                         | PI      | National High Magnetic Field<br>Laboratory                    | EMR                                             | No other support                                            |                                     |                  | P16303     | Field dependence of Electron Spin<br>Relaxation                                                           | Condensed<br>Matter                     | 3         | 19           |
| Thierry Dubroca (S)                       | С       | National High Magnetic Field<br>Laboratory                    | EMR                                             |                                                             |                                     |                  |            |                                                                                                           | Physics                                 |           |              |
| Mary Ellen Zvanut (S)                     | C       | University of Alabama, Birmingham                             | Physics                                         | No. other surgers at                                        |                                     |                  | D47224     | Calibratian And Maintenance Of                                                                            | Manuata                                 |           | 2            |
| Andrew Ozarowski (S)                      | PI      | National High Magnetic Field<br>Laboratory                    | EMR                                             | No other support                                            |                                     |                  | P17321     | Calibration And Maintenance Of<br>The 15/17 T EPR Instrument<br>Instruments                               | Magnets,<br>Materials                   | 1         | 2            |
| Markus Enders (S)                         | PI      | Heidelberg University                                         | Chemistry                                       | No other support                                            |                                     |                  | P17384     | Unpaired electron spin properties                                                                         | Chemistry                               | 2         | 9            |
| Jurek Krzystek (S)                        | С       | National High Magnetic Field<br>Laboratory                    | Condensed Matter Science                        |                                                             |                                     |                  |            | of light d-block metal compounds                                                                          |                                         |           |              |
| Joshua Telser (S)                         | С       | Roosevelt University                                          | Biological, Physical and Health<br>Sciences     |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Likai Song (S)                            | PI      | NHMFL                                                         | EMR                                             | No other support                                            |                                     |                  | P17449     | Developing Multifrequencey EPR                                                                            | Biology,                                | 7         | 80           |
| Krishnendu Kundu (P)                      | С       | NHMFL                                                         | EMR                                             |                                                             |                                     |                  |            | Methods for Biological Applications                                                                       | Biochemistry,<br>Biophysics             |           |              |
| Jonathan Marbey (G)                       | С       | NHMFL                                                         | EMR                                             |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Enrique Colacio (S)<br>Jurek Krzystek (S) | PI<br>C | University of Granada<br>NHMFL                                | Inorganic Chemistry<br>Condensed Matter Science | No other support                                            |                                     |                  | P17454     | High-frequency and -field EPR of 2D<br>Co(II) SMMs with different                                         | Chemistry                               | 2         | 8            |
| Mykhaylo Ozerov (S)                       | С       | NHMFL                                                         | Condensed Matter Science, DC Field<br>CMS       |                                                             |                                     |                  |            | hexacoordinated Co(II) ions.                                                                              |                                         |           |              |
| Russell Maier (P)                         | PI      | National Institute of Standards and<br>Technology             | Materials Measurement Laboratory                | National Institute of<br>Standards and Technology<br>(NIST) | US<br>Government<br>Lab             |                  | P17488     | High Frequency EPR<br>Characterization of Mn and Fe-<br>Related Point Defects in the                      | Condensed<br>Matter<br>Physics          | 1         | 2            |
| Andrew Ozarowski (S)                      | С       | NHMFL                                                         | EMR                                             |                                                             |                                     |                  |            | Perovskite Structure                                                                                      |                                         |           |              |
| Zofia Janas (S)                           | PI      | University of Wroclaw                                         | Faculty of Chemistry                            | No other support                                            | 0.1                                 |                  | P17629     | High-Field EPR Studies on V(IV) and<br>V(III) Complexes of Schiff Bases and                               | Chemistry                               | 3         | 8            |
| Julia Jezierska (S)                       | С       | University of Wroclaw                                         | Chemistry                                       | Wroclaw University,<br>Poland                               | Other                               |                  |            | Diaminebis(aryloxides)                                                                                    |                                         |           |              |
| Andrew Ozarowski (S)                      | С       | National High Magnetic Field<br>Laboratory                    | EMR                                             | Wroclaw University,<br>Poland                               | Non US<br>College and<br>University |                  |            |                                                                                                           |                                         |           |              |
| Alina Bienko (S)                          | PI      | University of Wroclaw                                         | Faculty of Chemistry                            | Wroclaw University                                          | Non US<br>College and<br>University |                  | P17642     | Search for New Single-Molecule<br>Magnets: High-Field EPR Studies on<br>High-Spin Complexes of d-Electron | Chemistry                               | 1         | 8            |
| Andrew Ozarowski (S)                      | С       | National High Magnetic Field<br>Laboratory                    | EMR                                             |                                                             |                                     |                  |            | Metals – Co(II), Ni(II), Re(IV)                                                                           |                                         |           |              |
| Ziling Xue (S)                            | PI      | University of Tennessee, Knoxville                            | Chemistry                                       | No other support                                            |                                     |                  | P17697     | Investigating Molecular Magnetism                                                                         | Chemistry                               | 4         | 18           |
| Alexandria Bone (G)                       | С       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            | by Magneto-Raman Spectroscopy                                                                             |                                         |           |              |
| Adam Hand (G)                             | С       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Brian Kettell (G)                         | С       | University of Tennessee Space Institute                       | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Jurek Krzystek (S)                        | С       | National High Magnetic Field<br>Laboratory                    | Condensed Matter Science                        |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Clay Mings (G)                            | с       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Duncan Moseley (G)                        | C       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Likai Song (S)                            | С       | National High Magnetic Field<br>Laboratory                    | EMR                                             |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Pagnareach Tin (G)                        | С       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |
| Chelsea Widener (G)                       | С       | University of Tennessee, Knoxville                            | Chemistry                                       |                                                             |                                     |                  |            |                                                                                                           |                                         |           |              |

|                                                    |         | Participants<br>(Name, Role, Org., Dept.)                                  |                                                              |                                                           | nding Sources<br>ency, Division,                            | Award #)     | Proposal # | Proposal Title                                                                                                                              | Discipline                     | Exp.<br># | Days<br>Used |
|----------------------------------------------------|---------|----------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------|--------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------|--------------|
| Srinivasa Rao Singamaneni (S)<br>Johan van Tol (S) | PI<br>C | University of Texas, El Paso<br>National High Magnetic Field<br>Laboratory | Physics<br>EMR                                               | No other support<br>The University of Texas at<br>El Paso | US College<br>and<br>University                             |              | P17698     | Controlling Spin States in<br>Honeycomb Two-Dimensional<br>Layered Solids using Coherent Light                                              | Condensed<br>Matter<br>Physics | 3         | 12           |
| Joseph Zadrozny (S)                                | PI      | Colorado State University                                                  | Chemistry                                                    | NSF                                                       | CHE -<br>Chemistry                                          | CHE1836537   | P17730     | Molecular Control of Spin<br>Relaxation and EPR Linewidth in                                                                                | Chemistry                      | 2         | 9            |
| Cassidy Jackson (G)                                | С       | Colorado State University                                                  | Chemistry                                                    | Colorado State University                                 | US College<br>and<br>University                             |              |            | Transition Metal Complexes                                                                                                                  |                                |           |              |
| lan Moseley (G)                                    | С       | Colorado State University                                                  | Chemistry                                                    |                                                           | Oniversity                                                  |              |            |                                                                                                                                             |                                |           |              |
| Johan van Tol (S)                                  | С       | National High Magnetic Field<br>Laboratory                                 | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Lucio Frydman (S)                                  | PI      | National High Magnetic Field                                               | NMR                                                          | No other support                                          |                                                             |              | P17754     | Three-Spins Solution State DNP                                                                                                              | Biology,<br>Biochemistry,      | 2         | 19           |
| Adewale Akinfaderin (G)                            | С       | Laboratory<br>Florida State University                                     | Physics                                                      | NSF                                                       | CHE -                                                       | CHE1808660   |            |                                                                                                                                             | Biophysics                     |           |              |
| Thierry Dubroca (S)                                | C       | National High Magnetic Field                                               | EMR                                                          |                                                           | Chemistry                                                   |              |            |                                                                                                                                             |                                |           |              |
| Stephen Hill (S)                                   | С       | Laboratory<br>National High Magnetic Field                                 | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Krishnendu Kundu (P)                               | С       | Laboratory<br>National High Magnetic Field                                 | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Murari Soundararajan (P)                           | С       | Laboratory<br>NHMFL                                                        | CIMAR, NMR                                                   |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Johan van Tol (S)<br>Sungsool Wi (S)               | C<br>C  | NHMFL<br>NHMFL                                                             | EMR<br>NMR                                                   |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Michael Nippe (S)                                  | PI      | Texas A&M University                                                       | Chemistry                                                    | NSF                                                       | CHE -<br>Chemistry                                          | CHE1753014   | P17842     | Exploring Magnetic Coupling and<br>Spin Relaxation in Ln-                                                                                   | Chemistry                      | 1         | 2            |
| Stephen Hill (S)                                   | С       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            | [1]metallocenophane Compounds<br>using High-Field and Pulsed EPR                                                                            |                                |           |              |
| Trevor Latendresse (G)                             | С       | Texas A&M University                                                       | Chemistry                                                    |                                                           |                                                             |              |            | spectroscopy                                                                                                                                |                                |           |              |
| Jonathan Marbey (G)                                | C       | NHMFL                                                                      | EMR                                                          | N 11 1                                                    |                                                             |              | 545000     |                                                                                                                                             |                                |           | <u> </u>     |
| Benjamin Stein (S)                                 | PI      | Los Alamos National Laboratory                                             | C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY               | No other support                                          |                                                             |              | P17990     | Applications of Advanced Electron<br>Paramagnetic Resonance                                                                                 | Chemistry                      | 1         | 1            |
| Thomas Albrecht-Schmitt (S)<br>Samuel Greer (P)    | C<br>C  | Florida State University<br>Los Alamos National Laboratory                 | Chemistry and Biochemistry<br>C-PCS: PHYSICAL CHEM & APPLIED |                                                           |                                                             |              |            | Techniques to Actinide-Based<br>Molecular Systems                                                                                           |                                |           |              |
| Charles IIII (C)                                   | 6       | NU 18 451                                                                  | SPECTROSCOPY                                                 |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Stephen Hill (S)<br>Stosh Kozimor (S)              | C<br>C  | NHMFL<br>Los Alamos National Laboratory                                    | EMR<br>C-IIAC: INORGANIC ISOTOPE &                           |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Aaron Tondreau (S)                                 | c       | Los Alamos National Laboratory                                             | ACTINIDE CHEM<br>C-IIAC: INORGANIC ISOTOPE &                 |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Aalon fondread (5)                                 |         | Los Alamos National Laboratory                                             | ACTINIDE CHEM                                                |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Adam Fiedler (S)                                   | PI      | Marquette University                                                       | Chemistry                                                    | No other support                                          |                                                             |              | P18030     | Probing the Magnetic Anisotropy of                                                                                                          | Chemistry                      | 3         | 8.5          |
| John Berry (S)                                     | С       | University of Wisconsin, Madison                                           | Department of Chemistry                                      |                                                           |                                                             |              |            | Co(II) Complexes Featuring Radical<br>Ligands                                                                                               |                                |           |              |
| Kinga Kaniewska (G)                                | С       | Gdansk University of Technology                                            | Department of Inorganic Chemistry                            |                                                           |                                                             |              |            | -9                                                                                                                                          |                                |           |              |
| Jurek Krzystek (S)                                 | С       | NHMFL                                                                      | Condensed Matter Science                                     |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Andrew Ozarowski (S)                               | С       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Mykhaylo Ozerov (S)                                | C       | NHMFL                                                                      | Condensed Matter Science, DC Field<br>CMS                    |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Joshua Telser (S)                                  | С       | Roosevelt University                                                       | Biological, Physical and Health<br>Sciences                  |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Jianyuan Zhang (S)                                 | PI      | Rutgers University                                                         | Chemistry and Chemical Biology                               | No other support                                          |                                                             |              | P18049     | A Route to Molecular Quantum                                                                                                                | Chemistry                      | 7         | 90           |
| Stephen Hill (S)                                   | С       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            | Technologies Using Endohedral                                                                                                               | 1                              |           | 1            |
| Krishnendu Kundu (P)                               | C       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            | Metallofullerenes                                                                                                                           | 1                              |           | 1            |
| Jonathan Marbey (G)                                | С       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             | L                              |           |              |
| Sungsool Wi (S)                                    | PI      | * NHMFL                                                                    | NMR                                                          | NSF                                                       | CHE -<br>Chemistry                                          | CHE1808660   | P18056     | Solution State Overhauser DNP at 14 T                                                                                                       | Chemistry                      | 1         | 10           |
| Thierry Dubroca (S)                                | С       | NHMFL                                                                      | EMR                                                          |                                                           |                                                             |              |            |                                                                                                                                             |                                |           | ļ            |
| Christoph Boehme (S)                               | PI      | University of Utah                                                         | Department of Physics and<br>Astronomy                       | DOE                                                       | Office of<br>Science - BES<br>– Basic<br>Energy<br>Sciences | DE-SC0000909 | P18076     | Investigation of weak spin-orbit<br>coupling in organic semiconductor<br>diodes with high-field electrically<br>detected magnetic resonance | Condensed<br>Matter<br>Physics | 1         | 10           |
| Hans Malissa (P)                                   | С       | University of Utah                                                         | Department of Physics and<br>Astronomy                       |                                                           |                                                             |              |            |                                                                                                                                             |                                |           |              |
| Johan van Tol (S)                                  | с       | NHMFL                                                                      | EMR                                                          | 1                                                         |                                                             |              |            | 1                                                                                                                                           | 1                              | I         | 1            |

| EMR |
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|                                                |         | Participants<br>(Name, Role, Org., Dept.)                           |                                                             |                                                             | Inding Sources<br>ency, Division,                                          | Award #)     | Proposal # | Proposal Title                                                                           | Discipline                              | Exp.<br># | Days<br>Used |
|------------------------------------------------|---------|---------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------|--------------|------------|------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Naresh Dalal (S)<br>Riqiang Fu (S)             | PI<br>C | NHMFL                                                               | Chemistry<br>NMR                                            | NSF                                                         | CHE -<br>Chemistry                                                         | CHE1464955   | P18094     | Study of molecular dynamics on<br>metal organic framework<br>[(CH3)2NH2]Mg(HCOO)3] using | Chemistry                               | 1         | 2            |
| Sanath Kumar Rama Krishna (G)                  | С       | Florida State University                                            | Condensed Matter Physics                                    |                                                             |                                                                            |              |            | solid state NMR spectroscopy                                                             |                                         |           |              |
| Jamie Manson (S)                               | PI      | Eastern Washington University                                       | Chemistry and Biochemistry                                  | No other support                                            |                                                                            |              | P19143     | Determining phase diagrams in<br>bespoke S = 1 Ni(II) quantum                            | Condensed<br>Matter                     | 2         | 14.5         |
| Sam Curley (G)                                 | С       | University of Warwick                                               | Physics and Astronomy                                       | NSF                                                         | DMR -<br>Division of<br>Materials<br>Research                              | DMR1703003   |            | magnets                                                                                  | Physics                                 |           |              |
| Paul Goddard (S)                               | С       | University of Warwick                                               | Department of Physics                                       |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Andrew Ozarowski (S)                           | C       | NHMFL                                                               | EMR                                                         |                                                             |                                                                            |              |            |                                                                                          |                                         |           | <u> </u>     |
| Adam Veige (S)                                 | PI      | University of Florida                                               | Chemistry                                                   | NSF                                                         | CHE -<br>Chemistry                                                         | CHE1808234   | P19170     | Quantification of End Groups in<br>Cyclic vs. Linear Polyacetylenes by                   | Biology,<br>Biochemistry,               | 1         | 9            |
| Clifford Bowers (S)                            | С       | University of Florida                                               | Chemistry                                                   |                                                             |                                                                            |              |            | Carbon-13 Magic Angle Spinning<br>Nuclear Magnetic Resonance                             | Biophysics                              |           |              |
| Alec Esper (G)                                 | С       | University of Florida                                               | Chemistry                                                   |                                                             |                                                                            |              |            | Spectroscopy                                                                             |                                         |           |              |
| Frederic Mentink (S)                           | С       | National High Magnetic Field<br>Laboratory                          | NMR Division                                                |                                                             |                                                                            |              |            | spectroscopy                                                                             |                                         |           |              |
| Zhihui Miao (G)                                | С       | University of Florida                                               | Department of Chemistry                                     |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Brent Sumerlin (S)                             | С       | University of Florida                                               | Chemistry                                                   |                                                             |                                                                            |              | 1          |                                                                                          |                                         |           | 1            |
| Johan van Tol (S)                              | С       | National High Magnetic Field<br>Laboratory                          | EMR                                                         |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Tommy Zhao (G)                                 | С       | University of Florida                                               | Chemistry                                                   |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Dmytro Nesterov (P)                            | Ы       | Technical University of Lisbon                                      | Chemistry Department                                        | FCT - Fundação para a<br>Ciência e Tecnologia<br>(Portugal) | Non US<br>Foundation                                                       |              | P19177     | Magnetic Properties and EPR<br>spectroscopy of Tetranuclear<br>Copper Complexes          | Chemistry                               | 1         | 2            |
| Andrew Ozarowski (S)                           | С       | National High Magnetic Field<br>Laboratory                          | EMR                                                         |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| George Christou (S)                            | PI      | University of Florida                                               | Chemistry                                                   | No other support                                            |                                                                            |              | P19185     | High-Field EPR Studies of Exchange                                                       | Chemistry                               | 7         | 45.5         |
| ChristiAnna Brantley (G)                       | C       | University of Florida                                               | Chemistry                                                   | DOE                                                         | Office of<br>Science -<br>EFRC - Energy<br>Frontier<br>Research<br>Centers | DE-SC0019330 |            | Coupling Within Single-Molecule<br>Magnet Oligomers                                      |                                         |           |              |
| Tuhin Ghosh (P)<br>Stephen Hill (S)            | C<br>C  | University of Florida<br>National High Magnetic Field<br>Laboratory | Department of Chemistry<br>EMR                              |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Daphné Lubert-Perquel (P)<br>Johan van Tol (S) | C<br>C  | Imperial College London<br>NHMFL                                    | Physics<br>EMR                                              |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Johan van Tol (S)                              | PI      | National High Magnetic Field<br>Laboratory                          | EMR                                                         | No other support                                            |                                                                            |              | P19207     | Testing and Maintenance                                                                  | Condensed<br>Matter<br>Physics          | 1         | 2            |
| Frederic Mentink (S)                           | PI      | National High Magnetic Field<br>Laboratory                          | NMR Division                                                | No other support                                            |                                                                            |              | P19241     | Improving biradicals for MAS-DNP<br>at high field: a combined approach                   | Chemistry                               | 2         | 9            |
| Krishnendu Kundu (P)                           | С       | National High Magnetic Field<br>Laboratory                          | EMR                                                         |                                                             |                                                                            |              |            | of Spin-Dynamics theory, DFT and<br>high-field EPR                                       |                                         |           |              |
| Snorri Sigurdsson (S)                          | С       | University of Iceland                                               | Chemistry                                                   |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Henry La Pierre (S)                            | PI '    | <ul> <li>Georgia Institute of Technology</li> </ul>                 | School of Chemistry and<br>Biochemistry                     | DOE                                                         | Office of<br>Science - BES<br>– Basic<br>Energy<br>Sciences                | DE-SC0019385 | P19275     | Study of Zero Field Splitting in<br>Molecular Tb4+ Complexes by High<br>Field EPR        | Biology,<br>Biochemistry,<br>Biophysics | 4         | 14           |
| Thaige Gompa (G)                               | С       | Georgia Institute of Technology                                     | School of Chemistry and<br>Biochemistry                     | Arnold and Mabel<br>Beckman Foundation                      | US<br>Foundation                                                           |              |            |                                                                                          |                                         |           |              |
| Samuel Greer (P)                               | С       | Los Alamos National Laboratory                                      | C-PCS: PHYSICAL CHEM & APPLIED<br>SPECTROSCOPY              |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Arun Ramanathan (G)<br>Natalie Rice (G)        | C<br>C  | Georgia Institute of Technology<br>Georgia Institute of Technology  | Chemistry<br>School of Chemistry and                        |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
| Joshua Telser (S)                              | С       | Roosevelt University                                                | Biochemistry<br>Biological, Physical and Health<br>Sciences |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |
|                                                |         |                                                                     |                                                             |                                                             |                                                                            |              |            |                                                                                          |                                         |           |              |

|                       |    | Participants<br>(Name, Role, Org., Dept.)                         |                                                                   |                                         | nding Sources<br>ency, Division,                                             | Award #)                | Proposal # | Proposal Title                                                                                                            | Discipline                              | Exp.<br># | Days<br>Used |
|-----------------------|----|-------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------|-------------------------|------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Likai Song (S)        | PI | National High Magnetic Field                                      | EMR                                                               | No other support                        |                                                                              |                         | P19282     | Instrument Development and                                                                                                | Magnets,                                | 2         | 61           |
| Krishnendu Kundu (P)  | с  | Laboratory<br>National High Magnetic Field                        | EMR                                                               |                                         |                                                                              |                         |            | Maintenance of the HiPER<br>Spectrometer                                                                                  | Materials                               |           |              |
| Jonathan Marbey (G)   | С  | Laboratory<br>National High Magnetic Field<br>Laboratory          | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Linda Doerrer (S)     | PI | Boston University                                                 | Chemistry Department                                              | NSF                                     | CHE -<br>Chemistry                                                           | CHE1800313              | P19306     | A Unique {Mn6} Cluster with Axial<br>Symmetry as a Single-Molecule                                                        | Chemistry                               | 1         | 10           |
| Jessica Elinburg (G)  | С  | Boston University                                                 | Chemistry                                                         |                                         | ,                                                                            |                         |            | Magnet Candidate                                                                                                          |                                         |           |              |
| Andrew Ozarowski (S)  | С  | National High Magnetic Field<br>Laboratory                        | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Rudi van Eldik (S)    | PI | <ul> <li>University of Erlangen-Nuremberg,<br/>Germany</li> </ul> | Department of Chemistry and<br>Pharmacy                           | National Science Center<br>(NCN) Poland | Other                                                                        | 2019/03/X/ST4/01<br>317 | P19314     | Characterization of the first mixed-<br>valence Ru(II)/Ru(III) ion-pair                                                   | Chemistry                               | 1         | 4            |
| Anna Katafias (S)     | С  | N Copernicus University Torun                                     | Faculty of Chemistry                                              | (                                       |                                                                              |                         |            | complex                                                                                                                   |                                         |           |              |
| Anna Kozakiewicz (S)  | С  | Nicolaus Copernicus University in<br>Torun                        | Faculty of Chemistry                                              |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Andrew Ozarowski (S)  | С  | National High Magnetic Field                                      | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Grzegorz Wrzeszcz (S) | С  | Laboratory<br>Nicolaus Copernicus University in<br>Torun          | Department of Inorganic and<br>Coordination Chemistry, Faculty of |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Stergios Piligkos (S) | PI | University of Copenhagen                                          | Chemistry<br>Department of Chemistry                              | No other support                        |                                                                              |                         | P19318     | Pulsed EPR of Yb(trensal) based                                                                                           | Magnets,                                | 8         | 63           |
| Christian Buch (G)    | С  | University of Copenhagen                                          | Chemistry                                                         | Villum Foundation                       | Non US<br>Foundation                                                         |                         |            | quantum gates                                                                                                             | Materials                               |           |              |
| Stephen Hill (S)      | С  | NHMFL                                                             | EMR                                                               |                                         | roundation                                                                   |                         |            |                                                                                                                           |                                         |           |              |
| Krishnendu Kundu (P)  | С  | NHMFL                                                             | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Jonathan Marbey (G)   | С  | NHMFL                                                             | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Likai Song (S)        | С  | NHMFL                                                             | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Johan van Tol (S)     | С  | NHMFL                                                             | EMR                                                               |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Kirill Kovnir (S)     | PI | <ul> <li>Iowa State University</li> </ul>                         | Chemistry                                                         | No other support                        |                                                                              |                         | P19330     | EPR investigation of Cr2Se2 dimer                                                                                         | Chemistry                               | 3         | 8.5          |
| Eranga Gamage (G)     | С  | Iowa State University                                             | Chemistry                                                         | lowa State University                   | US College<br>and<br>University                                              |                         |            |                                                                                                                           |                                         |           |              |
| Andrew Ozarowski (S)  | C  | National High Magnetic Field<br>Laboratory                        | EMR                                                               |                                         | University                                                                   |                         |            |                                                                                                                           |                                         |           |              |
| Jianjun Pan (S)       | PI | University of South Florida                                       | Physics                                                           | NIH                                     | NIGMS -<br>National<br>Institute of<br>General<br>Medical<br>Sciences        | GM117531                | P19341     | Interactions of the Helix 0 of<br>Endophilin with Lipid Membranes<br>Defined by Multi-Frequency EPR                       | Biology,<br>Biochemistry,<br>Biophysics | 2         | 29           |
| Albert Stiegman (S)   | PI | Florida State University                                          | Chemistry                                                         | DOE                                     | Office of<br>Science - BES<br>– Basic<br>Energy<br>Sciences                  | DE-FG-02-<br>03ER15467  | P19345     | Characterization of the active sites<br>in the Phillip's ethylene<br>polymerization catalyst with EPR<br>spectroscopy     | Chemistry                               | 2         | 6            |
| Jurek Krzystek (S)    | С  | NHMFL                                                             | Condensed Matter Science                                          |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Nathan Peek (G)       | С  | Florida State University (FSU)                                    | Chemistry and Biochemistry                                        |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Susannah Scott (S)    | С  | University of California, Santa Barbara                           | Chemical Engineering                                              |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Ellis Reinherz (S)    | PI | Dana-Farber Cancer Institute                                      | Medicine                                                          | No other support<br>NIH                 | NIAID -<br>National<br>Institute of<br>Allergy and<br>Infectious<br>Diseases | AI126901                | P19358     | EPR analysis of HIV-1 MPER<br>segment for optimized vaccine<br>design                                                     | Biology,<br>Biochemistry,<br>Biophysics | 4         | 47           |
| Mas Subramanian (S)   | PI | * Oregon State University                                         | Chemistry                                                         | NSF                                     | DMR -<br>Division of<br>Materials<br>Research                                | DMR1508527              | P19361     | Frequency- and field-domain<br>magnetic resonance investigation of<br>novel materials based on Mn4+-<br>doped sillenites. | Magnets,<br>Materials                   | 1         | 1.5          |
| Jurek Krzystek (S)    | С  | NHMFL                                                             | Condensed Matter Science                                          |                                         |                                                                              |                         | 1          |                                                                                                                           |                                         |           |              |
| Mykhaylo Ozerov (S)   | С  | NHMFL                                                             | Condensed Matter Science, DC Field<br>CMS                         |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |
| Joshua Telser (S)     | С  | Roosevelt University                                              | Biological, Physical and Health<br>Sciences                       |                                         |                                                                              |                         |            |                                                                                                                           |                                         |           |              |

| Boolfloy Biologi (1)         H         BMAR         Chemitry         Nor         DMAR         DMARS02737         P3322         Multimeter utilization MML<br>producting dynamics at<br>producting dynamics at<br>pro |                                                                                                                                                                                                                                                  |                   | Participants<br>(Name, Role, Org., Dept.)           |                                                   |                  | nding Sources<br>ncy, Division, |            | Proposal # | Proposal Title                                        | Discipline                     | Exp.<br># | Day<br>Use |   |
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| Adam Refunction Col     Monto Source Marrow and Konsensity     Oracle State University     Central Sta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Geoffrey Strouse (S)                                                                                                                                                                                                                             | PI                | NHMFL                                               | Chemistry                                         | NSF              | Division of<br>Materials        | DMR1905757 | P19372     | investigation of plasmonic and                        | Chemistry                      | 1         | 1          |   |
| Carl Coli (0)       C       Nonda Sate Unversion       Owneraby & Biotemint Y       Owneraby & Biotemint Y       Description       Section                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Adam Altenhof (G)                                                                                                                                                                                                                                | С                 | Florida State University                            | Chemistry and Biochemistry                        |                  |                                 |            |            |                                                       |                                |           |            |   |
| athong (sin)     C     NHARE     NHARE       barthong (sin)     C     NHARE     OWARAWAR     Demistry       barthong (sin)     C     NHARE     Demistry     Demistry       barthong (sin)     C     Rod State University     Physics       State Charters (sin)     C     National High Magnetic Roid     Demistry       barthong (sin)     C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Nhat Nguyen Bui (P)                                                                                                                                                                                                                              | С                 | NHMFL                                               | CMS                                               |                  |                                 |            |            |                                                       |                                |           |            |   |
| han hang find find for a start kine water field for a start kine kine water field for a start kine water field for a start kine wate                                                                                                                                               | Carl Conti (G)                                                                                                                                                                                                                                   | С                 | Florida State University                            | Chemistry & Biochemistry                          |                  |                                 |            |            |                                                       |                                |           |            |   |
| Jook Barry     Proof Matrike University     Proof Matrike University     Community     <                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Zhehong Gan (S)                                                                                                                                                                                                                                  | С                 | NHMFL                                               | NHMFL                                             |                  |                                 |            |            |                                                       |                                |           |            |   |
| Interfacts (Mich  (Mich) Mich) (Mich (Mich (Mich (Mich (Mich (Mich (Mich (Mich)                                                                                                                                                                      | Ivan Hung (S)                                                                                                                                                                                                                                    | С                 | NHMFL                                               | CIMAR/NMR                                         |                  |                                 |            |            |                                                       |                                |           |            |   |
| Rader Song (S) C Normality College Dalin Kind (S) Consisty and Clericity Delinin Kind (S) Consisty Delinin Consisty Delinin Kind (S) Consisty Delinin Consisty                                                                                                                                                | Jason Kuszynski (G)                                                                                                                                                                                                                              | С                 | Florida State University                            | Chemistry                                         |                  |                                 |            |            |                                                       |                                |           |            |   |
| Likal Song (h)CNMMTDMACNMMTDMACNot (h)Not (h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Frederic Mentink (S)                                                                                                                                                                                                                             | С                 | NHMFL                                               | NMR Division                                      |                  |                                 |            |            |                                                       |                                |           |            |   |
| State Morgan         P         University College Dublin         School of Chemistry and Chemical<br>Beiging         No other support         P19822         Mutilierroic behavior at spin-state<br>transition - beyond Mintall         Chemistry         1         5           Statinea Cikkara (S)         C         Nucleon High Magnetic Field         CAS, DC Field Facility         No other support         Field Pacific Paci                                                                                                                                                                                                                                                                                                                        | Robert Schurko (S)                                                                                                                                                                                                                               | С                 | Florida State University                            | Chemistry                                         |                  |                                 |            |            |                                                       |                                |           |            |   |
| Biology         Biology <t< td=""><td>Likai Song (S)</td><td>С</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Likai Song (S)                                                                                                                                                                                                                                   | С                 |                                                     |                                                   |                  |                                 |            |            |                                                       |                                |           |            |   |
| shaline Chikara (5)         C         National High Magnetic Field         CMS, DC Field Facility         Figure Chicara (5)         C         Physics         Figure Chicara (5)         C         National High Magnetic Field         School of Chemistry         Physics         Figure Chicara (5)         Figure Chicara (5)         C         National High Magnetic Field         Physics         Figure Chicara (5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Grace Morgan (S)                                                                                                                                                                                                                                 | PI                | University College Dublin                           | •                                                 | No other support |                                 |            | P19428     |                                                       | Chemistry                      | 1         | 5          |   |
| Britham (Cinim (G)       C       Matical Higher (H)       PLAGE       PLAGE <th< td=""><td>Shalinee Chikara (S)</td><td>С</td><td></td><td></td><td></td><td></td><td></td><td></td><td>transitions – beyond Mn(taa)</td><td></td><td></td><td></td></th<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Shalinee Chikara (S)                                                                                                                                                                                                                             | С                 |                                                     |                                                   |                  |                                 |            |            | transitions – beyond Mn(taa)                          |                                |           |            |   |
| Supplen Hill (5)       C       National High Magnetic Field<br>Laboratory       EAR       Laboratory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Brittony Grimm (G)                                                                                                                                                                                                                               | c                 | -                                                   | Physics                                           |                  |                                 |            |            |                                                       |                                |           |            |   |
| Vibe Jakobas (6)       C       Unnersity College Dubin       School of Chemistry       Sc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                  |                   | National High Magnetic Field                        |                                                   |                  |                                 |            |            |                                                       |                                |           |            |   |
| Initial Kuppen (P)       C       University College Dublin       School of Chemistry       Physics       Feature (P)       C       Notice (P)       P19459       Conservation (P)       P19459       P194597       P1945975       P194597       P194597 <th< td=""><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |                   | -                                                   |                                                   |                  |                                 |            |            |                                                       |                                |           |            |   |
| ohn Singleton (S)       C       National High Magnetic Field<br>Laboratory       Physics       ESS - ES1846611<br>alt hand figh Magnetic Field<br>(Complex AIr Nitrogen Prototination<br>Sciences       P1       National High Magnetic Field<br>(Complex AIr Nitrogen Prototination)       Immestigating Oxygen Vacancies of<br>Various Metal Doped Titania for<br>Various Metal Doped Titania for<br>Complex Air Nitrogen Prototination<br>Complex Air Nitrogen Prototinatin<br>Prototin Prototination<br>Air Nitrogen Prototin<br>Nitrogen                                                                        |                                                                                                                                                                                                                                                  |                   |                                                     | -                                                 |                  |                                 |            |            |                                                       |                                |           |            |   |
| Invine Tage (s)     C     NHME     Physics     Image (c)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                  |                   | National High Magnetic Field                        | -                                                 |                  |                                 |            |            |                                                       |                                |           |            |   |
| Marta Hatzell (5)       PI       & Georgia Institute of Technology       Institute of Technology       Institute of Technology       Institute of Technology       Engineering       1       7         Michael Shatruk (S)       PI       National High Magnetic Field       Department of Chemistry       No other support       P19472       EPP Investigation of Lantanide<br>Complexes as Potential Hosts for<br>Cubits and Molecular<br>Qubits       Magnets,<br>Materials       1       3         Michael Shatruk (S)       PI       National High Magnetic Field<br>Laboratory       Department of Chemistry<br>EMR       No other support       P19472       EPP Investigation of Lantanide<br>Complexes as Potential Hosts for<br>Qubits       Magnets,<br>Materials       1       3         Daphe Lubert-Perque (P)       C       Imperial College London<br>Physics       Physics       Determining spin relaxation<br>properties of metal phosphates<br>with varying Multic content at high<br>field       Chemistry       1       5         Daniel Jardon Álvarez (P)       C       Weizmann Institute of Science<br>Laboratory       Materials and Interfaces       No other support       P19484       P19484       Determining spin relaxation<br>motin High Magnetic Field<br>Labora                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (i. i.e. 7-af (C)                                                                                                                                                                                                                                | 6                 |                                                     | Dhusie                                            |                  |                                 |            |            |                                                       |                                |           |            |   |
| Mechanical Engineering       Environment<br>al Chemical<br>Sciences       Environment<br>al Chemical<br>Sciences       Status       Various Metal Doped Titania for<br>Direct Air Nitrogen Photofixation       Magets,<br>Materials       1       3         Michael Shatruk (S)       PI       National High Magnetic Field<br>Laboratory       Department of Chemistry       No other support       P19472       EPR Investigation of Lantanide<br>Complexes as Potential Holos,<br>Materials       Namets,<br>Materials       1       3         Viguel Gakiya (G)       C       Florida State University       Chemistry and Biochemistry       No other support       P19472       EPR Investigation of Lantanide<br>Complexes as Potential Holos,<br>Materials       Namets,<br>Materials       1       3         Daphe Luber-Perquel (P)       C       Notalinal High Magnetic Field<br>Laboratory       EMR       European Research<br>Council       Non US       803024       P19484       Determining spin relaxation<br>properties of metal phosphates<br>with varying Multi Content step<br>in field       1       2         Inrique Colacio (S)       P1       University of Granada       Inorganic Chemistry       No other support       P19485       High-frequency and -field EPR and<br>primetia of instal phosphates<br>with varying Multi Content step<br>in field       Chemistry       1       2.5         Andrew Ozarowski (S)       C       National High Magnetic Field<br>Laboratory       Condensed Matter Science, DC Field       No other support </td <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                  |                   |                                                     |                                                   |                  |                                 |            |            |                                                       |                                |           |            |   |
| Laboratory       Laboratory       Chemistry       Chemistry and Biochemistry         Miguel Gakiya (G)       C       Florida State University       Chemistry and Biochemistry         Stephen Hill (S)       C       National High Magnetic Field       EMR         Laboratory       C       Imperial College London       Physics         Daphé Lubert-Perquel (P)       C       Imperial College London       Physics         Michai Leskes (S)       Pl       Veizmann Institute of Science       Materials and Interfaces       European Research<br>Council       No US<br>Council       803024       P19484       Determining spin relaxation<br>propervise of metal phosphates<br>with avpiropravise of metal phosphates<br>michai Laboratory       Chemistry       1       5         Dariel Jardón Álvarez (P)       C       Weizmann Institute of Science       Materials and Interfaces       European Research<br>Council       No US<br>Council       803024       P19485       High-frequency and -field EPR and<br>Field       Chemistry       1       2         Jurek Krzystek (S)       C       National High Magnetic Field<br>Laboratory       Condensed Matter Science, CME       No other support       Field       High-frequency and -field EPR and<br>Field Science, CME       Coll       Council       Softwas complexes       P19485       High-frequency and -field BPR and<br>Field Science, CME       Co                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Marta Hatzell (S)                                                                                                                                                                                                                                | PI                | <ul> <li>Georgia Institute of Technology</li> </ul> |                                                   | NSF              | Environment<br>al Chemical      | ECS1846611 | P19459     | Various Metal Doped Titania for                       | Engineering                    | 1         | 7          |   |
| Automal High Magnetic Field<br>Laboratory       EMR       EMR       Ruropean Research<br>Council       Non US       Rogade       P19484       Determining spin relaxation<br>properties of metal phosphates<br>with varying MM(II) content at high<br>field       Chemistry       1       5         Daphel Luber-Perquel (P)       C       Weizmann Institute of Science       Materials and Interfaces       European Research<br>Council       Non US       803024       P19484       Determining spin relaxation<br>properties of metal phosphates<br>with varying MM(II) content at high<br>field       Chemistry       1       5         Daniel Jardón Álvarez (P)       C       Weizmann Institute of Science       Materials and Interfaces       No other support       Souncil       Council                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Michael Shatruk (S)                                                                                                                                                                                                                              | PI                |                                                     | Department of Chemistry                           | No other support |                                 |            | P19472     | Complexes as Potential Hosts for                      |                                | 1         | 3          |   |
| Daphe Lubert-Perquel (P)       C       Inperpendical program (non-program                                                                                                                                                                                                | Miguel Gakiya (G)                                                                                                                                                                                                                                | С                 | Florida State University                            | Chemistry and Biochemistry                        |                  |                                 |            |            |                                                       |                                |           |            |   |
| Michal Leskes (S) PI * Weizmann Institute of Science Materials and Interfaces Council Council Council Council Council Council Council Council P19484 Determining spin relaxation properties of metal phosphates with varying M(II) content at high magnetic field EPR and fi                                                                                                                                               | Stephen Hill (S)                                                                                                                                                                                                                                 | С                 |                                                     | EMR                                               |                  |                                 |            |            | Qubits                                                |                                |           |            |   |
| Daniel Jardón Álvarez (P)CWeizmann Institute of ScienceMaterials and InterfacesCouncilCouncilproperties of metal phosphates<br>with varying Mn[II] content at high<br>fieldofcEnrique Colacio (S)PIUniversity of GranadaInorganic ChemistryNo other supportP19485High-frequency and -field EPR and<br>FIRMS of prismatic trigonal Co(II)<br>and pentagonal bipyramidal Dy(III)<br>SIMs complexesCodensed Matter Science<br>LaboratoryNo other supportP19485High-frequency and -field EPR and<br>FIRMS of prismatic trigonal Co(II)<br>and pentagonal bipyramidal Dy(III)<br>SIMs complexesChemistry12Andrew Ozarowski (S)CNational High Magnetic Field<br>LaboratoryCondensed Matter Science, DC Field<br>CMSNo other supportP19505C ALIBRATION AND MAINTENANCE<br>OF THE 15/17 T EPR INSTRUMENT<br>MaterialsMagnets,<br>Materials12.5gor Fritsky (S)PI* Taras Shevchenko National University<br>v fixivChemistryChemistryTaras Shevchenko<br>University, Kiev, Ukraine<br>University, Kiev, Ukraine<br>University, Kiev, UkraineNon US<br>College and<br>UniversityP19517HF-EPR study of stable water-<br>soluble maganese(IV)<br>havahydrazide clathrochelate<br>complexes with unusual electronic15Andrew Ozarowski (S)CNational High Magnetic FieldEMREMRNon US<br>University, Kiev, Ukraine<br>University, Kiev, UkraineNon US<br>College and<br>UniversityP19517HF-EPR study of stable water-<br>soluble maganese(IV)<br>havahydrazide clathrochelate<br>complexes with unusual electronic15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Daphné Lubert-Perquel (P)                                                                                                                                                                                                                        | С                 | Imperial College London                             | Physics                                           |                  |                                 |            |            |                                                       |                                |           |            |   |
| Indexed value       Indexed value <th indexed="" td="" value<<=""><td>Vichal Leskes (S)</td><td>PI</td><td><ul> <li>Weizmann Institute of Science</li> </ul></td><td></td><td></td><td></td><td>803024</td><td>P19484</td><td>properties of metal phosphates</td><td>Chemistry</td><td>1</td><td>5</td></th>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <td>Vichal Leskes (S)</td> <td>PI</td> <td><ul> <li>Weizmann Institute of Science</li> </ul></td> <td></td> <td></td> <td></td> <td>803024</td> <td>P19484</td> <td>properties of metal phosphates</td> <td>Chemistry</td> <td>1</td> <td>5</td> | Vichal Leskes (S) | PI                                                  | <ul> <li>Weizmann Institute of Science</li> </ul> |                  |                                 |            | 803024     | P19484                                                | properties of metal phosphates | Chemistry | 1          | 5 |
| Jurek Krzystek (S)       C       National High Magnetic Field<br>Laboratory       Condensed Matter Science<br>Laboratory       First Science CMS       First Science CMS       First Science CMS       First Science SCIENCE       Science SCIENCE </td <td>Daniel Jardón Álvarez (P)</td> <td>С</td> <td>Weizmann Institute of Science</td> <td>Materials and Interfaces</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Daniel Jardón Álvarez (P)                                                                                                                                                                                                                        | С                 | Weizmann Institute of Science                       | Materials and Interfaces                          |                  |                                 |            |            |                                                       |                                |           |            |   |
| Index       National High Magnetic Field<br>Laboratory       Condensed Matter Science<br>Laboratory       Condensed Matter Science<br>CMS       Condense<br>CMS       Condense<br>CMS       Condense<br>CMS       Condense<br>CMS       Condense<br>CMS       Condense<br>CMS       Cond                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Enrique Colacio (S)                                                                                                                                                                                                                              | PI                | University of Granada                               | Inorganic Chemistry                               | No other support |                                 |            | P19485     |                                                       | Chemistry                      | 1         | 2          |   |
| Mythanylo Ozerov (S)       C       National High Magnetic Field<br>Laboratory       Condensed Matter Science, DC Field<br>CMS       No other support       P19505       CALIBRATION AND MAINTENANCE<br>OF THE 15/17 T EPR INSTRUMENT       Magnets,<br>Materials       1       2.5         Igor Fritsky (S)       PI       *       Taras Shevchenko National University<br>Kivi       Chemistry       Taras Shevchenko<br>University, Kiev, Ukraine       Non US<br>College and<br>University       P19517       HF-EPS study of stable water-<br>soluble manganese(IV)<br>hexahydrazide clathrochelate<br>complexes with unusual electronic       1       5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Jurek Krzystek (S)                                                                                                                                                                                                                               | С                 |                                                     | Condensed Matter Science                          |                  |                                 |            |            | and pentagonal bipyramidal Dy(III)                    |                                |           |            |   |
| Laboratory     OF THE 15/17 T EPR INSTRUMENT     Materials     Materials       Igor Fritsky (S)     PI     *     Taras Shevchenko National University<br>of Kyiv     Chemistry     Taras Shevchenko     Non US     P19517     HF-EPR study of stable water-<br>soluble manganese(IV)     Chemistry     1     5       Andrew Ozarowski (S)     C     National High Magnetic Field     EMR     University, Kiev, Ukraine     College and<br>University     Diversity     College and<br>University     Diversity     College and<br>College and<br>University     College and<br>University     Diversity     College and<br>College and<br>University     Diversity     College and<br>College and<br>University     Diversity     College and<br>College and<br>University     Diversity     College and<br>College and                                                                                                                                                                                                                     | Mykhaylo Ozerov (S)                                                                                                                                                                                                                              | С                 |                                                     |                                                   |                  |                                 |            |            |                                                       |                                |           |            |   |
| of Kyiv     University, Kiev, Ukraine     College and<br>University, Kiev, Ukraine     soluble manganese(IV)       Andrew Ozarowski (S)     C     National High Magnetic Field     EMR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Andrew Ozarowski (S)                                                                                                                                                                                                                             | PI                |                                                     | EMR                                               | No other support |                                 |            | P19505     |                                                       |                                | 1         | 2.5        |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | gor Fritsky (S)                                                                                                                                                                                                                                  | PI                |                                                     | Chemistry                                         |                  | College and                     |            | P19517     | soluble manganese(IV)<br>hexahydrazide clathrochelate | Chemistry                      | 1         | 5          |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Andrew Ozarowski (S)                                                                                                                                                                                                                             | С                 |                                                     | EMR                                               |                  |                                 |            |            |                                                       |                                |           |            |   |

## 4. High B/T Facility

|                                                                                                     |                        | Participants<br>(Name, Role, Org., Dept.)                                                                                              |                                                                             | Funding Sources<br>(Funding Agency, Division,        |                      | Proposal # | Proposal Title                                                                                                                                   | Discipline                     | Exp.<br>#      | Days<br>Used |
|-----------------------------------------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------|----------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------|--------------|
| Ryuji Nomura (S)<br>Keegan Gunther (G)<br>Yoonseok Lee (S)<br>Lucia Steinke (P)<br>Andrew Woods (P) | PI<br>C<br>C<br>C<br>C | Tokyo Institute of Technology<br>University of Florida<br>University of Florida<br>University of Florida (UF)<br>University of Florida | Physics<br>Physics<br>Department of Physics<br>High B/T Facility<br>Physics | Japanese Society for Promotion of Sciences<br>(JSPS) | Non US<br>Foundation | P16308     | Investigating Spin Degrees of<br>Freedom of Surface Andreev Bound<br>States of Non-unitary Superfluid<br>Helium Three in High Magnetic<br>Fields | Condensed<br>Matter<br>Physics | 1              | 85           |
| Chao Huan (P)<br>Johnny Adams (G)<br>Donald Candela (S)<br>Marc Lewkowitz (G)<br>Neil Sullivan (S)  | РІ<br>С<br>С<br>С<br>С | University of Florida<br>University of Florida<br>University of Massachusetts<br>University of Florida<br>University of Florida        | Physics<br>Physics<br>Physics<br>Physics<br>Physics                         | UCGP                                                 |                      | P17606     | Studies of Novel Phases of 3He in<br>Extreme Conditions                                                                                          | Condensed<br>Matter<br>Physics | 1              | 85           |
|                                                                                                     |                        |                                                                                                                                        |                                                                             | •                                                    |                      | •          | Total Proposals:<br>2                                                                                                                            | Expo                           | eriments:<br>2 | Days         |

# 5. ICR Facility

| Image: Notice Org., Dept.)         Image: Notice Org., Dept.) <th< th=""><th></th><th></th><th>Participants</th><th></th><th></th><th>Funding Sources</th><th></th><th>Duene seed ()</th><th>Duenes d This</th><th>Dissipling</th><th>Exp.</th><th>Days</th></th<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |    | Participants                    |                                   |                    | Funding Sources      |          | Duene seed () | Duenes d This                      | Dissipling    | Exp. | Days |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----|---------------------------------|-----------------------------------|--------------------|----------------------|----------|---------------|------------------------------------|---------------|------|------|
| Matrix Addressen (f)     C     Unvestign (the south Waters)     Encounce that Sciences<br>Automation<br>Automation<br>(science framework)     Other<br>Automation<br>(science framework)     Other<br>Automation<br>(science framework)     Instantion<br>(science framework)     Other<br>(science framework)     Instantion<br>(science framework)     Insta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |    |                                 |                                   | (Funding           |                      | ward #)  | Proposal #    | Proposal litle                     | Discipline    | #    | Used |
| Martin Andersen (1)     C     University of Need South Welles     School of Civil and Environmental Account International South So                                                                                                                                                                                                                                                                                                                                                                    | Andy Baker (S)          | PI | · - · ·                         | School of Biological, Earth and   |                    |                      | -        | P16162        | Groundwater organic matter:        | Chemistry     | 1    | 1    |
| Angen Behne (s)     C     Inside State Unversity     Engineering<br>Service Training<br>Service Training              |                         |    |                                 |                                   |                    |                      |          |               | carbon source or sink?             |               |      |      |
| Magan Bahasa (1)       C       Monor Solution University of Magan Solution University Magan Solution University of Magan Solution University                                                                                                                                                                                                                                                                                                                                                                          | Martin Andersen (T)     | С  | University of New South Wales   |                                   |                    | Other                |          |               |                                    |               |      |      |
| Megan Belmie (6)       C.       Farida Sate University       Extb Ocean and Atmospheric       Advantation Stational Conference of Contractional Society       One-random Stational Conference of Contractional Society       Instructional Society       I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |    |                                 | Engineering                       |                    |                      |          |               |                                    |               |      |      |
| Magan Refine [6]       C       Rotids State University       Earth, Decan and Atmosphere<br>Science       Other<br>Advectors Science       Other<br>Control<br>Interfectors Science       Other<br>Control<br>Interfectors Science       Other<br>Control<br>Interfectors Science       Other<br>Control<br>Interfectors Science       Other<br>Control<br>Interfectors Science       Interfectors Science       Other<br>Interfectors Science       Interfectors Science       <                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Magan behne (i)       Partial State University       Leth, Ocean and Atmosphere       Selence Honology       Other Partial State University       James Honology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |    |                                 |                                   | 0                  |                      |          |               |                                    |               |      |      |
| Magan Behne (G)       C       Rinds State University       End, Gean and Amaganesis       Degramation<br>of Control of States University       Degramation<br>of Control of States University       Degramation<br>of Control of States University       Images Behne (G)       Degramation<br>of Control of Con                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Mage lebelse (c)       C       Fonds State University       Fond, State University                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Celment Bröger (T)       C       NSW Sydney       Science       Accelerator Solice<br>Accelerator Accelerator<br>Accelerator Solice<br>Accelerator Accelerator Accelerator Accelerator<br>Accelerator Accelerator<br>Accelerator Accelerator<br>Accelerator Accelerator Acce                                                                                        |                         |    |                                 |                                   | (ANSTO)            |                      |          |               |                                    |               |      |      |
| Chement Reigner (1)       C       UNSW Sydney       Genereind Waters initiative<br>Research Center       Initiative<br>Stategy (XGR8)<br>Stategy (XGR8)       Other<br>Stategy (XGR8)<br>Stategy (XGR8)       Initiative<br>Stategy (XGR8)       Initiat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Megan Behnke (G)        | С  | Florida State University        |                                   |                    | Other                |          |               |                                    |               |      |      |
| Ckinent Brigger (1)       C       UNSW Sydney       Consected Waters Initiative<br>Reservic Centre<br>Display       Consected Waters Initiative<br>Reservice Centre<br>Display       Consected Centre<br>Display       Consec                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                         |    |                                 | Science                           |                    |                      |          |               |                                    |               |      |      |
| Generative storager (1)       G.       Unservisy of the south values       School of Civit and Environmental Engineering Engin                                                                                                                                                                                                                                                                                                                                                                                  |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Clement Bridger (1)       C       UNSW Sydney       Benearch Water, initiative<br>Breacht Centre       Research<br>Strange (NCRRSP)<br>Strange (NCRRSP)<br>Strange (NCRRSP)       Other       Research<br>Strange (NCRRSP)       Strange (NCRRSP)<br>Strange (NCRRSP)       Strange (NCRRSP)<br>Strange (NCRRSP)       Strange (NCRRSP)      Strange (NCRRSP)       Strange (NCRS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Ckinent Bridger (1)       Cu       UNSW Sydney       Connected Waters Initiative       Infrastructure<br>Numery Initiative<br>Names y nature<br>Atomas y nature<br>Atomas y nature<br>Names y nature<br>Nature<br>Names y nature<br>Names y nature<br>Names y nature<br>Names |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Climent Brigger (1)       C       NSW Sydny       Sone Ceted Water Sinch Centre       Share of Chinange Hondons's Sydney       Sone Ceted Water Sinch Centre       Sone Synch Centr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Clement Brigger (1)       C       UNSW Sydney       Concected Waters Initiative<br>Research Centre       NSW Department of<br>Primary Inductive<br>Concert Market For<br>Concert Market Fo                                                                                  |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Hung Hunnue (T)       C       Nex Sydney       School of Civil and Environmental Engineering NCGET       Fundion water Strand Strand Engineering NCGET       Fundion Strand St                                                                                                                                                                                                                                                                                                                                                                                                    | Clément Brügger (T)     | С  | UNSW Sydney                     | Connected Waters Initiative       |                    | Other                |          |               |                                    |               |      |      |
| Huang Hanoue (T)       C       UNSW Sydney       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Image Hanoue (T)       C       University of New South Wales       School of Clwi and Environmental<br>Engineering       Engineering       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F       F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |    |                                 | Research Centre                   | Primary Industries |                      |          |               |                                    |               |      |      |
| Huang Hancue (1)       C       USSW Sydney       School of Civil and Environmental Engineering       National Center for Karonal Center                                                                                                                                                                                                                                                                                                                                                                                            |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Huang Hancue (T)       C       UNSW Sydney       School of Civil and Environmental<br>Engineering<br>School of Civil and Environmental<br>Engineering       Image: School of Civil and Environmental<br>Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Huang Hanue (1)       C       NSW Sydney       School of Civil and friviromental<br>Engineering.       Free straining (NC.GRT)       School of Civil and friviromental<br>Engineering.       School of Civil and Friviromental<br>Engindeering. </td <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Huarg Hance (T)       C       NSWS Sydney       School of Biological, Earth and Fining (NCGRT)       File       File <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Hang Hangu (T)       C       UNSW Sydpey       School of Civit and Environmental<br>Engineering       Training (NCGR1)       Training (NCGR1)       Figure (T)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Huang Hanzue (T)       C       UNSW Sydney       School of Cuil and Environmental Engineering Einering Eine                                                                                                                                                                                                                                                                                                                                                                                  |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Christopher Marjol (1)       C       University of New South Wales       School of Biological, Earth and<br>Environmental Sciences         Lita McDonough (G)       C       University of New South Wales       School of Biological, Earth and<br>Environmental Sciences         Karina Meredith (1)       C       Australia's Nuclear Science and<br>Environmental Sciences       Australia's Nuclear Science and<br>Environmental Sciences       Herbology organization         Denis O'Carroll (1)       C       University of New South Wales       School of Biological, Earth and<br>Environmental Sciences       School of Biological, Earth and<br>Environmental Sciences       Herbology organization         Phetdala Oudone (6)       C       University of New South Wales       School of Clui and Environmental<br>Engineering<br>Engineering       Earth, Ocean & Atmospheric<br>Science       School of Eloigical, Earth and<br>Engineering       Figure 4000000000000000000000000000000000000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Huang Hanxue (T)        | С  | UNSW Sydney                     | School of Civil and Environmental |                    |                      |          |               |                                    |               |      |      |
| Liza McDonough (6)<br>C<br>Liza McDonough (6)<br>C<br>Liza McDonough (6)<br>C<br>Marina Meredith (1)<br>C<br>Australia's Nuclear Science and<br>Environmental Sciences<br>Australia's Nuclear Science and<br>Environmental Sciences<br>Phetdala Oudone (6)<br>C<br>Minestry of New South Wales<br>School of Civil and Environmental<br>Engineering<br>Robert Spencer (S)<br>C<br>Lisa Anderson (S)<br>C<br>Lisa Anderson (S)<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |    |                                 | Engineering                       |                    |                      |          |               |                                    |               |      |      |
| Liza McDonough (6)<br>C<br>Liza McDonough (6)<br>C<br>Liza McDonough (6)<br>C<br>Marina Meredith (1)<br>C<br>Australia's Nuclear Science and<br>Environmental Sciences<br>Australia's Nuclear Science and<br>Environmental Sciences<br>Phetdala Oudone (6)<br>C<br>Minestry of New South Wales<br>School of Civil and Environmental<br>Engineering<br>Robert Spencer (S)<br>C<br>Lisa Anderson (S)<br>C<br>Lisa Anderson (S)<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>C<br>Minestry of Virginia<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>C<br>Minestry of Clemistry and<br>Biochemistry<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Christopher Marjo (T)   | С  | University of New South Wales   | School of Biological, Earth and   |                    |                      |          |               |                                    |               |      |      |
| Karian Meredith (T)       C       Australia's Nuclear Science an<br>Technology organization       Australia's Nuclear Science an<br>Technology organization       Helen Subclair Science and<br>Technology organization       School of Civil and Environmental<br>Engineering<br>Engineering       Helen Subclair Science and<br>Technology organization       Helen Subclair Science and<br>Engineering       Helen Subclair Science and<br>Engineering <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Karina Meredith (T)       C       Australia's Nuclear Science and Technology organization       Australia's Nuclear Science and Technology organization       Image: Proceeding organizatio       Image: Proceeding organizati                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Liza McDonough (G)      | С  | University of New South Wales   | School of Biological, Earth and   |                    |                      |          |               |                                    |               |      |      |
| Technology organization       Technology organization <td></td> <td></td> <td></td> <td>Environmental Sciences</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |    |                                 | Environmental Sciences            |                    |                      |          |               |                                    |               |      |      |
| Denis O'Carroll (T)       C       University of New South Wales       School of Civil and Environmental<br>Engineering         Phetdala Oudone (G)       C       University of New South Wales       School of Giolgical, Earth and<br>Engineering         Helen Rutlidge (T)       C       University of New South Wales       School of Civil and Environmental<br>Engineering         Robert Spencer (S)       C       Florida State University       Earth, Ocean & Atmospheric<br>Science         Donald Hunt (S)       PI       University of Virginia       Chemistry         Lissa Anderson (S)       C       NHMFL       ICR         Cizabet Duselis (G)       C       University of Virginia       ICR         Van Lin (G)       C       Horida State University<br>of Virginia       ICR<br>Pathology<br>Department of Chemistry and<br>Biophenistry       Pathology<br>Department of Chemistry and<br>Biophenistry       Pa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Karina Meredith (T)     | С  | Australia's Nuclear Science and | Australia's Nuclear Science and   |                    |                      |          |               |                                    |               |      |      |
| Phetdala Oudone (G)       C       University of New South Wales       Engineering<br>School of Biological, Earth and<br>Engineering       Fugheering       F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |    | Technology organization         | Technology organization           |                    |                      |          |               |                                    |               |      |      |
| Phetdala Oudone (G)       C       University of New South Wales       Engineering<br>School of Biological, Earth and<br>Engineering       Fugheering       F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Denis O'Carroll (T)     | С  | University of New South Wales   | School of Civil and Environmental |                    |                      |          |               |                                    |               |      |      |
| Helen Rutlidge (T)CUniversity of New South WalesEnvironmental Sciences<br>EngineeringEnvironmental Sciences<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>EngineeringEnvironmental<br>Engineering <th< td=""><td></td><td></td><td></td><td>Engineering</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |    |                                 | Engineering                       |                    |                      |          |               |                                    |               |      |      |
| Helen Ruttidge (T)       C       University of New South Wales       School of Civil and Environmental<br>Engineering         Robert Spencer (S)       C       Florida State University       Earth, Ocean & Atmospheric<br>Science       School of Civil and Environmental<br>Engineering       Image: School of Civil and Environmental<br>Engineering       Image                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Phetdala Oudone (G)     | С  | University of New South Wales   |                                   |                    |                      |          |               |                                    |               |      |      |
| Robert Spencer (S)CFlorida State UniversityEngineering<br>Earth, Ocean & Atmospheric<br>ScienceEngineering<br>Earth, Ocean & Atmospheric<br>Earth, Ocean & Atmospheric <br< td=""><td></td><td></td><td></td><td>Environmental Sciences</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></br<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                         |    |                                 | Environmental Sciences            |                    |                      |          |               |                                    |               |      |      |
| Robert Spencer (S)       C       Florida State University       Earth, Ocean & Atmospheric<br>Science       Image: Comparison of the compariso                                                                                                                                                                                                                                                                                                                                                                                            | Helen Rutlidge (T)      | С  | University of New South Wales   | School of Civil and Environmental |                    |                      |          |               |                                    |               |      |      |
| Science       Sciences       Sciences       Sciences       Sciences       Sciences       Sciences       Sciences       Sciences       Science       Sciences       Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |    |                                 | Engineering                       |                    |                      |          |               |                                    |               |      |      |
| Lisa Anderson (S)       C       NHMFL       ICR         Lisa Anderson (S)       C       University of Virginia       Chemistry         David Herold (S)       C       University of Virginia       Chemistry         Place Herold (S)       C       University of California, San Diego       Pathology         Yuan Lin (G)       C       Florida State University       Department of Chemistry and Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Robert Spencer (S)      | С  | Florida State University        | Earth, Ocean & Atmospheric        |                    |                      |          |               |                                    |               |      |      |
| Lissa Anderson (S) C NHMFL ICR<br>Elizabeth Duselis (G) C University of Virginia Chemistry<br>David Herold (S) C University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Horita State University of California, San Diego Pathology<br>Yuan Lin (G) C Horita State University of California, San Diego Pathology<br>Yuan Lin (G) C Horita State University of California, San Diego Pathology<br>Yuan Lin (G) C Horita State University of California, San Diego Pathology<br>Yuan Lin (G) C Horita State University of California State University of California State University of Chemistry and<br>Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                         |    |                                 | Science                           |                    |                      |          |               |                                    |               |      |      |
| Lissa Anderson (S) C NHMFL ICR Chemistry<br>Elizabeth Duselis (G) C University of Virginia Chemistry<br>David Herold (S) C University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Biochemistry Biochemistry and Biochemistry Air (Chemistry Air                                                                                                                                                                                                                                                                                    |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Lissa Anderson (S) C NHMFL ICR Chemistry<br>Elizabeth Duselis (G) C University of Virginia Chemistry<br>David Herold (S) C University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Biochemistry Biochemistry and Biochemistry Air (Chemistry Air                                                                                                                                                                                                                                                                                    |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Lissa Anderson (S) C NHMFL ICR Chemistry<br>Elizabeth Duselis (G) C University of Virginia Chemistry<br>David Herold (S) C University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University of California, San Diego Pathology<br>Biochemistry Biochemistry and Biochemistry Air (Chemistry Air                                                                                                                                                                                                                                                                                    | Donald Hunt (S)         | PI | University of Virginia          | Chemistry                         | NIH                | NIGMS - National     | GM037537 | P16320        | Hemoglobin Characterization by FT- | Biology,      | 1    | 2    |
| Lissa Anderson (S)       C       NHMFL       ICR         Elizabeth Duselis (G)       C       University of Virginia       Chemistry         David Herold (S)       C       University of California, San Diego       Pathology         Yuan Lin (G)       C       Florida State University       Biochemistry and Biochemistry and Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |    |                                 |                                   |                    | Institute of General |          |               | ICR MS                             | Biochemistry, |      |      |
| Elizabeth Duselis (G)       C       University of Virginia       Chemistry         David Herold (S)       C       University of California, San Diego       Pathology         Yuan Lin (G)       C       Florida State University       Department of Chemistry and Biochemistry       Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |    |                                 |                                   |                    | Medical Sciences     |          |               |                                    | Biophysics    |      |      |
| David Herold (S) C University of California, San Diego Pathology<br>Yuan Lin (G) C Florida State University Department of Chemistry and<br>Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |    |                                 |                                   |                    |                      |          |               |                                    |               |      |      |
| Yuan Lin (G) C Florida State University Department of Chemistry and<br>Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |    |                                 |                                   |                    |                      |          | 1             |                                    |               |      |      |
| Biochemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |    |                                 |                                   |                    |                      |          | 1             |                                    |               |      |      |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | loffroy Shahanewite (S) | c  | University of Virginia          |                                   |                    |                      |          | 1             |                                    |               |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Jenney Shabanowitz (S)  | L  | oniversity of virginia          | chemistry                         |                    |                      |          | 1             |                                    |               |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |    |                                 |                                   |                    |                      |          | 1             |                                    |               |      |      |
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|                                             |        | Participants                               |                                                                    |                  | Funding Sources                       |                |            |                                               |               | Exp. | Days   |
|---------------------------------------------|--------|--------------------------------------------|--------------------------------------------------------------------|------------------|---------------------------------------|----------------|------------|-----------------------------------------------|---------------|------|--------|
|                                             |        | (Name, Role, Org., Dept.)                  |                                                                    | (Fundi           | ng Agency, Division,                  | Award #)       | Proposal # | Proposal Title                                | Discipline    | #    | Used   |
| Zhiyong Ren (S)                             | PI     | University of Colorado, Boulder            | Civil Environmental Architectural                                  | Chevron Energy   |                                       | ,              | P17328     | Mechanisms of Enhanced of                     | Chemistry     | 1    | 1      |
|                                             |        |                                            | Engineering                                                        | Company          | 040550 5 H                            | 4453000        |            | Petroleum Hydrocarbon                         |               |      | 1      |
| Huan Chen (S)                               | C      | National High Magnetic Field<br>Laboratory | Ion Cyclotron Resonance                                            | NSF              | CAREER - Faculty<br>Early Career      | 1453906        |            | Degradation by Bioelectro chemical<br>Systems |               |      | 1      |
|                                             |        | Laboratory                                 |                                                                    |                  | Development                           |                |            | Systems                                       |               |      | 1      |
|                                             |        |                                            |                                                                    |                  | Program                               |                |            |                                               |               |      | 1      |
| Logan Krajewski (G)                         | С      | National High Magnetic Field               | Chemistry and Biochemistry                                         | NSF              | CBET - Chemical,                      | CBET1512705    |            |                                               |               |      | 1      |
|                                             |        | Laboratory                                 |                                                                    |                  | Bioengineering,<br>Environmental, and |                |            |                                               |               |      | 1      |
|                                             |        |                                            |                                                                    |                  | Transport Systems                     |                |            |                                               |               |      | 1      |
| Lu Lu (P)                                   | С      | University of Colorado, Boulder            | Civil, Environmental, and                                          | NSF              | CBET - Chemical,                      | CBET1510682    |            |                                               |               |      | 1      |
|                                             |        |                                            | Architectural Engineering                                          |                  | Bioengineering,<br>Environmental, and |                |            |                                               |               |      | 1      |
|                                             |        |                                            |                                                                    |                  | Transport Systems                     |                |            |                                               |               |      | 1      |
| Amy McKenna (S)                             | С      | National High Magnetic Field               | ICR                                                                | NSF              | CBET - Chemical,                      | CBET1704921    |            |                                               |               |      | 1      |
|                                             |        | Laboratory                                 |                                                                    |                  | Bioengineering,                       |                |            |                                               |               |      | 1      |
|                                             |        |                                            |                                                                    |                  | Environmental, and                    |                |            |                                               |               |      | 1      |
| Fernando Rosario-Ortiz (S)                  | С      | University of Colorado, Boulder            | Environmental Engineering                                          |                  | Transport Systems                     |                |            |                                               |               |      | 1      |
| Huan Wang (P)                               | c      | University of Colorado, Boulder            | Environmental Engineering                                          |                  |                                       |                |            |                                               |               |      | 1      |
| Yi Zuo (S)                                  | c      | Chevron, San Ramon                         | Environmental Unit                                                 |                  |                                       |                |            |                                               |               |      | 1      |
| Neil Kelleher (S)                           | PI     | Northwestern University                    |                                                                    | NIH              | NIGMS - National                      | P41 GM108569   | P17465     | Characterization of Higher-MW                 | Biology,      | 1    | 1      |
| Nell Kellerier (S)                          | PI     | Northwestern Oniversity                    | Department of Biochemistry,<br>Molecular Biology, and Cell Biology | мп               | Institute of General                  | P41 GIVI108509 | P17405     | Proteoforms from FACS-Sorted                  | Biochemistry, | 1    | 1      |
|                                             |        |                                            |                                                                    |                  | Medical Sciences                      |                |            | Patient B- and T- Cells                       | Biophysics    |      | 1      |
| Lissa Anderson (S)                          | С      | National High Magnetic Field               | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| Lissa Anderson (5)                          | C      | Laboratory                                 | ich                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| David Butcher (P)                           | С      | National High Magnetic Field               | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
|                                             |        | Laboratory                                 |                                                                    |                  |                                       |                |            |                                               |               |      | 1      |
| Caroline DeHart (P)                         | С      | Northwestern University                    | Proteomics Center of Excellence                                    |                  |                                       |                |            |                                               |               |      | 1      |
| Benjamin DesSoye (P)                        | С      | Northwestern University                    | Chemistry                                                          |                  |                                       |                |            |                                               |               |      | 1      |
| Rafael Melani (P)                           | С      | Northwestern university                    | CLP                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| Kristina Srzentic (P)                       | С      | Northwestern University                    | Chemistry                                                          |                  |                                       |                |            |                                               |               |      | 1      |
| Paul Thomas (S)                             | С      | Northwestern University                    | Departments of Chemistry and                                       |                  |                                       |                |            |                                               |               |      | 1      |
|                                             |        |                                            | Molecular Biosciences and the<br>Proteomics Center of Excellence   |                  |                                       |                |            |                                               |               |      | 1      |
| Archana Agarwal (S)                         | PI     | University of Utah                         | Department of Pathology/ARUP                                       | No other support |                                       |                | P17485     | 21 Tesla FT-ICR MS Analysis of                | Biology,      | 3    | 25.83  |
|                                             |        |                                            | Laboratories                                                       |                  |                                       |                |            | Hemoglobinopathy                              | Biochemistry, | -    |        |
| Lissa Anderson (S)                          | С      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               | Biophysics    |      | 1      |
| Didia Coelho Graca (T)                      | C<br>C | Hôpitaux Universitaires de Genève<br>NHMFL | Division of Laboratory Medicine,<br>Chemistry                      |                  |                                       |                |            |                                               |               |      | 1      |
| Lidong He (G)<br>Chris Hendrickson (S)      | c      | NHMFL                                      | Ion Cyclotron Resonance Program                                    |                  |                                       |                |            |                                               |               |      | 1      |
| Pierre Lescuyer (T)                         | c      | Universitaires de Gene`ve                  | Service de Me´decine de laboratoire                                |                  |                                       |                |            |                                               |               |      | 1      |
| Yuan Lin (G)                                | c      | Florida State University                   | Department of Chemistry and                                        |                  |                                       |                |            |                                               |               |      | 1      |
|                                             | C      | Honda state oniversity                     | Biochemistry                                                       |                  |                                       |                |            |                                               |               |      | 1      |
| Alan Marshall (S)                           | С      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| Alan Rockwood (S)                           | С      | University of Utah                         | School of Medicine and ARUP                                        |                  |                                       |                |            |                                               |               |      | 1      |
| Christine Schaner Tooley (S)                | PI     | SUNY Buffalo                               | Laboratories                                                       | NIH              | NIGMS - National                      | GM011127       | P17590     | Quantitative analysis of MYL9 N-              | Biology,      | 2    | 8      |
| christine schaner rooley (5)                | FI     | SONT BUILLO                                | Biochemistry                                                       | INIT             | Institute of General                  | GIVI011127     | P17550     | terminal post-translational                   | Biochemistry, | 2    | °      |
|                                             |        |                                            |                                                                    |                  | Medical Sciences                      |                |            | modifications                                 | Biophysics    |      | 1      |
| Lissa Anderson (S)                          | С      | National High Magnetic Field               | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
|                                             |        | Laboratory                                 |                                                                    |                  |                                       |                |            |                                               |               |      | 1      |
| Christopher Nevitt (G)                      | С      | University of Louisville                   | Biochemistry and Molecular                                         |                  |                                       |                |            |                                               |               |      | 1      |
| Zalika Banavic (G)                          | с      | Florida State University                   | Genetics<br>Ion Cyclotron Resonance                                |                  |                                       |                |            |                                               | 1             |      | 1      |
| Zeljka Popovic (G)<br>Chris Hendrickson (S) | PI     | NHMFL                                      | Ion Cyclotron Resonance                                            | No other support |                                       |                | P17599     | Analytical Method Development for             | Magnets,      | 4    | 267.42 |
| Lissa Anderson (S)                          | C      | NHMFL                                      | ICR                                                                | No other support |                                       |                | F1/333     | FT-ICR MS                                     | Materials     | 4    | 207.42 |
| Greg Blakney (S)                            | c      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| Martha Chacon (S)                           | c      | NHMFL                                      | Ion Cyclotron Resonance                                            |                  |                                       |                |            |                                               | 1             |      | ł      |
| Alan Marshall (S)                           | c      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               | 1             |      | l      |
| Amy McKenna (S)                             | c      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               |               |      | 1      |
| Zeljka Popovic (G)                          | c      | Florida State University                   | Ion Cyclotron Resonance                                            |                  |                                       |                |            |                                               | 1             |      | l      |
| Donald Smith (S)                            | c      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               | 1             |      | l      |
| 55.1010 5111(1)                             | C      |                                            |                                                                    |                  |                                       |                |            |                                               | 1             |      | l      |
| Chad Weisbrod (S)                           | С      | NHMFL                                      | ICR                                                                |                  |                                       |                |            |                                               | 1             | 1    | 1      |
| 1-1                                         |        |                                            |                                                                    |                  |                                       |                |            |                                               |               |      |        |

#### ICR

|                                        |        | Participants                                          |                                                   |                                          | Funding Sources                                                        |              | Proposal # | Proposal Title                                                                                                           | Discipline    | Exp. | Days |
|----------------------------------------|--------|-------------------------------------------------------|---------------------------------------------------|------------------------------------------|------------------------------------------------------------------------|--------------|------------|--------------------------------------------------------------------------------------------------------------------------|---------------|------|------|
|                                        |        | (Name, Role, Org., Dept.)                             |                                                   | (Funding                                 | g Agency, Division, A                                                  | Award #)     | Proposal # | Proposal fille                                                                                                           | Discipline    | #    | Used |
| Donald Smith (S)                       | PI     | National High Magnetic Field                          | ICR                                               | No other support                         |                                                                        |              | P17604     | Complex Mixture Method                                                                                                   | Chemistry     | 3    | 11   |
| Greg Blakney (S)                       | C      | Laboratory<br>National High Magnetic Field            | ICR                                               |                                          |                                                                        |              |            | Development                                                                                                              |               |      |      |
| Chris Hendrickson (S)                  | С      | Laboratory<br>National High Magnetic Field            | Ion Cyclotron Resonance Program                   |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Amy McKenna (S)                        | С      | Laboratory<br>National High Magnetic Field            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Ryan Rodgers (S)                       | С      | Laboratory<br>National High Magnetic Field            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Steven Rowland (S)                     | С      | Laboratory<br>National Renewable Energy<br>Laboratory | National Bioenergy Center                         |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Chad Weisbrod (S)                      | С      | National High Magnetic Field<br>Laboratory            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Alan Marshall (S)                      | PI     | National High Magnetic Field<br>Laboratory            | ICR                                               | No other support                         |                                                                        |              | P17699     | Comprehensive Compositional and<br>Structural Comparison of Coal and                                                     | Chemistry     | 1    | 1.5  |
| Martha Chacon (S)                      | С      | National High Magnetic Field<br>Laboratory            | Ion Cyclotron Resonance                           |                                          |                                                                        |              |            | Petroleum Asphaltenes based on<br>Extrography Fractionation Coupled                                                      |               |      |      |
| Taylor Glattke (G)                     | С      | Florida State University                              | ICR                                               |                                          |                                                                        |              |            | with Fourier Transform Ion                                                                                               |               |      |      |
| Sydney Niles (G)                       | C      | National High Magnetic Field                          | Chemistry                                         |                                          |                                                                        |              |            | Cyclotron Resonance MS and<br>MS/MS Analysis                                                                             |               |      |      |
| Ryan Rodgers (S)                       | С      | Laboratory<br>National High Magnetic Field            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Aixin Hou (S)                          | PI     | Laboratory<br>Louisiana State University              | Department of Environmental                       | Gulf of Mexico                           | Other US Federal                                                       |              | P17789     | A Decade-long Study on Impact,                                                                                           | Chomistry     | 1    | 2    |
| Aixin Hou (S)                          | PI     | Louisiana state oniversity                            | Sciences                                          | Research Initiaitve                      | Agency                                                                 |              | P1//89     | Recovery, and Resilience in                                                                                              | Chemistry     | 1    | 2    |
| Huan Chen (S)                          | С      | National High Magnetic Field<br>Laboratory            | Ion Cyclotron Resonance                           |                                          |                                                                        |              |            | Louisiana Salt Marshes: The evolution of oil transformation                                                              |               |      |      |
| Cameron Davis (U)                      | C      | National High Magnetic Field<br>Laboratory            | ICR/CIRL                                          |                                          |                                                                        |              |            | compounds and plant-soil-<br>microbialresponses to the                                                                   |               |      |      |
| Qianxin Lin (S)                        | C      | Louisiana State University                            | Department of Oceanography and<br>Coastal Science |                                          |                                                                        |              |            | Deepwater Horizon oil spill                                                                                              |               |      |      |
| Amy McKenna (S)                        | С      | National High Magnetic Field<br>Laboratory            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Omics LLC (S)                          | PI     | Omics, LLC                                            | Omics                                             | FFI                                      |                                                                        |              | P17792     | Omics LLC                                                                                                                | Chemistry     | 1    | 2    |
| Martha Chacon (S)                      | С      | National High Magnetic Field<br>Laboratory            | Ion Cyclotron Resonance                           |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Ryan Rodgers (S)                       | С      | National High Magnetic Field<br>Laboratory            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Chris Hendrickson (S)                  | PI     | NHMFL                                                 | Ion Cyclotron Resonance Program                   | No other support                         |                                                                        |              | P17794     | Training of students on ICR                                                                                              | Biology,      | 1    | 2    |
| Lissa Anderson (S)                     | С      | NHMFL                                                 | ICR                                               |                                          |                                                                        |              |            | techniques                                                                                                               | Biochemistry, |      |      |
| David Butcher (P)                      | С      | NHMFL                                                 | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          | Biophysics    |      |      |
| Yuan Lin (G)                           | С      | Florida State University                              | Department of Chemistry and<br>Biochemistry       |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Peilu Liu (G)                          | С      | Florida State University                              | Chemistry                                         |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Zeljka Popovic (G)                     | С      | Florida State University                              | Ion Cyclotron Resonance                           |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Romy Chakraborty (S)                   | PI     | Lawrence Berkeley National<br>Laboratory              | Ecology                                           | DOE                                      | Office of Science -<br>BER - Biological &<br>Environmental<br>Research | DE-SC0205112 | P17797     | Mapping Utilization of Natural<br>Organic Matter to Activity of<br>Indigenous Key Functional<br>Microbesin Oak Ridge FRC | Chemistry     | 1    | 0.83 |
| Sara Gushgari-Doyle (P)                | C      | Lawrence Berkeley National<br>Laboratory              | Earth & Environmental Sciences                    | Lawrence Berkeley<br>National Laboratory | US Government Lab                                                      |              |            | Subsurface Sediments                                                                                                     |               |      |      |
| Amy McKenna (S)                        | С      | National High Magnetic Field<br>Laboratory            | ICR                                               |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Jana Voriskova (P)                     | С      | Lawrence Berkeley National<br>Laboratory              | Ecology Department                                |                                          |                                                                        |              |            |                                                                                                                          |               |      | 1    |
| Xiaoqin Wu (S)                         | С      | Lawrence Berkeley National<br>Laboratory              | Department of Ecology                             |                                          |                                                                        |              |            |                                                                                                                          |               |      |      |
| Brian Bothner (S)                      | PI     | Montana State University                              | Chemistry and Biochemistry                        | NSF                                      | MCB - Molecular and<br>Cellular Biosciences                            | MCB1714556   | P17821     | Describing the Thermoalkaline<br>Environments in Yellowstone                                                             | Chemistry     | 1    | 0.5  |
| Amy McKenna (S)                        | C      | National High Magnetic Field<br>Laboratory            | ICR                                               | NSF                                      | MCB - Molecular and<br>Cellular Biosciences                            | MCB1413534   |            | National Park: The Effects of pH,<br>Temperature and Location on                                                         |               |      |      |
| Jesse Peach (G)<br>David Podgorski (S) | C<br>C | Montana State University<br>University of New Orleans | Biochemistry<br>Department of Chemistry           |                                          |                                                                        |              |            | Organisms and the Dissolved<br>Organic Matter Composition                                                                |               |      |      |

|                        |    | Participants                                      |                                                      |                                                                                | Funding Sources                                |            |                                                                  | <b>D</b>    | Exp. | Days |
|------------------------|----|---------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------|------------|------------------------------------------------------------------|-------------|------|------|
|                        |    | (Name, Role, Org., Dept.)                         |                                                      | (Funding                                                                       | Agency, Division, Award #)                     | Proposal # | Proposal Title                                                   | Discipline  | #    | Used |
| Youneng Tang (S)       | PI | Florida State University                          | Civil and Environmental Engineering                  | Bill Hinkley Center<br>for Solid and<br>Hazardous Waste<br>Management          | UFDSP00011955                                  | P17822     | Detection of Organic Compound sin<br>Wastewater and Leachate     | Chemistry   | 1    | 1    |
| Huan Chen (S)          | С  | National High Magnetic Field<br>Laboratory        | Ion Cyclotron Resonance                              | Florida State<br>University                                                    | US College and<br>University                   |            |                                                                  |             |      |      |
| Liang Li (T)           | С  | Florida Department of Environmental<br>Protection | Environmental                                        | ,                                                                              |                                                |            |                                                                  |             |      |      |
| Runwei Li (G)          | С  | FSU-FAMU College of Engineering                   | Civil and Environmental Engineering                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Amy McKenna (S)        | С  | National High Magnetic Field<br>Laboratory        | ICR                                                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Zhiming Zhang (G)      | С  | Florida State University                          | Department of Civil and<br>Environmental Engineering |                                                                                |                                                |            |                                                                  |             |      |      |
| Robert Spencer (S)     | PI | Florida State University                          | Earth, Ocean & Atmospheric<br>Science                | Patagonia Ice Field<br>Shrinkage Impacts<br>on Coastal and Fjord<br>Ecosystems | Other                                          | P17826     | Insights into Organic Matter<br>Sources in Glacier Environments  | Chemistry   | 1    | 0.5  |
| Jason Fellman (S)      | С  | University of Alaska Southeast                    | Environmental Science                                | ,                                                                              |                                                |            |                                                                  |             |      |      |
| Amy Holt (G)           | С  | Florida State University                          | EAOS                                                 |                                                                                |                                                |            |                                                                  |             |      |      |
| Eran Hood (S)          | С  | University of Alaska Southeast                    | Environmental Science                                |                                                                                |                                                |            |                                                                  |             |      |      |
| Anne Kellerman (P)     | С  | Florida State University                          | Earth, Ocean and Atmospheric<br>Science              |                                                                                |                                                |            |                                                                  |             |      |      |
| Wenbo Li (G)           | С  | Florida State University                          | Earth, Ocean& Atomospheric<br>Science                |                                                                                |                                                |            |                                                                  |             |      |      |
| Amy McKenna (S)        | С  | National High Magnetic Field<br>Laboratory        | ICR                                                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Aron Stubbins (S)      | С  | Northeastern University                           | Marine and Environmental Science                     |                                                                                |                                                |            |                                                                  |             |      |      |
| Sasha Wagner (P)       | С  | University of Georgia                             | Marine Sciences and Oceanography                     |                                                                                |                                                |            |                                                                  |             |      |      |
| Jens Blotevogel (S)    | PI | Colorado State University                         | Civil & Environmental Engineering                    | DOD                                                                            | ER - Environmental ER-2718<br>Research Program | P17857     | Transformation of per- and<br>polyfluoroalkyl substances (PFASs) | Engineering | 1    | 2.53 |
| Thomas Borch (S)       | С  | Colorado State University                         | Soil and Crop Science                                |                                                                                |                                                |            | during bioelectrochemical                                        |             |      |      |
| Huan Chen (S)          | С  | National High Magnetic Field<br>Laboratory        | Ion Cyclotron Resonance                              |                                                                                |                                                |            | treatment of aqueous film-forming<br>foam (AFFF)                 |             |      |      |
| Greg Dooley (S)        | С  | Colorado State University                         | ERHS                                                 |                                                                                |                                                |            |                                                                  |             |      |      |
| Andrea Hanson (G)      | С  | Colorado State University                         | Civil and Environmental Engineering                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Amy McKenna (S)        | С  | National High Magnetic Field<br>Laboratory        | ICR                                                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Sydney Niles (G)       | С  | National High Magnetic Field<br>Laboratory        | Chemistry                                            |                                                                                |                                                |            |                                                                  |             |      |      |
| Nasim Pica (P)         | С  | Colorado State University                         | Environmental engineering                            |                                                                                |                                                |            |                                                                  |             |      |      |
| Hamidreza Sharifan (P) | С  | Colorado State University                         | Civil and Environmental Engineering                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Chad Weisbrod (S)      | С  | National High Magnetic Field<br>Laboratory        | ICR                                                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Robert Young (S)       | С  | Colorado State University                         | Soil & Crop Sciences                                 |                                                                                |                                                |            |                                                                  |             |      |      |
| Robert Spencer (S)     | PI | Florida State University                          | Earth, Ocean & Atmospheric<br>Science                | No other support                                                               |                                                | P17943     | Changes to Permafrost and<br>Vegetation Dissolved Organic        | Chemistry   | 2    | 1.67 |
| Valier Galy (S)        | С  | Woods Hole Oceanographic<br>Institution           | Marine Chemistry & Geochemistry                      |                                                                                |                                                |            | Matter: an insight into the Kolyma<br>River                      |             |      |      |
| Anne Kellerman (P)     | С  | Florida State University                          | Earth, Ocean and Atmospheric<br>Science              |                                                                                |                                                |            |                                                                  |             |      |      |
| Amy McKenna (S)        | С  | National High Magnetic Field<br>Laboratory        | ICR                                                  |                                                                                |                                                |            |                                                                  |             |      |      |
| Jennifer Rogers (U)    | С  | Florida State University                          | EOAS                                                 |                                                                                |                                                |            |                                                                  |             |      |      |
|                        |    |                                                   |                                                      |                                                                                |                                                |            |                                                                  |             |      |      |
|                        |    |                                                   |                                                      |                                                                                |                                                |            |                                                                  |             |      |      |
|                        |    |                                                   |                                                      |                                                                                |                                                |            |                                                                  |             |      |      |
|                        |    |                                                   |                                                      |                                                                                |                                                |            |                                                                  |             |      |      |

|                          |    | Participants                                |                                                   |                                     | Funding Sources         | 6                | <b>D</b>   |                                                             |               | Exp. | Days  |
|--------------------------|----|---------------------------------------------|---------------------------------------------------|-------------------------------------|-------------------------|------------------|------------|-------------------------------------------------------------|---------------|------|-------|
|                          |    | (Name, Role, Org., Dept.)                   |                                                   | (Funding                            | Agency, Division        |                  | Proposal # | Proposal Title                                              | Discipline    | #    | Used  |
| Martha Chacon (S)        | PI | NHMFL                                       | Ion Cyclotron Resonance                           | Conseil Régional                    | ,                       | 20071303002PFM   | P17944     | Comprehensive characterization of                           | Chemistry     | 1    | 17.25 |
| Wartha chacon (5)        |    |                                             | ion cyclotion resonance                           | d'Aquitaine                         |                         | 2007130300211101 | 11/544     | asphaltenes by FT-ICR MS and                                | chemistry     | -    | 17.25 |
| Nelson Acevedo (G)       | С  | Université de pau et des Pays de<br>l'Adour | Nouvelle Aquitaine                                | FEDER                               |                         | 31486/08011464   |            | chromatography separations                                  |               |      |       |
| Brice Bouyssiere (S)     | С  | University of Pau and Pays de l'Adour       | IPREM                                             | European Network                    |                         | 731077           |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | of Fourier-Transform                |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Ion-Cyclotron-                      |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Resonance Mass                      |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Spectrometry                        |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Centers                             |                         |                  |            |                                                             |               |      |       |
| Herve Carrier (S)        | С  | University of Pau and Pays de l'Adour       | UPPA                                              | German Research                     |                         | INST 264/56      |            |                                                             |               |      |       |
| Jimmy Castillo (S)       | С  | Central University of Venezuela             | Escuela de Quimica                                | Foundation<br>Franco-Venezuelan     |                         |                  |            |                                                             |               |      |       |
| Jinning Castillo (3)     | C  | central oniversity of venezuela             | Escueia de Química                                | Project RMR                         |                         |                  |            |                                                             |               |      |       |
| Jean-Luc Daridon (S)     | С  | University of Pau and Pays de l'Adour       | IPREM                                             | Laboratoire LabEx                   |                         | ANR-11-LABX-0029 |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | SynOrg                              |                         |                  |            |                                                             |               |      |       |
| Pierre Giusti (S)        | С  | Total                                       | Refining and Chemicals                            | Région Normandie                    |                         |                  |            |                                                             |               |      |       |
| Taylor Glattke (G)       | С  | Florida State University                    | ICR                                               |                                     |                         |                  |            |                                                             |               |      |       |
| Caroline Mangote (S)     | С  | Total                                       | Research & Technology                             |                                     |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   |                                     |                         |                  |            |                                                             |               |      |       |
| Aurora Mejia (S)         | С  | University of Pau and Pays de l'Adour       | UPPA                                              |                                     |                         |                  |            |                                                             |               |      |       |
| Remi Moulian (G)         | С  | University of Pau and Pays de l'Adour       | ICR                                               |                                     |                         |                  |            |                                                             |               |      |       |
| Anika Neumann (G)        | С  | University of Rostock                       | Department Life Light & Matter                    |                                     |                         |                  |            |                                                             |               |      |       |
| Vincent Piscitelli (S)   | С  | Central University of Venezuela             | Escuela de Quim´ica                               |                                     |                         |                  |            |                                                             |               |      |       |
| Sadia Radji (S)          | С  | University of Pau and Pays de l'Adour       | UPPA                                              |                                     |                         |                  |            |                                                             |               |      |       |
| Ryan Rodgers (S)         | С  | NHMFL                                       | ICR                                               |                                     |                         |                  |            |                                                             |               |      |       |
| Ralf Zimmermann (S)      | С  | University of Rostock                       | Division of Analytical and Technical<br>Chemistry |                                     |                         |                  |            |                                                             |               |      |       |
| Patricia Medeiros (S)    | PI | University of Georgia                       | Marine Sciences                                   | NSF                                 | OCE - Ocean<br>Sciences | OCE1832178       | P17972     | Dissolved Organic Matter<br>Composition and Transformations | Chemistry     | 2    | 14.33 |
| Renato Castelao (S)      | С  | University of Georgia                       | Marine Sciences                                   | NSF                                 | OCE - Ocean<br>Sciences | OCE1902131       |            | in Coastal Systems                                          |               |      |       |
| Martha Chacon (S)        | С  | NHMFL                                       | Ion Cyclotron Resonance                           |                                     |                         |                  |            |                                                             |               |      |       |
| Huan Chen (S)            | С  | NHMFL                                       | Ion Cyclotron Resonance                           |                                     |                         |                  |            |                                                             |               |      |       |
| William Fitt (S)         | С  | University of Georgia                       | Odum School of Ecology                            |                                     |                         |                  |            |                                                             |               |      |       |
| Brian Hopkinson (S)      | С  | University of Georgia                       | Department of Marine Sciences                     |                                     |                         |                  |            |                                                             |               |      |       |
| Maria Letourneau (G)     | С  | University of Georgia                       | Marine Sciences                                   |                                     |                         |                  |            |                                                             |               |      |       |
| Rachel Martineac (G)     | С  | University of Georgia                       | Marine Sciences                                   |                                     |                         |                  |            |                                                             |               |      |       |
| Amy McKenna (S)          | С  | NHMFL                                       | ICR                                               |                                     |                         |                  |            |                                                             |               |      |       |
| Nobuaki Takemori (S)     | PI | Ehime University                            | Proteo-Science Center                             | Biotechnology and                   | Other                   | BB/M025756/1     | P17980     | Development of a novel top-down                             | Biology,      | 1    | 9     |
|                          |    |                                             |                                                   | <b>Biological Sciences</b>          |                         |                  |            | proteomics workflow using a                                 | Biochemistry, |      |       |
|                          |    |                                             |                                                   | Research Council                    |                         |                  |            | polyacrylamide gel electrophoresis                          | Biophysics    |      |       |
| Lissa Anderson (S)       | С  | NHMFL                                       | ICR                                               | Biotechnology and                   | Other                   | BB/R005311/1     |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Biological Sciences                 |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Research Council                    |                         |                  |            |                                                             |               |      |       |
| Robert Beynon (T)        | С  | University of Liverpool                     | Centre for Proteome Research                      | US National                         | Other US Federal        | R01GM104610      |            |                                                             |               |      |       |
| Dhilin Danuaridan (T)    | c  | University of Discoursed                    | Contra for Protocore Processe                     | Institutes of Health                | Agency                  | D01 C1 44 02 470 |            |                                                             |               |      |       |
| Philip Brownridge (T)    | С  | University of Liverpool                     | Centre for Proteome Research                      | US National<br>Institutes of Health | Other                   | R01GM103479      |            |                                                             |               |      |       |
| David Butcher (P)        | С  | NHMFL                                       | ICR                                               | National Institute of               | Other US Federal        | P41 GM108569     |            |                                                             |               |      |       |
| David Butcher (r)        | C  |                                             |                                                   | General Medical                     | Agency                  | F41 010100505    |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Sciences, National                  | ABCINO)                 |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Institutes of Health                |                         |                  |            |                                                             |               |      |       |
| Victoria Harman (T)      | С  | University of Liverpool                     | Centre for Proteome Research                      | Japan Society for the               | Other                   | 18H04559         |            |                                                             |               |      |       |
|                          |    | ,                                           |                                                   | Promotion of                        |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             |                                                   | Science                             |                         |                  |            |                                                             |               |      |       |
| Hitoshi Hasegawa (T)     | С  | Ehime University                            | Department of Hematology                          |                                     |                         |                  |            |                                                             |               |      |       |
| Daisuke Higo (T)         | С  | Thermo Fisher Scientific                    |                                                   |                                     |                         |                  |            |                                                             |               |      |       |
| Jun Ishizaki (T)         | С  | Ehime University                            | Department of Hematology, Clinical                |                                     |                         |                  |            |                                                             |               |      |       |
|                          |    | ·                                           | Immunology and Infectious                         |                                     |                         |                  |            |                                                             |               |      |       |
| Joseph Loo (T)           | С  | University of California, Los Angeles       | Department of Chemistry and                       |                                     |                         |                  |            |                                                             |               |      |       |
| 3030pii 100 (1)          |    | Sinversity of California, Los Augeles       | Biochemistry                                      |                                     |                         |                  |            |                                                             |               |      |       |
| Rachel Ogorzalek Loo (T) | С  | University of California, Los Angeles       | Department of Biological Chemistry                |                                     |                         |                  |            |                                                             |               |      |       |
| Keisuke Shima (T)        | c  | Shimadzu Corporation                        | - sparement of biological enemistry               |                                     |                         |                  |            |                                                             |               |      |       |
|                          |    |                                             | Department of Income                              |                                     |                         |                  |            |                                                             |               |      |       |
| Junpei Suzuki (T)        | C  | Ehime University                            | Department of Immunology                          |                                     |                         |                  |            |                                                             |               |      |       |
| Ayako Takemori (T)       | С  | Ehime University                            | Division of Analytical Bio-Medicine               |                                     |                         |                  |            |                                                             |               |      |       |
| Masakatsu Yamashita (T)  | С  | Ehime University                            | Department of Immunology                          | 1                                   |                         |                  | 1          | 1                                                           | 1             | 1    | 1     |

|                                                  |        | Participants                                                     |                                                                 |                                              | Funding Sources                                            |             | Bronocal # | Droposal Title                                                                                      | Discipling                  | Exp. | Days |
|--------------------------------------------------|--------|------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------|-------------|------------|-----------------------------------------------------------------------------------------------------|-----------------------------|------|------|
|                                                  |        | (Name, Role, Org., Dept.)                                        |                                                                 | (Funding                                     | Agency, Division,                                          | Award #)    | Proposal # | Proposal Title                                                                                      | Discipline                  | #    | Used |
| Mark Nimlos (S)                                  | PI     | National Renewable Energy<br>Laboratory                          | National Bioenergy Center                                       | DOE                                          | EERE - Energy<br>Efficiency and<br>Renewable Energy        | DE-EE33392  | P18047     | High Resolution Mass Spectral<br>Analysis of Biomass Pyrolysis<br>Residues Used to Prepare Graphite | Chemistry                   | 1    | 3    |
| Martha Chacon (S)                                | С      | National High Magnetic Field<br>Laboratory                       | Ion Cyclotron Resonance                                         |                                              |                                                            |             |            | for Lithium Ion Batteries                                                                           |                             |      |      |
| Ermias Dheressa (U)                              | С      | National Renewable Energy<br>Laboratory                          | 5100                                                            |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Steven Rowland (S)                               | С      | National Renewable Energy<br>Laboratory                          | National Bioenergy Center                                       |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Nolan Wilson (S)                                 | С      | National Renewable Energy Lab                                    | National Bioscience Center                                      |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Mengqiang Zhu (S)                                | PI     | University of Wyoming                                            | Ecosystem Science and<br>Management                             | NSF                                          | CAREER - Faculty<br>Early Career<br>Development<br>Program | EAR-1752903 | P18048     | Oxidation of Dissolved Organic<br>Matter by Manganese Oxides                                        | Chemistry                   | 2    | 8.5  |
| Huan Chen (S)                                    | С      | National High Magnetic Field<br>Laboratory                       | Ion Cyclotron Resonance                                         | NSF                                          | DEB - Division of<br>Environmental<br>Biology              | DEB2027284  |            |                                                                                                     |                             |      |      |
| Than Dam (G)                                     | С      | University of Wyoming                                            | Department of Ecosystem Science<br>and Management               |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Zhen Hu (G)                                      | С      | University of Wyoming                                            | College Of Agriculture And Natural<br>Resources                 |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Hairuo Mao (P)                                   | С      | University of Wyoming                                            | Ecosystem science and<br>management                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Amy McKenna (S)                                  | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Jianchao Zhang (P)                               | С      | University of Wyoming                                            | Ecosystem Science and<br>Management                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Thomas Borch (S)                                 | PI     | Colorado State University                                        | Soil and Crop Science                                           | University<br>Tuebingen                      | Non US College and<br>University                           |             | P18055     | Investigation into Dissolved Organic<br>Matter in Arctic Soil                                       | Chemistry                   | 1    | 3    |
| William Bahureksa (G)                            | С      | Colorado State University                                        | Chemistry                                                       | German Academic<br>Scholarship<br>Foundation | Other Non US<br>Federal Agency                             |             |            |                                                                                                     |                             |      |      |
| Casey Bryce (P)<br>Andreas Kappler (S)           | C<br>C | University of Tuebingen<br>Eberhard Karls University of Tübingen | Center for Applied Geoscience<br>Center for Applied Geosciences |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Merritt Logan (G)<br>Monique Sézanne Patzner (G) | C<br>C | Colorado State University<br>University Tuebingen                | Chemistry<br>Geoscience                                         |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Jeramie Adams (S)                                | PI     | University of Wyoming                                            | Transportation Technology                                       | Petroleum                                    |                                                            |             | P18097     | Investigation of Fractionated and                                                                   | Biology,                    | 2    | 2.83 |
| Martha Chacon (S)                                | С      | National High Magnetic Field<br>Laboratory                       | Ion Cyclotron Resonance                                         |                                              |                                                            |             |            | Chemically Modified Interfacial<br>Asphaltenes                                                      | Biochemistry,<br>Biophysics |      |      |
| Amy McKenna (S)                                  | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Ryan Rodgers (S)                                 | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Collin Ward (S)                                  | PI     | Woods Hole Oceanographic<br>Institution                          | Department of Marine Chemistry<br>and Geochemistry,             | No other support                             |                                                            |             | P19124     | Chemical characterization of marine<br>plastic partial photochemical                                | Chemistry                   | 1    | 2.53 |
| Amy McKenna (S)                                  | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            | oxidation                                                                                           |                             |      |      |
| Sydney Niles (G)                                 | С      | National High Magnetic Field<br>Laboratory                       | Chemistry                                                       |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Ryan Rodgers (S)                                 | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Anna Walsh (G)                                   | С      | Woods Hole Oceanographic<br>Institution                          | Marine Chemistry and<br>Geochemistry                            |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Chad Weisbrod (S)                                | С      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
| Andrew Wozniak (S)                               | PI     | University of Delaware                                           | School of Marine Science and Policy                             | University of<br>Delaware                    | US College and<br>University                               | Start Up    | P19159     | Environmental controls on the<br>chemical composition of Delaware                                   | Chemistry                   | 1    | 1    |
| Huan Chen (S)                                    | С      | National High Magnetic Field<br>Laboratory                       | Ion Cyclotron Resonance                                         | Univ of Delaware                             | US College and<br>University                               |             |            | Bay's surface microlayer                                                                            |                             |      |      |
| Nicole Coffey (G)                                | С      | University of Delaware                                           | School of Marine Science and Policy                             |                                              | ,                                                          |             |            |                                                                                                     |                             |      |      |
| Amy McKenna (S)                                  | C      | National High Magnetic Field<br>Laboratory                       | ICR                                                             |                                              |                                                            |             |            |                                                                                                     |                             |      |      |
|                                                  |        |                                                                  |                                                                 |                                              |                                                            |             |            |                                                                                                     |                             |      |      |

|                                              |        | Participants                              |                                        |                  | Funding Sources                     |                             | Duene stal // | December of Trials                     | Dissisti      | Exp. | Days  |
|----------------------------------------------|--------|-------------------------------------------|----------------------------------------|------------------|-------------------------------------|-----------------------------|---------------|----------------------------------------|---------------|------|-------|
|                                              |        | (Name, Role, Org., Dept.)                 |                                        | (Funding         | g Agency, Division,                 | Award #)                    | Proposal #    | Proposal Title                         | Discipline    | #    | Used  |
| Roman Zubarev (S)                            | PI     | Karolinska Institute                      | Division of Molecular Biometry         | No other support |                                     | ,                           | P19161        | FT-ICR MS analysis of monoisotopic     | Biology,      | 2    | 20.83 |
| Lissa Anderson (S)                           | С      | National High Magnetic Field              | ICR                                    | UCGP             |                                     | 227000-520-                 |               | mammalian proteome and                 | Biochemistry, |      |       |
|                                              |        | Laboratory                                |                                        |                  |                                     | 038653                      |               | antibodies                             | Biophysics    |      |       |
| Greg Blakney (S)                             | С      | National High Magnetic Field              | ICR                                    |                  |                                     |                             |               |                                        |               |      |       |
|                                              |        | Laboratory                                |                                        |                  |                                     |                             |               |                                        |               |      |       |
| David Butcher (P)                            | С      | National High Magnetic Field              | ICR                                    |                  |                                     |                             |               |                                        |               |      |       |
| Chris Handrickson (C)                        | C      | Laboratory                                | Ion Cueletron Reconcises Program       |                  |                                     |                             |               |                                        |               |      |       |
| Chris Hendrickson (S)<br>Alan Marshall (S)   | C<br>C | NHMFL<br>NHMFL                            | Ion Cyclotron Resonance Program<br>ICR |                  |                                     |                             |               |                                        |               |      |       |
| Zeljka Popovic (G)                           | c      | Florida State University                  | Ion Cyclotron Resonance                |                  |                                     |                             |               |                                        |               |      |       |
| Chad Weisbrod (S)                            | c      | NHMFL                                     | ICR                                    |                  |                                     |                             |               |                                        |               |      |       |
| Xuepei Zhang (P)                             | С      | Karolinska Institutet                     | Department of Medical                  |                  |                                     |                             |               |                                        |               |      |       |
| Adeper Entities (17)                         | C C    |                                           | Biochemistry & Biophysics (MBB)        |                  |                                     |                             |               |                                        |               |      |       |
| Michael Timko (S)                            | PI     | Worcester Polytechnic Institute           | Chemical Engineering                   | MassCEC          |                                     |                             | P19162        | Comprehensive Mass Spectrometer        | Chemistry     | 2    | 12.33 |
| Feng Cheng (T)                               | С      | Worcester Polytechnic Institute           | Chemical Engineering                   | NSF              | CAREER - Faculty                    | 155428                      |               | Analysis of Algae and Food Waste       |               |      |       |
|                                              |        |                                           |                                        |                  | Early Career                        |                             |               | Hydrothermal Liquefaction              |               |      |       |
|                                              |        |                                           |                                        |                  | Development                         |                             |               | Products                               |               |      |       |
|                                              |        |                                           |                                        |                  | Program                             |                             |               |                                        |               |      |       |
| Daniela Fraga Alvarez (G)                    | С      | Worcester Polytechnic Institute           | Department of Chemical                 | DOE              | Other                               | DE-SC0015784                |               |                                        |               |      |       |
| Sorgio Granadas Facil (C)                    | c      | Clark University                          | Engineering                            | DOF              | Othor                               |                             |               |                                        |               |      |       |
| Sergio Granados-Focil (S)<br>Amy McKenna (S) | C<br>C | Clark University<br>NHMFL                 | Department of Chemistry<br>ICR         | DOE<br>NSF       | Other<br>CBET - Chemical,           | DE-EE0008513<br>CBET1605916 |               |                                        |               |      |       |
| Any McKenna (5)                              | C      |                                           |                                        | 1451             | Bioengineering,                     | CDL11005510                 |               |                                        |               |      |       |
|                                              |        |                                           |                                        |                  | Environmental, and                  |                             |               |                                        |               |      |       |
|                                              |        |                                           |                                        |                  | Transport Systems                   |                             |               |                                        |               |      |       |
| John Moses (S)                               | С      | CF Technologies, Inc.                     | Laboratory                             |                  |                                     |                             |               |                                        |               |      |       |
| Robert Nelson (S)                            | С      | Woods Hole Oceanographic                  | Dept Marine Chemistry and              |                  |                                     |                             |               |                                        |               |      |       |
|                                              |        | Institution                               | Geochemistry                           |                  |                                     |                             |               |                                        |               |      |       |
| Sydney Niles (G)                             | С      | NHMFL                                     | Chemistry                              |                  |                                     |                             |               |                                        |               |      |       |
| Alex Paulsen (S)                             | С      | Mainstream Engineering Corp               | Defense and Space                      |                  |                                     |                             |               |                                        |               |      |       |
| Chris Reddy (S)                              | С      | Woods Hole Oceanographic<br>Institution   | Geochemistry                           |                  |                                     |                             |               |                                        |               |      |       |
| Carla Roma (G)                               | с      | Worcester Polytechnic Institute           | Chemical Engineering                   |                  |                                     |                             |               |                                        |               |      |       |
| Jessica Sweeney (S)                          | c      | CF Technologies, Inc.                     | Laboratory                             |                  |                                     |                             |               |                                        |               |      |       |
| Geoffrey Tompsett (S)                        | c      | Worcester Polytechnic Institute           | Chemical Engineering                   |                  |                                     |                             |               |                                        |               |      |       |
| Ruihan Zhang (S)                             | c      | Worcester Polytechnic Institute           | Dept. Mechanical Engineering           |                  |                                     |                             |               |                                        |               |      |       |
| Jose Cerrato (S)                             | PI     | University of New Mexico                  | Civil Engineering                      | NSF              | CBET - Chemical,                    | CBET1652619                 | P19179        | Investigation of the effect of natural | Engineering   | 1    | 1     |
|                                              |        |                                           |                                        |                  | Bioengineering,                     |                             |               | organic matter and pH on the           |               |      |       |
|                                              |        |                                           |                                        |                  | Environmental, and                  |                             |               | precipitation of U (VI)                |               |      |       |
|                                              |        |                                           |                                        |                  | Transport Systems                   |                             |               |                                        |               |      |       |
| Huan Chen (S)                                | C      | National High Magnetic Field              | Ion Cyclotron Resonance                | NSF              | Other                               | HRD1454443                  |               |                                        |               |      |       |
| F. Omar Holguin (S)                          | С      | Laboratory<br>New Mexico State University | Department of Plant and                |                  |                                     |                             |               |                                        |               |      |       |
| F. Offar Holguin (3)                         | C      | New Mexico State Oniversity               | Environmental Science                  |                  |                                     |                             |               |                                        |               |      |       |
| Jackie Jarvis (S)                            | С      | New Mexico State University               | Plant and Environmental Sciences       |                  |                                     |                             |               |                                        |               |      |       |
| Carmen Velasco (G)                           | C      | University of New Mexico                  | Civil Engineering                      |                  |                                     |                             |               |                                        |               |      |       |
| Robert Spencer (S)                           | PI     | Florida State University                  | Earth, Ocean & Atmospheric             | NASA             |                                     |                             | P19189        | The dark side of DOM: probing          | Chemistry     | 1    | 2     |
|                                              |        |                                           | Science                                | 1                |                                     |                             |               | obscured and functionalized            |               |      |       |
| Taylor Glattke (G)                           | С      | Florida State University                  | ICR                                    | 1                |                                     |                             |               | freshwater DOM signatures              |               |      |       |
| Anne Kellerman (P)                           | С      | Florida State University                  | Earth, Ocean and Atmospheric           |                  |                                     |                             |               |                                        |               |      |       |
|                                              |        |                                           | Science                                | 1                |                                     |                             |               |                                        |               |      |       |
| Martin Kurek (G)                             | С      | FSU                                       | Earth, Ocean, and Atmospheric          | 1                |                                     |                             |               |                                        |               |      |       |
|                                              |        |                                           | Science                                | 1                |                                     |                             |               |                                        |               |      |       |
| Amy McKenna (S)                              | С      | National High Magnetic Field              | ICR                                    | 1                |                                     |                             |               |                                        |               |      |       |
|                                              |        | Laboratory                                |                                        | 1                |                                     |                             |               |                                        |               |      |       |
| Brett Poulin (S)                             | С      | U.S. Geological Survey                    | National Research Program              | 1                |                                     |                             |               |                                        |               |      |       |
| Jennifer Rogers (U)                          | С      | Florida State University                  | EOAS                                   |                  |                                     |                             |               |                                        |               |      |       |
| Gayan Rubasinghege (S)                       | PI     | New Mexico Tech                           | Chemistry                              | NIH              | NIGMS - National                    | GM103451                    | P19192        | Fate, Transformation, and              | Chemistry     | 1    | 1     |
|                                              |        |                                           |                                        | 1                | Institute of General                |                             |               | Toxicological Impacts of               |               |      |       |
|                                              |        |                                           |                                        |                  | Medical Sciences                    |                             |               | Pharmaceuticals and Personal Care      |               |      |       |
| Huan Chen (S)                                | C      | National High Magnetic Field              | Ion Cyclotron Resonance                | DOE              | Office of Science -                 | DE-SC547055_                |               | Products                               |               |      |       |
|                                              |        | Laboratory                                |                                        |                  | BER - Biological &<br>Environmental |                             |               |                                        |               |      |       |
|                                              |        |                                           |                                        | 1                | Research                            |                             |               |                                        |               |      |       |
| Ekanayaka Ellepola (G)                       | с      | New Mexico Tech                           | Chemistry                              | Center for       | Other US Federal                    |                             |               |                                        |               |      |       |
|                                              | 5      |                                           | ······· ,                              | Integrated       | Agency                              |                             |               |                                        |               |      |       |
|                                              |        |                                           |                                        | Nanotechnologies | - ,                                 |                             |               |                                        |               |      |       |
| Amy McKenna (S)                              | С      | NHMFL                                     | ICR                                    | 1                |                                     |                             | 1             |                                        | 1             |      |       |

|                                             |         | Participants                                              |                                                |                                               | Funding Sources                                                                         |             | Proposal # | Proposal Title                                                                                                                                                                        | Discipline                              | Exp. | Days |
|---------------------------------------------|---------|-----------------------------------------------------------|------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------|-------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|
|                                             |         | (Name, Role, Org., Dept.)                                 |                                                | (Fundin                                       | g Agency, Division, A                                                                   | ward #)     | Proposal # | Proposal Title                                                                                                                                                                        | Discipline                              | #    | Used |
| Boris Lau (S)<br>Martha Chacon (S)          | PI      | University of Massachusetts                               | Civil and Environmental Engineering            | NSF<br>University of                          | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems<br>Other | CBET1454443 | P19198     | Probing the Effects of Sulfidation on<br>the Reactivity of Natural Organic<br>Matter with Polymer-Capped Silver<br>Nanoparticles by Fourier-Transform<br>Ion Cyclotron Resonance Mass | Biology,<br>Biochemistry,<br>Biophysics | 4    | 10   |
|                                             |         |                                                           |                                                | Massachusetts -<br>Internal Research<br>Grant |                                                                                         |             |            | Spectrometry                                                                                                                                                                          |                                         |      |      |
| Salimar Cordero (O)                         | С       | University of Massachusetts                               | Civil and Environmental Engineering            |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| William Hockaday (S)                        | С       | Baylor University                                         | Geosciences                                    |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Richard Vachet (S)<br>Nishanth Tharayil (S) | C<br>Pl | University of Massachusetts Amherst<br>Clemson University | Chemistry<br>Plant & Environmental Sciences    | NSF                                           | DEB - Division of                                                                       | DEB1754679  | P19212     | Chemical characterization of                                                                                                                                                          | Chemistry                               | 2    | 7    |
| Nishantir marayir (5)                       |         | cienson onversity                                         | France Environmental Sciences                  | 1431                                          | Environmental<br>Biology                                                                | 0101/340/3  | F 19212    | dissolved organic matter originating<br>from decomposing leaf and root                                                                                                                | chemistry                               | 2    | ,    |
| Huan Chen (S)                               | С       | NHMFL                                                     | Ion Cyclotron Resonance                        |                                               |                                                                                         |             |            | litter to elucidate their differential                                                                                                                                                |                                         |      |      |
| Nimisha Edayilam (G)                        | С       | Clemson University (Clemson)                              | Plant and Environmental Science                |                                               |                                                                                         |             |            | ability to influence soil organic<br>matter sequestration                                                                                                                             |                                         |      |      |
| Amy McKenna (S)                             | С       | NHMFL                                                     | ICR                                            |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Mengxue Xia (P)                             | С       | Clemson University                                        | Plant and Environmental Sciences<br>Department |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| David Griffith (S)                          | PI      | Willamette University                                     | Chemistry                                      | No other support                              |                                                                                         |             | P19215     | Identification and resolution of<br>isobaric interferences of estrogens                                                                                                               | Chemistry                               | 1    | 1    |
| Carolyn Hutchinson (G)                      | С       | Iowa State University                                     | Chemistry                                      |                                               |                                                                                         |             |            | in wastewater                                                                                                                                                                         |                                         |      |      |
| Amy McKenna (S)                             | С       | NHMFL                                                     | ICR                                            |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Zeljka Popovic (G)                          | С       | Florida State University                                  | Ion Cyclotron Resonance                        |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Chad Weisbrod (S)                           | C       | National High Magnetic Field<br>Laboratory                | ICR                                            |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Robert Spencer (S)                          | PI      | Florida State University                                  | Earth, Ocean & Atmospheric<br>Science          | NSF                                           | GRFP - Graduate<br>Research Fellowship<br>Program                                       | GRFP1449440 | P19219     | Dissolved organic matter<br>composition and sources in sub-<br>catchments in a Southeast Alaskan<br>forested watershed                                                                | Chemistry                               | 1    | 9    |
| Megan Behnke (G)                            | С       | Florida State University                                  | Earth, Ocean and Atmospheric<br>Science        |                                               |                                                                                         |             |            | forested watershed                                                                                                                                                                    |                                         |      |      |
| Jason Fellman (S)                           | С       | University of Alaska Southeast                            | Environmental Science                          |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Sophia Gomez (U)                            | С       | Florida State University                                  | Biogeochemistry                                |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Amy McKenna (S)                             | С       | National High Magnetic Field<br>Laboratory                | ICR                                            |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Ryan Rodgers (S)                            | PI      | National High Magnetic Field                              | ICR                                            | NSF                                           | OCE - Ocean                                                                             | 1045811     | P19237     | The Role of Sulfur Functionality in                                                                                                                                                   | Chemistry                               | 1    | 2    |
| Martha Chacon (S)                           | С       | Laboratory<br>National High Magnetic Field<br>Laboratory  | Ion Cyclotron Resonance                        | NSF                                           | Sciences<br>OCE - Ocean<br>Sciences                                                     | 1634478     |            | the Production of Photogenerated<br>Water-Soluble Compounds from<br>Surrogate and MC252 Crude Oils                                                                                    |                                         |      |      |
| Elizabeth Kujawinski (S)                    | С       | Woods Hole Oceanographic<br>Institution                   | NA                                             | NSF                                           | OCE - Ocean<br>Sciences                                                                 | 1756242     |            | Surrogate and Wicz32 Crude Ons                                                                                                                                                        |                                         |      |      |
| Alan Marshall (S)                           | С       | National High Magnetic Field<br>Laboratory                | ICR                                            | NSF                                           | OCE - Ocean<br>Sciences                                                                 | 1756947     |            |                                                                                                                                                                                       |                                         |      |      |
| Sydney Niles (G)                            | С       | National High Magnetic Field<br>Laboratory                | Chemistry                                      | NSF                                           | OCE - Ocean<br>Sciences                                                                 | 1635562     |            |                                                                                                                                                                                       |                                         |      |      |
| Chris Reddy (S)                             | C       | Woods Hole Oceanographic<br>Institution                   | Geochemistry                                   |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Dave Valentine (S)                          | С       | University of California, Santa<br>Barbara                | Department of Geological Sciences              |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Helen White (S)                             | С       | Haverford College                                         | Chemistry                                      |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |
| Mary Zeller (P)                             | PI      | Leibniz Institute for Baltic Sea<br>Research Warnemünde   | Department of Marine Geology                   | NSF                                           | DEB - Division of<br>Environmental<br>Biology                                           | DEB1237517  | P19274     | Molecular characterization of<br>Florida Bay DOM                                                                                                                                      | Chemistry                               | 1    | 0.5  |
| Huan Chen (S)                               | с       | National High Magnetic Field<br>Laboratory                | Ion Cyclotron Resonance                        | NSF                                           | DEB - Division of<br>Environmental<br>Biology                                           | DEB1832229  |            |                                                                                                                                                                                       |                                         |      |      |
| John Kominoski (S)                          | С       | Florida International University                          | Biological Sciences                            |                                               | 2101021                                                                                 |             | 1          |                                                                                                                                                                                       |                                         |      |      |
|                                             |         |                                                           |                                                |                                               |                                                                                         |             |            |                                                                                                                                                                                       |                                         |      |      |

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|                                         |        | Participants                                                                    |                                                            |                                                             | Funding Sources                                                                |                   | Drom-set // | Dreneral Title                                                                                                             | Dissipling                              | Exp. | Days  |
|-----------------------------------------|--------|---------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------|-------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|-------|
|                                         |        | (Name, Role, Org., Dept.)                                                       |                                                            | (Funding                                                    | g Agency, Division, A                                                          | Award #)          | Proposal #  | Proposal Title                                                                                                             | Discipline                              | #    | Used  |
| Amy McKenna (S)                         | С      | NHMEL                                                                           | ICR                                                        | (*******                                                    | 5                                                                              |                   |             |                                                                                                                            |                                         |      |       |
| Chris Osburn (S)                        | C      | North Carolina State University                                                 | Marine, Earth, and Atmospheric<br>Sciences                 |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Ashley Smyth (S)                        | С      | University of Florida                                                           | Tropical Research and Education<br>Center                  |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Bryce Van Dam (P)                       | С      | Helmholtz-Zentrum Geesthacht                                                    | Institute for Coastal Science                              |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Karina Meredith (T)                     | PI     | <ul> <li>Australia's Nuclear Science and<br/>Technology organization</li> </ul> | Australia's Nuclear Science and<br>Technology organization | Australian<br>Department of<br>Foreign Affairs and<br>Trade | Other Non US<br>Federal Agency                                                 |                   | P19277      | Addressing Chronic Kidney Disease<br>of Unknown Aetiology (CKDu) in Sri<br>Lanka                                           | Biology,<br>Biochemistry,<br>Biophysics | 1    | 1.33  |
| Andy Baker (S)                          | С      | University of New South Wales                                                   | School of Biological, Earth and<br>Environmental Sciences  | Australian Nuclear<br>Science Technology<br>organization    | Other                                                                          |                   |             |                                                                                                                            |                                         |      |       |
| Megan Behnke (G)                        | С      | Florida State University                                                        | EAOS                                                       |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Rohana Chandrajith (S)                  | С      | University of Peradeniya                                                        | Faculty of Science                                         |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Liza McDonough (G)                      | С      | University of New South Wales                                                   | School of Biological, Earth and<br>Environmental Sciences  |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Robert Spencer (S)                      | С      | Florida State University                                                        | EAOS                                                       |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Jason Masoner (S)                       | PI     | * U.S. Geological Survey                                                        | Texas Water Science Center                                 | USGS                                                        | US Government Lab                                                              |                   | P19279      | Determining potential                                                                                                      | Engineering                             | 2    | 2     |
| Huan Chen (S)                           | С      | NHMFL                                                                           | Ion Cyclotron Resonance                                    | University of New<br>Orleans                                | US College and<br>University                                                   |                   |             | environmental exposure and effects through the irrigation of crops with                                                    |                                         |      |       |
| Isabelle Cozzarelli (S)                 | С      | U.S. Geological Survey                                                          | National Research Program                                  |                                                             |                                                                                |                   | 1           | treated WWTP effluent and applied                                                                                          |                                         |      |       |
| Katherine Humpal (G)                    | С      | University of New Orleans                                                       | Chemistry                                                  | 1                                                           |                                                                                |                   | 1           | biosolids (i.e. Chickasha<br>Wastewater Reuse Study)                                                                       |                                         |      |       |
| Dana Kolpin (S)                         | C      | U.S. Geological Survey                                                          | Research Hydrologist                                       |                                                             |                                                                                |                   |             | Music mater nease stady;                                                                                                   |                                         |      |       |
| Amy McKenna (S)<br>David Podgorski (S)  | C<br>C | NHMFL<br>University of New Orleans                                              | ICR<br>Department of Chemistry                             |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Robert Spencer (S)                      | PI     | Florida State University                                                        | Earth, Ocean & Atmospheric                                 | NOMIS Foundation                                            | Non US Foundation                                                              |                   | P19289      | Global perspective on the sources,                                                                                         | Chemistry                               | 1    | 3     |
| Tom Battin (S)                          | с      | Ecole Polytechnique Federale de                                                 | Science<br>ENAC IEE SBER                                   | Nowis roundation                                            | Non 05 Foundation                                                              |                   | 15265       | cycling and composition of<br>dissolved organic matter exported                                                            | chemistry                               | Ŧ    | 5     |
| Tom Battin (3)                          | C      | Lausanne                                                                        | ENACILE SDER                                               |                                                             |                                                                                |                   |             | from mountain glaciers                                                                                                     |                                         |      |       |
| Amy Holt (G)                            | С      | Florida State University                                                        | EAOS                                                       |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Anne Kellerman (P)                      | С      | Florida State University                                                        | EAOS                                                       |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Amy McKenna (S)                         | С      | NHMFL                                                                           | ICR                                                        |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Thomas Manning (S)                      | PI     | Valdosta State University                                                       | Chemistry                                                  | NSF                                                         | DUE                                                                            | DUE1240059        | P19292      | Bryostatin Analysis                                                                                                        | Chemistry                               | 1    | 2     |
| Taylor Glattke (G)                      | С      | Florida State University                                                        | ICR                                                        |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Sydney Niles (G)                        | c      | NHMFL                                                                           | Chemistry                                                  |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Pierre Giusti (S)                       | PI     | Total                                                                           | Research & Technology                                      | Conseil Régional                                            |                                                                                | 20071303002PFM    | P19298      | Analysis of Petroleum Products by                                                                                          | Biology,                                | 3    | 30.67 |
|                                         |        | - Ctai                                                                          | hesearch a reenhology                                      | d'Aquitaine                                                 |                                                                                | 2007 100000211111 | 1 10 100    | Gel Permeation Chromatography                                                                                              | Biochemistry,                           | 5    | 50.07 |
| Nelson Acevedo (S)                      | С      | University of Pau and Pays de l'Adour                                           | IPREM                                                      | FEDER                                                       |                                                                                | 31486/08011464    |             | (GPC) Online with Inductively                                                                                              | Biophysics                              |      |       |
| Carlos Afonso (S)                       | С      | Normandy University                                                             | Chemistry                                                  | EU                                                          |                                                                                | 636829            |             | Coupled Plasma Mass Spectrometry                                                                                           |                                         |      |       |
| Brice Bouyssiere (S)                    | С      | University of Pau and Pays de l'Adour                                           | IPREM                                                      | Total university of<br>pau et des pays de                   | Other                                                                          |                   |             | (ICP MS) and with Fourier<br>Transform Ion Cyclotron Resonance                                                             |                                         |      |       |
| Herve Carrier (S)<br>Jimmy Castillo (S) | C<br>C | University of Pau and Pays de l'Adour<br>Central University of Venezuela        | UPPA<br>Escuela de Quimica                                 |                                                             |                                                                                |                   |             | Mass Spectrometry (FT-ICR MS)                                                                                              |                                         |      |       |
| Martha Chacon (S)                       | С      | NHMFL                                                                           | Ion Cyclotron Resonance                                    | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Jean-Luc Daridon (S)                    | С      | University of Pau and Pays de l'Adour                                           | IPREM                                                      | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Pierre Giusti (S)                       | С      | Total                                                                           | Refining and Chemicals                                     | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Caroline Mangote (S)                    | C      | Total                                                                           | Research & Technology                                      | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Aurora Mejia (S)                        | С      | University of Pau and Pays de l'Adour                                           | UPPA                                                       |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Remi Moulian (G)<br>Sandra Mounicou (S) | C<br>C | Unknown<br>University of Pau and Pays de l'Adour                                | ICR<br>Chimie Analytique                                   | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Vincent Piscitelli (S)                  | c      | Central University of Venezuela                                                 | Escuela de Quim´ica                                        | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Jonathan Putman (G)                     | c      | NHMFL                                                                           | ICR                                                        |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Sadia Radji (S)                         | С      | University of Pau and Pays de l'Adour                                           | UPPA                                                       | 1                                                           |                                                                                |                   | 1           |                                                                                                                            |                                         |      |       |
| Ryan Rodgers (S)                        | С      | NHMFL                                                                           | ICR                                                        |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Juliana D'Andrilli (S)                  | PI     | Louisiana Universities Marine<br>Consortium (LUMCON)                            | Environmental Chemistry                                    | NSF                                                         | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems | CBET1804736       | P19300      | Disentangling the Underlying<br>Chemistry of Absorbance and<br>Fluorescence Spectroscopy:<br>Coupling Multi-detector Size- | Chemistry                               | 1    | 4     |
| Martha Chacon (S)                       | С      | NHMFL                                                                           | Ion Cyclotron Resonance                                    | 1                                                           |                                                                                |                   | 1           | Exclusion Based Fractionation of                                                                                           |                                         |      |       |
| Sarah Fischer (P)                       | C      | University of Colorado, Boulder                                                 | Civil, Environmental and<br>Architectural Engineering      |                                                             |                                                                                |                   |             | Dissolved Organic Matter to<br>Molecular-Level FT-ICR MS                                                                   |                                         |      |       |
| Sarah Hischer (F)                       |        |                                                                                 |                                                            |                                                             |                                                                                |                   |             |                                                                                                                            |                                         |      |       |
| Amy McKenna (S)                         | С      | National High Magnetic Field<br>Laboratory                                      | ICR                                                        |                                                             |                                                                                |                   |             | Composition Analysis                                                                                                       |                                         |      |       |

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|                                             |        | Participants                                                            |                                                                    |                                                                      | Funding Sources                                      | ;                            | Bronocal # | Droposal Title                                                                                     | Discipline | Exp. | Days |
|---------------------------------------------|--------|-------------------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|------------------------------|------------|----------------------------------------------------------------------------------------------------|------------|------|------|
|                                             |        | (Name, Role, Org., Dept.)                                               |                                                                    | (Funding                                                             | g Agency, Division                                   | , Award #)                   | Proposal # | Proposal Title                                                                                     | Discipline | #    | Used |
| Núria Catalán (S)                           | PI *   | U.S. Geological Survey (USGS)                                           | Water Mission Area                                                 | European Comission                                                   | Non US Council                                       | H2020-MSCA-<br>IF2018-839709 | P19309     | Potential effects of land use change<br>on fjords of Northern Patagonia                            | Chemistry  | 1    | 3.28 |
| Anne Kellerman (P)                          | C      | Florida State University                                                | Earth, Ocean and Atmospheric<br>Science                            |                                                                      |                                                      |                              |            | under climate change scenarios                                                                     |            |      |      |
| Jorge León-Muñoz (S)                        | C      | Universidad Católica de la Santísima<br>Concepción Facultad de Ciencias | Environmental Chemistry                                            |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Amy McKenna (S)                             | С      | National High Magnetic Field<br>Laboratory                              | ICR                                                                |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Robert Spencer (S)                          | С      | Florida State University                                                | EAOS                                                               |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Núria Catalán (S)                           | PI *   | U.S. Geological Survey (USGS)                                           | Water Mission Area                                                 | European Comission                                                   | Non US Council                                       | H2020-MSCA-IF-               | P19310     | CHROME: Linking chemical diversity                                                                 | Chemistry  | 1    | 2.78 |
| Bertrand Guenet (S)                         | С      | French National Center for Scientific<br>Research                       | Laboratoire des sciences du climat<br>et de l'environnement        |                                                                      |                                                      | 2018-839709                  |            | and reactivity of arctic dissolved<br>organic matter for its integration in<br>Earth system models |            |      |      |
| Anne Kellerman (P)                          | С      | Florida State University                                                | Earth, Ocean and Atmospheric<br>Science                            |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Amy McKenna (S)                             | С      | National High Magnetic Field<br>Laboratory                              | ICR                                                                |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Ada Pastor (P)                              | С      | Aarhus University                                                       | Bioscience-Aquatic Biology                                         |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Robert Spencer (S)<br>Kimberly Wickland (S) | c<br>c | Florida State University<br>U.S. Geological Survey                      | Earth, Ocean & Atmospheric<br>Science<br>National Research Program |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| David Harper (S)                            | PI *   | University of Tennessee, Knoxville                                      | Center for Renewable Carbon                                        | USDA - Department                                                    |                                                      | 2017 2016-08827              | P19320     | A Comprehensive Chemical Analysis                                                                  | Magnets,   | 1    | 6    |
| David Halper (5)                            | r i    | University of Tennessee, Knowine                                        | Center for Kenewable Carbon                                        | of Agriculture                                                       |                                                      | 2017 2010-00827              | F15520     | of Lignin Feedstocks                                                                               | Materials  | 1    | 0    |
| Huan Chen (S)                               | С      | National High Magnetic Field<br>Laboratory                              | Ion Cyclotron Resonance                                            | DOE                                                                  | BETO - Bioenergy<br>Technologies Office              | DE-EE0008353                 |            |                                                                                                    |            |      |      |
| Valerie Garcia-Negron (G)                   | C      | University of Tennessee, Knoxville                                      | Center for Renewable Carbon                                        |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Alexander Johs (S)                          | С      | Oak Ridge National Laboratory                                           | Environmental Sciences Division                                    |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| David Keffer (S)                            | С      | University of Tennessee, Knoxville                                      | Materials Science & Engineering                                    |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Amy McKenna (S)                             | С      | National High Magnetic Field<br>Laboratory                              | ICR                                                                |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Sydney Niles (G)                            | C      | National High Magnetic Field<br>Laboratory                              | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Orlando Rios (S)                            | С      | Oak Ridge National Laboratory                                           | Materials Science & Technology                                     |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Kendhl Seabright (P)                        | С      | University of Tennessee, Knoxville                                      | Center for Renewable Carbon                                        |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Lu Yu (G)                                   | C      | University of Tennessee, Knoxville                                      | Materials Science and Engineering                                  |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Kenneth Carroll (S)                         | PI *   | New Mexico State University                                             | Plant and Environmental Sciences                                   | New Mexico State<br>University<br>Agricultural<br>Experiment Station | US College and<br>University                         |                              | P19321     | Characterization of Produced Water<br>in the Permian Basin for Potential<br>Beneficial Use         | Chemistry  | 1    | 2    |
| Jackie Jarvis (S)                           | C      | New Mexico State University                                             | Plant and Environmental Sciences                                   |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Wenbin Jiang (G)                            | С      | New Mexico State University                                             | Civil Engineering                                                  |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Naima Khan (S)                              | С      | New Mexico State University                                             | Plant and Environmental Sciences                                   |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Pei Xu (S)                                  | С      | New Mexico State University                                             | Civil Engineering                                                  |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| Patrick Tomco (S)                           | PI     | University of Alaska Anchorage                                          | Chemistry Department                                               | NSF                                                                  | OIA - Office of                                      | 1929173                      | P19325     | Photo-enhanced toxicity of                                                                         | Chemistry  | 1    | 6.7  |
| Katrina Counihan (S)                        | С      | Alaska SeaLife Center                                                   | Research                                                           | Department of<br>Homeland Security                                   | Integrative Activities<br>Other US Federal<br>Agency |                              |            | dispersed and burned crude oil to<br>arctic mussels                                                |            |      |      |
| Rana Ghannam (G)                            | С      | University of New Orleans                                               | Chemistry                                                          | ,                                                                    | <i>.</i>                                             |                              | 1          |                                                                                                    |            |      | 1    |
| Maxwell Harsha (G)                          | С      | University of New Orleans                                               | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Deja Hebert (G)                             | С      | University of New Orleans                                               | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Katherine Humpal (G)                        | С      | University of New Orleans                                               | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| lurii Kurerov (G)                           | С      | University of New Orleans                                               | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Jonathan Long (G)                           | С      | Advanced Magnet Lab, Inc.                                               | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Amy McKenna (S)                             | С      | National High Magnetic Field<br>Laboratory                              | ICR                                                                |                                                                      |                                                      |                              |            |                                                                                                    |            |      |      |
| David Podgorski (S)                         | С      | University of New Orleans                                               | Department of Chemistry                                            |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Zachary Redman (P)                          | С      | University of Alaska, Anchorage                                         | Chemistry                                                          |                                                                      |                                                      |                              |            |                                                                                                    |            |      | 1    |
| Phoebe Zito (S)                             | С      | University of New Orleans                                               | Chemistry                                                          |                                                                      |                                                      |                              | I          |                                                                                                    | 1          |      | L    |

John Headley (S)

Huan Chen (S)

Nicole Heshka (S)

Amy McKenna (S)

Ian Vander Meulen (T)

Amin Mirkouei (S)

Martha Chacon (S)

Kavita Sharma (P)

Ethan Struhs (G)

Thomas Borch (S)

Eugene Kelly (S)

Merritt Logan (G)

Amy McKenna (S)

Sydney Niles (G)

Holly Roth (G)

Mike Wilkins (S)

Estrella Rogel (S)

Cesar Ovalles (S)

Ryan Rodgers (S)

Chris Reddy (S)

Martha Chacon (S)

Robert Nelson (S)

Sydney Niles (G)

Ryan Rodgers (S)

Dave Valentine (S)

Martha Chacon (S)

Francisco Lopez Linares (S)

Charles Rhoades (S)

Kerry Peru (T)

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| Participants<br>(Name, Role, Org., Dept.)                   |                                                                   | (Funding                                                    | Funding Sources<br>Agency, Division, | Award #)  | Proposal # | Proposal Title                                                                                    | Discipline | Exp.<br># | Day:<br>Use |
|-------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------|-----------|------------|---------------------------------------------------------------------------------------------------|------------|-----------|-------------|
| Environment and Climate Change                              | National Hydrology Research Centre                                | Environment Canada                                          | Non US Government                    | ,         | P19328     | APPI characterization of naphthenic                                                               | Chemistry  | 2         | 7           |
| Canada                                                      |                                                                   |                                                             | Lab                                  |           |            | acids in soft tailing capped                                                                      |            |           |             |
| National High Magnetic Field<br>Laboratory                  | Ion Cyclotron Resonance                                           |                                                             |                                      |           |            | treatments and weathering of<br>petroleum spill in a laboratory wave                              |            |           |             |
| Natural Resources Canada                                    | CanmetENERGY                                                      |                                                             |                                      |           |            | simulator                                                                                         |            |           |             |
| National High Magnetic Field<br>Laboratory                  | ICR                                                               |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Environment and Climate Change<br>Canada                    | Water Science and Technology                                      |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Environment and Climate Change<br>Canada                    | Watershed Hydrology and Ecology<br>and Ecology Research Division  |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| University of Idaho                                         | Mechanical and Biological                                         | University of Idaho                                         | Other                                |           | P19334     | Multi-level chemical fractionation                                                                | Chemistry  | 1         | 5           |
|                                                             | Engineering                                                       | (EIS Grant)                                                 | -                                    |           |            | scheme to enable in-depth                                                                         | ,          |           |             |
| National High Magnetic Field<br>Laboratory                  | Ion Cyclotron Resonance                                           |                                                             |                                      |           |            | characterization of bio-oil                                                                       |            |           |             |
| Idaho State University                                      | Department of Chemistry                                           |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| University of Idaho                                         | Engineering                                                       |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Colorado State University                                   | Soil and Crop Science                                             | No other support                                            |                                      |           | P19338     | Forest fire-impacted soil organic                                                                 | Chemistry  | 3         | 3.08        |
| Colorado State University                                   | College of Agricultural Sciences                                  |                                                             |                                      |           |            | matter chemistry                                                                                  |            |           |             |
| Colorado State University                                   | Chemistry                                                         |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| National High Magnetic Field                                | ICR                                                               |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Laboratory<br>National High Magnetic Field                  | Chemistry                                                         |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Laboratory                                                  | Rocky Mountain Research Station                                   |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| U.S. Department of Agriculture<br>Colorado State University | Chemistry                                                         |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Colorado State University                                   | College of Agricultural Sciences                                  |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Chevron ETC                                                 | Products and Analytical                                           | Chevron Research                                            | Other                                |           | P19359     | Entangling Petroleum Properties                                                                   | Chemistry  | 2         | 5           |
| National High Magnetic Field<br>Laboratory                  | Ion Cyclotron Resonance                                           |                                                             |                                      |           |            | with Molecular Composition:<br>Analysis of Asphaltene Fractions by                                |            |           |             |
| Chevron, Richmond                                           | Downstream and Service-Petroleum<br>and Material Characterization |                                                             |                                      |           |            | High-Temperature GC Coupled to ICP MS.                                                            |            |           |             |
| Chevron Energy Tech. Comp.                                  | Downstream and Services                                           |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| National High Magnetic Field                                | ICR                                                               |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Laboratory                                                  |                                                                   |                                                             |                                      |           |            | <u> </u>                                                                                          |            |           |             |
| Woods Hole Oceanographic<br>Institution                     | Geochemistry                                                      | No other support                                            |                                      |           | P19420     | Brazil Oil Spill - Analysis of Field<br>Samples                                                   | Chemistry  | 1         | 1.5         |
| National High Magnetic Field<br>Laboratory                  | Ion Cyclotron Resonance                                           |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Woods Hole Oceanographic<br>Institution                     | Dept Marine Chemistry and<br>Geochemistry                         |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| National High Magnetic Field<br>Laboratory                  | Chemistry                                                         |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| National High Magnetic Field<br>Laboratory                  | ICR                                                               |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| University of California, Santa<br>Barbara                  | Department of Geological Sciences                                 |                                                             |                                      |           |            |                                                                                                   |            |           |             |
| Woods Hole Oceanographic                                    | Department of Marine Chemistry                                    | NSF                                                         | OCE - Ocean                          | OCE174530 | P19429     | Analysis of photochemical                                                                         | Chemistry  | 1         | 0.5         |
| Institution                                                 | and Geochemistry,                                                 |                                                             | Sciences                             | · · · · - |            | incorporation of 180-labeled                                                                      | ,          |           |             |
| Woods Hole Oceanographic                                    | Marine Chemistry & Geochemistry                                   | Canadian Division of                                        | Non US Ministry                      | 1.06      |            | dioxygen and water into crude oil                                                                 |            |           |             |
| Institution                                                 |                                                                   | Fisheries and Ocean<br>Sciences: Multi-<br>Partner Research |                                      |           |            | using ultra high-resolution mass<br>spectrometry: a novel assessment<br>of reactants and pathways |            |           |             |

|                      |      | Barbara                                        |                                                     |                                                                                                   |                                                            |             |        |                                                                                                                                        |                                         |   |     |
|----------------------|------|------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------|--------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---|-----|
| Collin Ward (S)      | PI   | Woods Hole Oceanographic<br>Institution        | Department of Marine Chemistry<br>and Geochemistry, | NSF                                                                                               | OCE - Ocean<br>Sciences                                    | OCE174530_  | P19429 | Analysis of photochemical<br>incorporation of 18O-labeled                                                                              | Chemistry                               | 1 | 0.5 |
| Danielle Freeman (G) | С    | Woods Hole Oceanographic<br>Institution        | Marine Chemistry & Geochemistry                     | Canadian Division of<br>Fisheries and Ocean<br>Sciences: Multi-<br>Partner Research<br>Initiative | Non US Ministry                                            | 1.06        |        | dioxygen and water into crude oil<br>using ultra high-resolution mass<br>spectrometry: a novel assessment<br>of reactants and pathways |                                         |   |     |
| Amy McKenna (S)      | С    | NHMFL                                          | ICR                                                 |                                                                                                   |                                                            |             |        |                                                                                                                                        |                                         |   |     |
| Taylor F Nelson (P)  | С    | Woods Hole Oceanographic<br>Institution        | Marine Chemistry & Geochemistry                     |                                                                                                   |                                                            |             |        |                                                                                                                                        |                                         |   |     |
| Leslie Hicks (S)     | PI * | University of North Carolina at Chapel<br>Hill | Chemistry                                           | NSF                                                                                               | CAREER - Faculty<br>Early Career<br>Development<br>Program | MCB-1552522 | P19430 | Leveraging top-down proteomics to<br>assess reversible cysteine oxidation<br>in Chlamydomonas reinhardtii                              | Biology,<br>Biochemistry,<br>Biophysics | 1 | 4.5 |
| Lissa Anderson (S)   | С    | NHMFL                                          | ICR                                                 | NSF                                                                                               | MCB - Molecular and<br>Cellular Biosciences                | MCB1714405  |        |                                                                                                                                        |                                         |   |     |
| Amanda Smythers (G)  | С    | University of North Carolina at Chapel<br>Hill | Chemistry                                           |                                                                                                   |                                                            |             |        |                                                                                                                                        |                                         |   |     |

| ICR |
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|                                            |           | Participants                                                        |                                                               |                                                                      | Funding Source               |                       | Proposal # | Proposal Title                                                                     | Discipline                | Exp. | Days  |
|--------------------------------------------|-----------|---------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|------------------------------|-----------------------|------------|------------------------------------------------------------------------------------|---------------------------|------|-------|
|                                            |           | (Name, Role, Org., Dept.)                                           |                                                               |                                                                      | g Agency, Divisior           | n, Award #)           | -          | -                                                                                  | Discipline                | #    | Used  |
| Robert Spencer (S)                         | PI        | Florida State University                                            | Earth, Ocean & Atmospheric<br>Science                         | NASA                                                                 |                              |                       | P19435     | Characterizing DOM compositions<br>across a changing arctic                        | Chemistry                 | 1    | 19.5  |
| Martin Kurek (G)                           | С         | FSU                                                                 | Earth, Ocean, and Atmospheric<br>Science                      |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Amy McKenna (S)                            | С         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Sydney Niles (G)                           | С         | National High Magnetic Field<br>Laboratory                          | Chemistry                                                     |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Brett Poulin (S)                           | С         | U.S. Geological Survey                                              | National Research Program                                     |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| RAGHAB RAY (P)                             | PI *      | The University of Tokyo, Atmosphere<br>and Ocean Research Institute | Chemical Oceanography                                         | No other support                                                     |                              |                       | P19448     | Composition and fate of dissolved<br>organic matter derived from                   | Chemistry                 | 1    | 0.25  |
| Amy McKenna (S)                            | с         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            | mangroves                                                                          |                           |      |       |
| Toshihiro Miyajima (S)                     | С         | The University of Tokyo, Atmosphere<br>and Ocean Research Institute | Atmosphere and Ocean Research<br>Institute                    |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Robert Spencer (S)                         | С         | Florida State University                                            | Earth, Ocean & Atmospheric<br>Science                         |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Aron Stubbins (S)                          | С         | Northeastern University                                             | Marine and Environmental Science                              |                                                                      |                              |                       |            |                                                                                    |                           |      | 1     |
| Colleen McMahan (S)                        | PI *      | U.S. Department of Agriculture                                      | Bioproducts Research Unit/Western<br>Regional Research Center | USDA - Department<br>of Agriculture                                  |                              | 2030-24-1410-<br>022D | P19457     | Determination of isoprenoid<br>pathway metabolites in                              | Biology,<br>Biochemistry, | 1    | 0.33  |
| Catherine Brewer (S)                       | С         | New Mexico State University                                         | Chemical and Materials Engineering                            | New Mexico State<br>University<br>Agricultural<br>Experiment Station | US College and<br>University |                       |            | bioengineered guayule                                                              | Biophysics                |      |       |
| Mostafa Dehghanizadeh (G)                  | С         | New Mexico State University                                         | Chemical and Materials Engineering                            |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Claudia Galvan (T)                         | С         | New Mexico State University                                         | Plant and Environmental Science                               |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| F. Omar Holguin (S)                        | С         | New Mexico State University                                         | Department of Plant and<br>Environmental Science              |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Jackie Jarvis (S)                          | С         | New Mexico State University                                         | Plant and Environmental Sciences                              |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Dante Placido (P)                          | С         | U.S. Department of Agriculture                                      | Bioproducts Research Unit/Western<br>Regional Research Center |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Sergei Shalygin (G)                        | C<br>PI * | New Mexico State University                                         | Plant and Environmental Science                               | NSF                                                                  | 005 0000                     | 0000000075            | P19460     | Microbially madiated ail                                                           | Chamistry                 | 1    | 1.83  |
| Samantha Joye (S)<br>Zachary Marinelli (G) | C C       | University of Georgia<br>University of Georgia                      | Department of Marine Sciences<br>Marine Sciences              | NSF                                                                  | OCE - Ocean<br>Sciences      | OCE2023575            | P19460     | Microbially-mediated oil<br>transformation in contrasting<br>natural environments. | Chemistry                 | 1    | 1.83  |
| Amy McKenna (S)                            | c         | National High Magnetic Field                                        | ICR                                                           |                                                                      |                              |                       |            | natural chimonificitis.                                                            |                           |      |       |
|                                            | c         | Laboratory                                                          |                                                               |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Ryan Rodgers (S)                           | С         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Ryan Sibert (G)                            | С         | University of Georgia                                               | Marine Science Department                                     |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Ryan Rodgers (S)                           | PI        | National High Magnetic Field<br>Laboratory                          | ICR                                                           | No other support                                                     |                              |                       | P19464     | Understanding of Emulsion<br>Formation from Photo-Oxidized                         | Chemistry                 | 1    | 17.33 |
| Joseph Frye (G)                            | С         | National High Magnetic Field<br>Laboratory                          | CIMAR                                                         |                                                                      |                              |                       |            | Crude Oils                                                                         |                           |      |       |
| Alan Marshall (S)                          | С         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Jon Hawkings (P)                           | PI *      | Florida State University                                            | Earth, Ocean and Atmospheric<br>Sciences                      | European Research<br>Council                                         | Non US Council               | 793962                | P19475     | Glacial influence on organic matter<br>export in polar watersheds                  | Chemistry                 | 1    | 1.83  |
| Anne Kellerman (P)                         | С         | Florida State University                                            | Earth, Ocean and Atmospheric<br>Science                       |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Matthew Marshall (G)                       | С         | University of Bristol                                               | School of Geographical Sciences                               |                                                                      |                              |                       |            |                                                                                    |                           |      | 1     |
| Amy McKenna (S)                            | С         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Robert Spencer (S)                         | С         | Florida State University                                            | Earth, Ocean & Atmospheric<br>Science                         |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Jemma Wadham (S)                           | С         | University of Bristol                                               | School of Geographical Sciences                               |                                                                      |                              |                       |            |                                                                                    |                           |      |       |
| Xiaolin Li (S)                             | PI *      | Xiamen University                                                   | School of Marine and Earth Sciences                           | NSFC                                                                 | Other                        | 41676059              | P19493     | Fate of Diazotroph-derived                                                         | Chemistry                 | 1    | 0.33  |
| Peng Jiang (G)                             | С         | Xiamen University                                                   | State Key Laboratory of Marine<br>Environmental Science       |                                                                      |                              |                       |            | Nitrogen in the North Pacific<br>Subtropical Gyre: Revealed by the                 |                           |      |       |
| Amy McKenna (S)                            | С         | National High Magnetic Field<br>Laboratory                          | ICR                                                           |                                                                      |                              |                       |            | Molecular Characterization of<br>Dissolved Organic Nitrogen                        |                           |      |       |
| Robert Spencer (S)                         | С         | Florida State University                                            | Earth, Ocean & Atmospheric<br>Science                         |                                                                      |                              |                       |            |                                                                                    |                           |      |       |

|                       |    | Participants<br>(Name, Role, Org., Dept.)                    |                                                        | (Funding                                      | Funding Sources<br>Agency, Division, A  | Award #)               | Proposal # | Proposal Title                                                    | Discipline | Exp.<br># | Days<br>Used |
|-----------------------|----|--------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------|-----------------------------------------|------------------------|------------|-------------------------------------------------------------------|------------|-----------|--------------|
| Jens Blotevogel (S)   | PI | Colorado State University                                    | Civil & Environmental Engineering                      | No other support                              |                                         |                        | P19497     | Membrane Distillation of Oil & Gas                                | Chemistry  | 1         | 0.33         |
| Andrea Hanson (G)     | С  | Colorado State University                                    | Civil and Environmental Engineering                    |                                               |                                         |                        |            | Produced Water                                                    |            |           |              |
| Amy McKenna (S)       | С  | NHMFL                                                        | ICR                                                    |                                               |                                         |                        |            |                                                                   |            |           |              |
| Radisav Vidic (S)     | С  | University of Pittsburgh                                     | Civil & Environmental Engineering                      |                                               |                                         |                        |            |                                                                   |            |           |              |
| Robert Young (S)      | С  | Colorado State University                                    | Soil & Crop Sciences                                   |                                               |                                         |                        |            |                                                                   |            |           | i i          |
| Calvin Mukarakate (S) | PI | <ul> <li>National Renewable Energy<br/>Laboratory</li> </ul> | National Bioenergy Center                              | DOE                                           | BETO - Bioenergy<br>Technologies Office | DE-AC36-08-<br>GO28308 | P19502     | Impacts of Biomass Feed, Catalyst,<br>and Operating Conditions on | Chemistry  | 1         | 5            |
| Martha Chacon (S)     | С  | NHMFL                                                        | Ion Cyclotron Resonance                                |                                               |                                         |                        |            | Molecular Transformations during                                  |            |           |              |
| Kristiina Iisa (S)    | С  | National Renewable Energy<br>Laboratory                      | Catalytic Carbon Transformation<br>and Scale-Up Center |                                               |                                         |                        |            | Catalytic Fast Pyrolysis Oil                                      |            |           |              |
| Steven Rowland (S)    | С  | National Renewable Energy<br>Laboratory                      | National Bioenergy Center                              |                                               |                                         |                        |            |                                                                   |            |           |              |
| David Podgorski (S)   | PI | University of New Orleans                                    | Department of Chemistry                                | Enbridge Energy                               |                                         |                        | P19518     | Extraction Selectivity of Polar                                   | Chemistry  | 1         | 1            |
| Barbara Bekins (S)    | С  | U.S. Geological Survey                                       | National Research Program                              | Shell Global<br>Solutions                     |                                         |                        |            | Compounds in Petroleum<br>Contaminated Groundwater Plumes         |            |           |              |
| Rana Ghannam (G)      | с  | University of New Orleans                                    | Chemistry                                              | USGS Toxic<br>Substances<br>Hydrology Program | Other US Federal<br>Agency              |                        |            |                                                                   |            |           |              |
| Amy McKenna (S)       | С  | NHMFL                                                        | ICR                                                    | Minnesota Pollution<br>Control Agency         | Other                                   |                        |            |                                                                   |            |           |              |
| Phoebe Zito (S)       | С  | University of New Orleans                                    | Chemistry                                              | <i>,</i>                                      |                                         |                        |            |                                                                   |            |           |              |
| Chris Hendrickson (S) | PI | NHMFL                                                        | Ion Cyclotron Resonance Program                        | No other support                              |                                         |                        | P19548     | Analytical Method Development for                                 | Chemistry  | 1         | 14           |
| Lissa Anderson (S)    | С  | NHMFL                                                        | ICR                                                    |                                               |                                         |                        |            | FT-ICR MS                                                         |            |           | 1            |
| Greg Blakney (S)      | С  | NHMFL                                                        | ICR                                                    |                                               |                                         |                        |            |                                                                   |            |           | 1            |
| Amy McKenna (S)       | С  | NHMFL                                                        | ICR                                                    |                                               |                                         |                        |            |                                                                   |            |           | 1            |
| Chad Weisbrod (S)     | С  | NHMFL                                                        | ICR                                                    |                                               |                                         |                        |            |                                                                   |            |           |              |
|                       |    |                                                              |                                                        |                                               |                                         |                        |            | Total Proposals:                                                  | Expe       | eriments: | Days:        |
|                       |    |                                                              |                                                        |                                               |                                         |                        |            | 67                                                                |            | 92        | 612          |

### 6. NMR Facility

|                            |    | Participants                                       |                                                           |                  | Funding Sources                                              |                | Proposal # | Proposal Title                                                  | Discipling                | Exp.     | Days |
|----------------------------|----|----------------------------------------------------|-----------------------------------------------------------|------------------|--------------------------------------------------------------|----------------|------------|-----------------------------------------------------------------|---------------------------|----------|------|
|                            |    | (Name, Role, Org., Dept.)                          |                                                           | (Funding         | Agency, Division, Award                                      | #)             | Proposal # | Proposal Title                                                  | Discipline                | #        | Used |
| Anant Paravastu (S)        | PI | Georgia Institute of Technology                    | School of Chemical &                                      | NIH              | Other                                                        | 1R01AG04       | P11458     | Solid State NMR Structural                                      | Biology,                  | 1        | 2.5  |
|                            |    |                                                    | Biomolecular Engineering                                  |                  |                                                              | 5703-01A1      |            | Characterization of oligomeric ß-                               | Biochemistry,             |          |      |
| Yuan Gao (G)               | С  | Georgia Institute of Technology                    | School of Chemical and                                    |                  |                                                              |                |            | Amyloid (1-42) peptide                                          | Biophysics                |          |      |
| Cong Guo (P)               | с  | NHMFL                                              | Biomolecular Engineering<br>physics                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Danting Huang (G)          | с  | Florida State University                           | College of Engineering                                    |                  |                                                              |                |            |                                                                 |                           |          |      |
| Frederic Mentink (S)       | с  | NHMFL                                              | NMR Division                                              |                  |                                                              |                |            |                                                                 |                           |          |      |
| Terrone Rosenberry (S)     | с  | Mayo Clinic, Jacksonville                          | Neuroscience                                              |                  |                                                              |                |            |                                                                 |                           |          |      |
| Jens Watzlawik (P)         | c  | Mayo Clinic, Jacksonville                          | College of Medicine                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Sungsool Wi (S)            | с  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Huan-Xiang Zhou (S)        | c  | University of Illinois at Chicago                  | Physics and Chemistry                                     |                  |                                                              |                |            |                                                                 |                           |          |      |
|                            | PI |                                                    |                                                           | NIH              | NICME National Institute                                     | GM12773        | P16233     | Structure Determination of the                                  | Biology                   | 2        | 12   |
| Fang Tian (S)              | Ы  | Pennsylvania State University                      | Biochemistry and Molecular<br>Biology, Penn State Medical | NIH              | NIGMS - National Institute<br>of General Medical             | GIVI12773<br>0 | P16233     | Structure Determination of the<br>Transmembrane Domain of Human | Biology,<br>Biochemistry, | 2        | 12   |
|                            |    |                                                    | School                                                    |                  | Sciences                                                     | 0              |            | Amyloid Precursor Protein Binding                               | Biophysics                |          |      |
| Riqiang Fu (S)             | С  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            | Receptor LR11 (sorLA) in a                                      |                           |          |      |
|                            |    |                                                    |                                                           |                  |                                                              |                |            | Biological Membrane                                             |                           |          |      |
| Liliya Vugmeyster (S)      | PI | University of Colorado, Denver                     | Chemistry                                                 | NIH              | NIGMS - National Institute<br>of General Medical             | GM11511<br>1   | P16309     | Dynamics of amyloid-beta fibrils by<br>deuteron NMR             | Biology,<br>Biochemistry, | 1        | 4    |
|                            |    |                                                    |                                                           |                  | Sciences                                                     | 1              |            | deateron minit                                                  | Biophysics                |          |      |
| Dan Au (G)                 | С  | University of Colorado, Denver                     | Bioengineering                                            |                  |                                                              |                |            |                                                                 |                           |          |      |
| Dmitry Ostrovsky (S)       | С  | University of Alaska, Anchorage                    | Mathematics                                               |                  |                                                              |                |            |                                                                 |                           |          |      |
| Sungsool Wi (S)            | PI | NHMFL                                              | NMR                                                       | No other support |                                                              |                | P16311     | Development of the state-of-the-                                | Biology,                  | 6        | 39   |
| Tim Cross (S)              | С  | NHMFL                                              | NHMFL/Chemistry &                                         | NSF              | DMR - Division of Materials                                  | DMR1644        |            | art solid-state NMR methods                                     | Biochemistry,             |          |      |
|                            |    |                                                    | Biochemistry                                              |                  | Research                                                     | 779            |            | suitable at ultrahigh magnetic fields<br>and MAS spinning rates | Biophysics                |          |      |
| Lucio Frydman (S)          | С  | NHMFL                                              | NMR                                                       | Israel Science   | Non US Foundation                                            | 965/18         |            | and MAS spinning rates                                          |                           |          |      |
| Kwang Hun Lim (S)          | с  | East Carolina University                           | Chomistry                                                 | Foundation       |                                                              |                |            |                                                                 |                           |          |      |
| Yiseul Shin (G)            | c  | Florida State University                           | Chemistry<br>Chemistry                                    |                  |                                                              |                |            |                                                                 |                           |          |      |
|                            | -  | NHMFL                                              | ·                                                         | N 11 1           |                                                              |                | 246240     |                                                                 |                           | <i>.</i> | 404  |
| Ashley Blue (T)            | PI |                                                    | NHMFL                                                     | No other support |                                                              |                | P16319     | NMR System Maintenance                                          | Magnets,<br>Materials     | 6        | 121  |
| Kevin Chalek (G)           | С  | University of California, Riverside                | Chemistry                                                 | NIH              | NIGMS - National Institute<br>of General Medical<br>Sciences | GM12269<br>8   |            |                                                                 | Waterials                 |          |      |
| Bo Chen (S)                | с  | University of Central Florida                      | Department of Physics                                     |                  | Selences                                                     |                |            |                                                                 |                           |          |      |
| Banghao CHen (S)           | C  | Florida State University                           | Chemistry & Biochemistry                                  |                  |                                                              |                |            |                                                                 |                           |          |      |
| Justin Douglas (S)         | c  | University of Kansas                               | Molecular Structures Group                                |                  |                                                              |                |            |                                                                 |                           |          |      |
| Thierry Dubroca (S)        | c  | NHMFL                                              | EMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Emily Foley (G)            | c  | University of California, Santa                    | Materials                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Linny Foley (G)            | C  | Barbara                                            | Waterials                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Riqiang Fu (S)             | С  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Zhehong Gan (S)            | С  | NHMFL                                              | NHMFL                                                     |                  |                                                              |                |            |                                                                 |                           |          |      |
| Ivan Hung (S)              | С  | NHMFL                                              | CIMAR/NMR                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Jessica Kelz (G)           | С  | University of California, Irvine                   | Chemistry                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Jason Kitchen (T)          | С  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Joanna Long (S)            | С  | University of Florida                              | Biochemistry & Molecular Biology                          |                  |                                                              |                |            |                                                                 |                           |          |      |
| Frederic Mentink (S)       | с  | ,<br>NHMFL                                         | NMR Division                                              |                  |                                                              |                |            |                                                                 |                           |          |      |
| Lakshmi Bhai N Vidyadharan | c  | Ohio State University                              | Department of Chemistry and                               |                  |                                                              |                |            |                                                                 |                           |          |      |
| (G)                        |    | ,                                                  | Biochemistry                                              |                  |                                                              |                |            |                                                                 |                           |          |      |
| Lauren O'Donnell (P)       | С  | Hunter College of CUNY                             | Physics                                                   |                  |                                                              |                |            |                                                                 |                           |          |      |
| Sarah Overall (P)          | С  | Swiss Federal Institute of Technology<br>in Zurich | Chemistry                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Luke Reynolds (G)          | С  | University of British Columbia                     | Physics and Astronomy                                     |                  |                                                              |                |            |                                                                 |                           |          |      |
| Jens Rosenberg (S)         | С  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Victor Schepkin (S)        | С  | NHMFL                                              | CIMAR                                                     |                  |                                                              |                |            |                                                                 |                           |          |      |
| Kan Tagami (G)             | С  | University of California, San Diego                | Chemistry                                                 |                  |                                                              |                |            |                                                                 |                           |          |      |
| Tanya Whitmer (S)          | с  | Ohio State University                              | CCIC                                                      |                  |                                                              |                |            |                                                                 |                           |          |      |
| Sungsool Wi (S)            | c  | NHMFL                                              | NMR                                                       |                  |                                                              |                |            |                                                                 |                           |          |      |
| Qiong Wu (S)               | c  | University of Texas, Southwestern                  | Biophysics                                                |                  |                                                              |                |            |                                                                 |                           |          |      |
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| NMR |
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|                                          |         | Participants<br>(Name, Role, Org., Dept.)                                                        |                                                                                  |                                                                                                                                             | Funding Sources<br>Agency, Division, Award                          | #)                        | Proposal # | Proposal Title                                                                                                                                                | Discipline                | Ехр.<br># | Day:<br>Used |
|------------------------------------------|---------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------|--------------|
| Benito Marinas (S)<br>Daniel Mosiman (G) | PI<br>C | University of Illinois at Urbana-<br>Champaign<br>University of Illinois at Urbana-<br>Champaign | Civil and Environmental<br>Engineering<br>Civil and Environmental<br>Engineering | NSF                                                                                                                                         | GRFP - Graduate Research<br>Fellowship Program                      | GRFP1746<br>047           | P17334     | Determination of fluoride chemical<br>environment on calcium<br>hydroxyapatite nanoparticles of<br>different crystallinities –<br>distinguishing the dominant | Engineering               | 2         | 10           |
|                                          |         | F - U                                                                                            | 0 0                                                                              |                                                                                                                                             |                                                                     |                           |            | mechanism(s) of fluoride removal                                                                                                                              |                           |           |              |
| Tuo Wang (S)                             | PI      | Louisiana State University                                                                       | Chemistry                                                                        | NSF                                                                                                                                         | OIA - Office of Integrative<br>Activities                           | 1833040                   | P17348     | Structure and Packing of Complex<br>Carbohydrates in Native Plant and                                                                                         | Biology,<br>Biochemistry, | 6         | 24           |
| Arnab Chakraborty (G)                    | С       | Louisiana State University                                                                       | Chemistry                                                                        | NIH                                                                                                                                         | NIAID - National Institute of<br>Allergy and Infectious<br>Diseases | AI121149                  |            | Fungal Cell Walls from Solid-State<br>DNP-NMR                                                                                                                 | Biophysics                |           |              |
| Malitha Dickwella Widanage<br>(G)        | С       | Louisiana State University                                                                       | chemistry                                                                        | NSF                                                                                                                                         | CAREER - Faculty Early<br>Career Development<br>Program             | 1942665                   |            |                                                                                                                                                               |                           |           |              |
| Zhehong Gan (S)                          | С       | National High Magnetic Field<br>Laboratory                                                       | NHMFL                                                                            | NSF                                                                                                                                         | MCB - Molecular and<br>Cellular Biosciences                         | MCB1942<br>665            |            |                                                                                                                                                               |                           |           |              |
| Alex Kirui (G)                           | С       | Louisiana State University                                                                       | Chemistry                                                                        |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Frederic Mentink (S)                     | С       | NHMFL                                                                                            | NMR Division                                                                     |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Cecil Dybowski (S)                       | PI      | University of Delaware                                                                           | Chemistry and Biochemistry                                                       | NSF                                                                                                                                         | DMR - Division of Materials<br>Research                             | DMR1608<br>366            | P17354     | Assessing the potential of high-<br>field, natural abundance 67Zn solid-                                                                                      | Chemistry                 | 1         | 6            |
| Silvia Centeno (S)                       | С       | The Metropolitan Museum of Art                                                                   | Scientifi Research                                                               | NSF                                                                                                                                         | DMR - Division of Materials<br>Research                             | DMR1608<br>594            |            | state NMR for understanding the<br>reactivity of ZnO-based pigments in                                                                                        |                           |           |              |
| Valeria Di Tullio (P)                    | С       | The Metropolitan Museum of Art                                                                   | Scientific Research                                                              |                                                                                                                                             |                                                                     |                           |            | paint films                                                                                                                                                   |                           |           |              |
| Nicholas Zumbulyadis (S)                 | С       | Independent Scholar and Consultant                                                               | Consultancy                                                                      |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Myriam Cotten (S)                        | PI      | College of William and Mary                                                                      | Applied Science                                                                  | NSF                                                                                                                                         | MCB - Molecular and<br>Cellular Biosciences                         | MCB1716<br>608            | P17425     | Investigating Host Defense<br>Mechanisms at Biological                                                                                                        | Biology,<br>Biochemistry, | 5         | 57           |
| Riqiang Fu (S)                           | С       | NHMFL                                                                                            | NMR                                                                              |                                                                                                                                             |                                                                     |                           |            | Membranes                                                                                                                                                     | Biophysics                |           |              |
| Leonard Mueller (S)                      | PI      | University of California, Riverside                                                              | Chemistry                                                                        | NSF                                                                                                                                         | CHE - Chemistry                                                     | CHE17106<br>71            | P17435     | Chemically-Rich Structure and<br>Dynamics in the Active Site of                                                                                               | Biology,<br>Biochemistry, | 1         | 7            |
| Varun Sakhrani (G)                       | С       | University of California, Riverside                                                              | Chemistry                                                                        | NIH                                                                                                                                         | NIGMS - National Institute<br>of General Medical<br>Sciences        | GM09756<br>9              |            | Tryptophan Synthase from 170<br>Quadrupole Central Transition NMR<br>at 36 T                                                                                  | Biophysics                |           |              |
| Chang Hyun Lee (S)                       | PI      | Dankook University                                                                               | Energy Engineering Department                                                    | No other support                                                                                                                            |                                                                     |                           | P17436     | Solid-state NMR characterization of                                                                                                                           | Chemistry                 | 2         | 15           |
| Jin Pyo Hwang (G)                        | С       | Dankook University                                                                               | Energy Engineering                                                               | Korea Institute of<br>Energy Technology<br>Evaluation and<br>Planning (KETEP) and<br>the Ministry of Trade,<br>Industry & Energy<br>(MOTIE) | Non US Foundation                                                   | No.<br>20153010<br>031920 |            | nanodispersed polymeric<br>membrane materials for energy<br>generation and valued chemicals<br>production                                                     |                           |           |              |
| Woo Young Kim (G)                        | С       | Dankook University                                                                               | Energy Engineering                                                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Chang Hoon Oh (G)                        | С       | Dankook University                                                                               | Energy Engineering                                                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| In Kee Park (G)                          | С       | Dankook University                                                                               | Energy Engineering                                                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Se Youn Pyo (G)                          | С       | Dankook University                                                                               | Energy engineering                                                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Sungsool Wi (S)                          | С       | NHMFL                                                                                            | NMR                                                                              |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Gianluigi Veglia (S)                     | PI      | University of Minnesota, Twin Cities                                                             | BMBB                                                                             | NIH                                                                                                                                         | NHLBI - National Heart and<br>Blood Institute                       | HL144130                  | P17438     | NMR Structural Analysis of<br>Sarcoplasmic Reticulum Proteins in                                                                                              | Biology,<br>Biochemistry, | 2         | 6            |
| Riqiang Fu (S)                           | С       | NHMFL                                                                                            | NMR                                                                              | NIH                                                                                                                                         | NIGMS - National Institute<br>of General Medical<br>Sciences        | GM06474<br>2              |            | Membranes                                                                                                                                                     | Biophysics                |           |              |
| Zhehong Gan (S)                          | С       | NHMFL                                                                                            | NHMFL                                                                            |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Tata Gopinath (P)                        | С       | University of Minnesota, Twin Cities                                                             | Biochemistry                                                                     |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Erik Larsen (G)                          | С       | University of Minnesota, Twin Cities                                                             | Chemistry                                                                        |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Sarah Nelson (G)                         | С       | University of Minnesota, Twin Cities                                                             | Biochemistry, Molecular Biology,<br>and Biophysics                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Joana Paulino (P)                        | С       | NHMFL                                                                                            | CIMAR                                                                            |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
|                                          | С       | University of Minnesota, Twin Cities                                                             | Biochemistry, Molecular Biology,<br>and Biophysics                               |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |
| Songlin Wang (P)                         |         |                                                                                                  |                                                                                  | 1                                                                                                                                           |                                                                     |                           |            | 1                                                                                                                                                             | 1                         | 1         |              |
| Songlin Wang (P)<br>Xiaoling Wang (P)    | С       | University of California, Santa<br>Barbara (UC Santa Barbara, UCSB)                              | Physics                                                                          |                                                                                                                                             |                                                                     |                           |            |                                                                                                                                                               |                           |           |              |

|                            |    | Participants                                      |                                                   |                   | Funding Sources                                                                |                       | Bronocal # | Proposal Title                                                                    | Discipling                              | Exp. | Days |
|----------------------------|----|---------------------------------------------------|---------------------------------------------------|-------------------|--------------------------------------------------------------------------------|-----------------------|------------|-----------------------------------------------------------------------------------|-----------------------------------------|------|------|
|                            |    | (Name, Role, Org., Dept.)                         |                                                   | (Funding          | Agency, Division, Award                                                        | #)                    | Proposal # | Proposal Title                                                                    | Discipline                              | #    | Used |
| Danielle Laurencin (S)     | PI | University of Montpellier                         | Institut Charles Gerhardt de                      | CNRS              | Other                                                                          | ,                     | P17464     | High resolution solid state NMR                                                   | Chemistry                               | 2    | 20   |
| Christian Bonhomme (S)     | с  | Pierre and Marie Curie University                 | Montpellier<br>Laboratoire de Chimie de la        | European Research | Non US Council                                                                 |                       |            | studies of biomaterials at 36<br>T:analysis of calcium and oxygen                 |                                         |      |      |
| Chia-Hsin Chen (P)         | С  | French National Center for Scientific             | Matière Condensée<br>Institut Charles Gerhardt de | Council           |                                                                                |                       |            | local environments                                                                |                                         |      |      |
| Zhehong Gan (S)            | С  | Research<br>NHMFL                                 | Montpellier<br>NHMFL                              |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Christel Gervais (S)       | c  | Sorbonne University                               | Laboratoire de Chimie de la                       |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
|                            | -  | ,                                                 | Matière Condensée                                 |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Ieva Goldberga (P)         | С  | French National Center for Scientific<br>Research | Institut Charles Gerhardt de<br>Montpellier       |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Frederic Mentink (S)       | С  | NHMFL                                             | NMR Division                                      |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Ayyalusamy Ramamoorthy (S) | PI | University of Michigan                            | Chemistry & Biophysics                            | NIH               | NIGMS - National Institute<br>of General Medical<br>Sciences                   | GM08401<br>8          | P17486     | Solid-State NMR Experiments on<br>Magnetically-Aligned Polymer<br>Macro-Nanodiscs | Biology,<br>Biochemistry,<br>Biophysics | 2    | 15   |
| Riqiang Fu (S)             | С  | NHMFL                                             | NMR                                               |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Zhehong Gan (S)            | с  | NHMFL                                             | NHMFL                                             |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Thirupathi Ravula (P)      | C  | University of Michigan                            | Chemistry                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Tim Cross (S)              | PI | NHMFL                                             | NHMFL/Chemistry &                                 | NIH               | NIAID - National Institute of                                                  | AI119178              | P17493     | Mycobacterium tuberculosis                                                        | Biology,                                | 40   | 308  |
|                            |    |                                                   | Biochemistry                                      |                   | Allergy and Infectious<br>Diseases                                             | /                     |            | Divisome: Insights on protein<br>structure and protein-protein                    | Biochemistry,<br>Biophysics             | 10   | 500  |
| Cristian Escobar (P)       | С  | NHMFL                                             | ІМВ                                               | NIH               | NIAID - National Institute of<br>Allergy and Infectious<br>Diseases            | AI101119              |            | interaction of important drug targets                                             |                                         |      |      |
| Joana Paulino (P)          | С  | NHMFL                                             | CIMAR                                             | NIH               | NIAID - National Institute of<br>Allergy and Infectious<br>Diseases            | AI131512              |            |                                                                                   |                                         |      |      |
| Huajun Qin (T)             | С  | Florida State University                          | Chemistry & Biochemistry                          |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| riseul Shin (G)            | С  | Florida State University                          | Chemistry                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| loshua Taylor (U)          | С  | Florida State University                          | Chemistry & Biochemistry                          |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Rongfu Zhang (P)           | С  | NHMFL                                             | NHMFL                                             |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Aaron Rossini (S)          | PI | Iowa State University                             | Chemistry                                         | NSF               | CHE - Chemistry                                                                | CHE17099              | P17500     | Enhancing the Resolution of 1H                                                    | Chemistry                               | 3    | 19   |
| Kuizhi Chen (P)            | С  | NHMFL                                             | NMR                                               | NSF               | CBET - Chemical,<br>Bioengineering,<br>Environmental, and<br>Transport Systems | 72<br>CBET1916<br>809 |            | Solid-State NMR Spectra With Fast<br>MAS and High Magnetic Fields                 |                                         |      |      |
| Rick Dorn (G)              | С  | Iowa State University                             | Chemistry                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Zhehong Gan (S)            | С  | NHMFL                                             | NHMFL                                             |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Ivan Hung (S)              | С  | NHMFL                                             | CIMAR/NMR                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Amrit Venkatesh (G)        | С  | Iowa State University                             | Chemistry                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Yining Huang (S)           | PI | University of Western Ontario                     | Chemistry                                         | NSERC of Canada   | Other Non US Federal<br>Agency                                                 |                       | P17504     | O-17 solid-state NMR of metal-<br>organic frameworks                              | Chemistry                               | 4    | 24   |
| Zhehong Gan (S)            | С  | NHMFL                                             | NHMFL                                             | NSERC             | Other Non US Federal<br>Agency                                                 |                       |            |                                                                                   |                                         |      |      |
| Ivan Hung (S)              | С  | NHMFL                                             | CIMAR/NMR                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      | 1    |
| Vinicius Martins (G)       | С  | University of Western Ontario                     | Chemistry                                         |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
| Hadi Mohammadigoushki (S)  | PI | Florida State University                          | Chemical and Biomedical<br>Engineering            | NSF               | CAREER - Faculty Early<br>Career Development                                   | ХХХ                   | P17560     | Dynamics and structural<br>characterization of living polymers                    | Engineering                             | 3    | 4    |
| Samuel Grant (S)           | C  | NHMFL                                             | Chemical & Biomedical<br>Engineering              | NSF               | Program<br>CAREER - Faculty Early<br>Career Development                        | CBET<br>1942150       |            | via NMR spectroscopy                                                              |                                         |      |      |
| Samuel Holder (G)          | С  | Florida State University                          | Chemical & Biomedical<br>Engineering              |                   | Program                                                                        |                       |            |                                                                                   |                                         |      |      |
| sungsool Wi (S)            | С  | NHMFL                                             | NMR                                               |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |
|                            |    |                                                   |                                                   |                   |                                                                                |                       |            |                                                                                   |                                         |      |      |

|                                         |    | Participants                                           |                                               |                  | Funding Sources                                                       |                | Dropers I // | Droporal Title                                                                    | Dissipling                              | Exp. | Days |
|-----------------------------------------|----|--------------------------------------------------------|-----------------------------------------------|------------------|-----------------------------------------------------------------------|----------------|--------------|-----------------------------------------------------------------------------------|-----------------------------------------|------|------|
|                                         |    | (Name, Role, Org., Dept.)                              |                                               | (Funding         | Agency, Division, Award                                               | #)             | Proposal #   | Proposal Title                                                                    | Discipline                              | #    | Used |
| Zhehong Gan (S)                         | PI | NHMFL                                                  | NHMFL                                         | No other support | <u> </u>                                                              |                | P17597       | Development of 1.5 GHz NMR using                                                  | Magnets,                                | 1    | 5    |
| William Brey (S)                        | С  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              | 36T Series-Connected-Hybrid (SCH)                                                 | Materials                               |      |      |
| Kuizhi Chen (P)                         | с  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              | Magnet                                                                            |                                         |      |      |
| Po-Hsiu Chien (G)                       | c  | Florida State University                               | Chemistry and Biochemistry                    |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Tim Cross (S)                           | C  | NHMFL                                                  | NHMFL/Chemistry &<br>Biochemistry             |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Ivan Hung (S)                           | С  | NHMFL                                                  | CIMAR/NMR                                     |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Ilya Litvak (S)                         | c  | NHMFL                                                  | CIMAR/NMR                                     |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Joana Paulino (P)                       | c  | NHMFL                                                  | CIMAR                                         |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Jeffrey Schiano (S)                     | c  | Pennsylvania State University                          | Electrical Engineering                        |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Tim Cross (S)                           | PI | National High Magnetic Field                           | NHMFL/Chemistry &                             | NIH              | NIAID - National Institute of                                         | AI119178       | P17605       | Interactions of Tuberculosis                                                      | Biology,                                | 7    | 110  |
|                                         |    | Laboratory                                             | Biochemistry                                  |                  | Allergy and Infectious<br>Diseases                                    |                |              | Divisome Membrane Domains ChiZ,<br>CrgA and FtsQ                                  | Biochemistry,<br>Biophysics             |      |      |
| Samuel Grant (S)                        | PI | NHMFL                                                  | Chemical & Biomedical<br>Engineering          | NIH              | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke | NS102395       | P17628       | In vivo tracking of cell therapy to<br>treat stroke: Cell migration & 23Na<br>MRI | Biology,<br>Biochemistry,<br>Biophysics | 59   | 115  |
| Frederick Bagdasarian (G)               | С  | Florida State University                               | College of Engineering                        |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Cesario Borlongan (S)                   | С  | University of South Florida                            | College of Medicine,<br>Neurosurgery          |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Bruce Bunnell (S)                       | С  | Tulane University                                      | Pharmacology                                  |                  |                                                                       |                |              |                                                                                   | 1                                       |      |      |
| Shannon Helsper (G)                     | С  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              |                                                                                   | 1                                       |      |      |
| Teng Ma (S)                             | С  | Florida State University                               | Chemistry & Biomedical<br>Engineering         |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Jens Rosenberg (S)                      | С  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Xuegang Yuan (G)                        | С  | Florida State University                               | Chemical & Biomedical                         |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Kwang Hun Lim (S)                       | PI | East Carolina University                               | Chemistry                                     | NIH              | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke | NS097490       | P17630       | Molecular Basis of Distinct Tau<br>Strains and their Prion-like<br>Propagation    | Biology,<br>Biochemistry,<br>Biophysics | 11   | 96   |
| Anvesh Kumar Reddy Dasari<br>(G)        | С  | East Carolina University                               | Chemistry                                     | NIH              | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke | NS109749       |              |                                                                                   | .,                                      |      |      |
| Sungsool Wi (S)                         | С  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Bo Chen (S)                             | PI | University of Central Florida                          | Department of Physics                         | NSF              | MCB - Molecular and<br>Cellular Biosciences                           | MCB1856<br>055 | P17687       | Molecular basis of tunable<br>iridescence of cephalopods                          | Biology,<br>Biochemistry,               | 2    | 11   |
| Zhehong Gan (S)                         | С  | NHMFL                                                  | NHMFL                                         |                  |                                                                       |                |              |                                                                                   | Biophysics                              |      |      |
| Ivan Hung (S)                           | С  | NHMFL                                                  | CIMAR/NMR                                     |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Lucio Frydman (S)                       | PI | NHMFL                                                  | NMR                                           | NSF              | CHE - Chemistry                                                       | CHE18086<br>60 | P17754       | Three-Spins Solution State DNP                                                    | Biology,<br>Biochemistry,               | 1    | 9    |
| Adewale Akinfaderin (G)                 | С  | Florida State University                               | Physics                                       |                  |                                                                       | 00             |              |                                                                                   | Biophysics                              |      |      |
| Thierry Dubroca (S)                     | C  | NHMFL                                                  | EMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Stephen Hill (S)                        | C  | NHMFL                                                  | EMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Krishnendu Kundu (P)                    | c  | NHMFL                                                  | EMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Murari Soundararajan (P)                | C  | NHMFL                                                  | CIMAR, NMR                                    |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Johan van Tol (S)                       | C  | NHMFL                                                  | EMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Sungsool Wi (S)                         | c  | NHMFL                                                  | NMR                                           |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
| Sabyasachi Sen (S)                      | PI | University of California, Davis                        | Chemical Engineering and<br>Materials Science | NSF              | DMR - Division of Materials<br>Research                               | DMR1855<br>176 | P17811       | Investigation of the atomistic basis<br>of structural relaxation and viscous      | Condensed<br>Matter                     | 11   | 134  |
| Zhehong Gan (S)                         | С  | NHMFL                                                  | NHMFL                                         |                  | Acocuren                                                              | 1/0            |              | flow in supercooled chalcogenide                                                  | Physics                                 |      |      |
| Ivan Hung (S)                           | c  | National High Magnetic Field<br>Laboratory             | CIMAR/NMR                                     |                  |                                                                       |                |              | liquids by high field dynamical NMR<br>spectroscopy                               | ,                                       |      |      |
| Yiqing Xia (G)                          | С  | University of California, Davis                        | Materials Science                             |                  |                                                                       |                |              |                                                                                   | 1                                       |      |      |
| Bing Yuan (G)                           | c  | University of California, Davis                        | Engineering                                   |                  |                                                                       |                |              |                                                                                   | 1                                       |      |      |
| Weidi Zhu (G)                           | c  | University of California, Davis                        | Materials Science & Engineering               |                  |                                                                       |                |              |                                                                                   | 1                                       |      |      |
| Smita Mohanty (S)                       | PI | Oklahoma State University                              | Chemistry                                     | No other support |                                                                       |                | P17830       | Asparagine-linked N-glycosylation:                                                | Biology,                                | 4    | 58   |
| Omar Al-Danoon (G)                      | C  | Oklahoma State University                              | Chemistry                                     | no other support |                                                                       |                | 1 1/030      | structure & function studies                                                      | Biochemistry,                           | -    | 50   |
|                                         | С  |                                                        | Department of Chemistry                       |                  |                                                                       |                |              |                                                                                   | Biophysics                              |      |      |
| Bharat Chaudhary (G)<br>Salik Dahal (G) | С  | Oklahoma State University<br>Oklahoma State University |                                               |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
|                                         | L  | Orianoma state University                              | Chemistry                                     |                  |                                                                       |                |              |                                                                                   |                                         |      |      |
|                                         |    |                                                        |                                               |                  |                                                                       |                |              |                                                                                   |                                         |      |      |

|                          | Participants |                                                                 |                                                      |                       | Funding Sources      |                | Proposal #    | Proposal Title                                                      | Discipline        | Exp. | Days |
|--------------------------|--------------|-----------------------------------------------------------------|------------------------------------------------------|-----------------------|----------------------|----------------|---------------|---------------------------------------------------------------------|-------------------|------|------|
|                          |              | (Name, Role, Org., Dept.)                                       | (Funding                                             | Agency, Division, Awa | rd #)                | Proposal #     | Proposal Inte | Discipline                                                          | #                 | Used |      |
| esh Dalal (S)            | PI           | National High Magnetic Field                                    | Chemistry                                            | NSF                   | CHE - Chemistry      | CHE16083       | P17847        | Probing Site Symmetry of Al                                         | Condensed         | 1    | 8    |
| een Bindra (G)           | С            | Laboratory<br>National Institute of Standards and<br>Technology | PML                                                  |                       |                      | 64             |               | dopants in Doped ZnSe Quanutm<br>Dots Using MAS NMR                 | Matter<br>Physics |      |      |
| ath Kumar R. Krishna (G) | С            | Florida State University                                        | Condensed Matter Physics                             |                       |                      |                |               |                                                                     |                   |      |      |
| offrey Strouse (S)       | С            | National High Magnetic Field                                    | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| rk Davis (S)             | PI           | Laboratory<br>California Institute of Technology                | Chemical Engineering                                 | Chevron Corporation   |                      | 15038035/      | P17852        | Zn-67 NMR Investigation of strong                                   | Chemistry         | 1    | 4    |
| K Davis (5)              | r i          | canonia institute of recimology                                 | chemical Engineering                                 | chevion corporation   |                      | 15051812       | F17652        | Lewis Acid Sites in Zincosilicates                                  | chemistry         | 1    | 4    |
| jong Hwang (S)           | С            | California Institute of Technology                              | Chemistry and Chemical<br>Engineering                |                       |                      |                |               |                                                                     |                   |      |      |
| gsool Wi (S)             | С            | National High Magnetic Field<br>Laboratory                      | NMR                                                  |                       |                      |                |               |                                                                     |                   |      |      |
| hong Gan (S)             | PI           | National High Magnetic Field<br>Laboratory                      | NHMFL                                                | No other support      |                      |                | P17856        | Development of solid-state NMR<br>methods for applications at high- | Chemistry         | 13   | 73   |
| id Bryce (S)             | С            | University of Ottawa                                            | Department of Chemistry and<br>Biomolecular Sciences |                       |                      |                |               | field and the 36 T SCH magnet                                       |                   |      |      |
| hi Chen (P)              | С            | NHMFL                                                           | NMR                                                  |                       |                      |                |               |                                                                     |                   |      |      |
| Hsiu Chien (G)           | С            | Florida State University                                        | Chemistry and Biochemistry                           |                       |                      |                |               |                                                                     |                   |      |      |
| Cross (S)                | С            | NHMFL                                                           | NHMFL/Chemistry &<br>Biochemistry                    |                       |                      |                |               |                                                                     |                   |      |      |
| r Gor'kov (S)            | С            | NHMFL                                                           | CIMAR                                                |                       |                      |                |               |                                                                     |                   |      |      |
| ert Griffin (S)          | С            | Massachusetts Institute of<br>Technology                        | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| n Hung (S)               | С            | National High Magnetic Field<br>Laboratory                      | CIMAR/NMR                                            |                       |                      |                |               |                                                                     |                   |      |      |
| yasachi Sen (S)          | С            | University of California, Davis                                 | Chemical Engineering and<br>Materials Science        |                       |                      |                |               |                                                                     |                   |      |      |
| rit Venkatesh (G)        | С            | Iowa State University                                           | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| g Wu (S)                 | С            | Queen's University at Kingston                                  | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| ery White (S)            | PI           | Oklahoma State University                                       | Chemical Engineering                                 | NSF                   | CHE - Chemistry      | CHE17641<br>16 | P17925        | Elucidating H+/Al Siting and<br>Chemical Structures in Zeolites by  | Chemistry         | 12   | 76   |
| yam Abdolrahmani (G)     | С            | Oklahoma State University                                       | Chemistry                                            |                       |                      |                |               | Ultra-High Field NMR                                                |                   |      |      |
| thi Chen (P)             | С            | National High Magnetic Field<br>Laboratory                      | NMR                                                  |                       |                      |                |               |                                                                     |                   |      |      |
| hong Gan (S)             | С            | National High Magnetic Field<br>Laboratory                      | NHMFL                                                |                       |                      |                |               |                                                                     |                   |      |      |
| ah Horstmeier (G)        | С            | Oklahoma State University                                       | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| n Hung (S)               | С            | National High Magnetic Field<br>Laboratory                      | CIMAR/NMR                                            |                       |                      |                |               |                                                                     |                   |      |      |
| g Wu (S)                 | PI           | Queen's University at Kingston                                  | Chemistry                                            | NSERC of Canada       | Non US Council       |                | P17926        | Probing the hydrogen nuclear                                        | Chemistry         | 3    | 12   |
| hong Gan (S)             | С            | National High Magnetic Field                                    | NHMFL                                                | NSERC of Canada       | Other Non US Federal |                |               | wavefunction in OHO low-barrier                                     |                   |      |      |
| n Hung (S)               | С            | Laboratory<br>National High Magnetic Field                      | CIMAR/NMR                                            |                       | Agency               |                |               | hydrogen bonds by 1H-17O double<br>resonance NMR                    |                   |      |      |
| an Murray (S)            | PI           | Laboratory<br>University of California Davis                    | Chemistry                                            | No other support      |                      |                | P17941        | Molecular Determinants for the                                      | Biology,          | 6    | 44   |
| 1 Hung (S)               | С            | National High Magnetic Field                                    | CIMAR/NMR                                            |                       |                      |                |               | Assembly of Low Complexity                                          | Biochemistry,     | Ĩ    |      |
|                          | 2            | Laboratory                                                      |                                                      |                       |                      |                |               | Protein Domains                                                     | Biophysics        |      |      |
| ven McKnight (S)         | С            | University of Texas, Southwestern                               | Medical Center                                       |                       |                      |                |               |                                                                     |                   |      |      |
| ary Sutton (G)           | С            | University of California, Davis                                 | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
| ily Sysoev (P)           | С            | University of Texas, Southwestern                               | Biochemistry                                         |                       |                      |                |               |                                                                     |                   |      |      |
| ki Wittmer (G)           | С            | University of California, Davis                                 | Chemistry                                            |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |
|                          |              |                                                                 |                                                      |                       |                      |                |               |                                                                     |                   |      |      |

|                         |    | Participants                               |                                           |                  | Funding Sources                                                       |                                   | Dreneral   | Dreneral Title                                                                                        | Dissipling                              | Exp. | Days |
|-------------------------|----|--------------------------------------------|-------------------------------------------|------------------|-----------------------------------------------------------------------|-----------------------------------|------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|
|                         |    | (Name, Role, Org., Dept.)                  |                                           | (Funding         | g Agency, Division, Award                                             | 1 #)                              | Proposal # | Proposal Title                                                                                        | Discipline                              | #    | Used |
| Robert Schurko (S)      | PI | Florida State University                   | Chemistry                                 | NSF              | CHE - Chemistry                                                       | CHE20038<br>54                    | P17946     | Multinuclear Solid-State NMR of<br>Quadrupolar Nuclei in Active                                       | Biology,<br>Biochemistry,               | 37   | 217  |
| Christer Aakeroy (S)    | С  | Kansas State University                    | Chemistry and Biochemistry                | State of Florida | Other                                                                 | 54                                |            | Pharmaceutical Ingredients                                                                            | Biophysics                              |      |      |
| Adam Altenhof (G)       | С  | Florida State University                   | Chemistry and Biochemistry                | State of Florida | Other                                                                 | n/a                               |            |                                                                                                       |                                         |      |      |
| Zach Dowdell (G)        | C  | Florida State University                   | Chemistry                                 | NSERC            | Other Non US Federal                                                  | NSERC                             |            |                                                                                                       |                                         |      |      |
|                         |    |                                            | · ,                                       |                  | Agency                                                                | RGPIN-<br>2016_066                |            |                                                                                                       |                                         |      |      |
| Zachary Dowdell (G)     | С  | Florida State University                   | Chemistry                                 | nserc            | Non US Council                                                        | 42<br>NSERC<br>RGPIN-<br>2016_066 |            |                                                                                                       |                                         |      |      |
| Ulrich Fekl (S)         | с  | University of Toronto (Mississauga)        | Chemistry and Biochemistry                | nserc            | Non US Council                                                        | 42<br>NSERC<br>RGPIN-<br>2016_006 |            |                                                                                                       |                                         |      |      |
| Tomislav Friscic (S)    | С  | McGill University                          | Chemistry                                 | NSERC            | Non US Council                                                        | 642                               |            |                                                                                                       |                                         |      |      |
| Lucio Frydman (S)       | c  | National High Magnetic Field               | NMR                                       | NSERC            | Non US Council                                                        | n/a                               |            |                                                                                                       |                                         |      |      |
| Euclo Hyuman (5)        | C  | Laboratory                                 |                                           | NJENC            | Non 05 council                                                        | ii/u                              |            |                                                                                                       |                                         |      |      |
| Zhehong Gan (S)         | с  | National High Magnetic Field<br>Laboratory | NHMFL                                     | nserc            | Non US Council                                                        | NSERC<br>RGPN-<br>2016_066<br>42  |            |                                                                                                       |                                         |      |      |
| James Harper (S)        | С  | Brigham Young University (BYU)             | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Sean Holmes (P)         | С  | Florida State University                   | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| James Hook (S)          | С  | University of New South Wales              | Chemistry                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Ivan Hung (S)           | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Igor Huskic (P)         | С  | McGill University                          | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Robbie Iuliucci (S)     | С  | Washington and Jefferson College           | Chemistry                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Michael Jaroszewicz (G) | С  | University of Windsor                      | Chemistry                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Karthik Nagapudi (S)    | С  | Genentech Inc.                             | Small Molecule Pharmaceutical<br>Sciences |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Austin Peach (G)        | С  | Florida State University                   | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Ernest Prack (G)        | С  | University of Toronto (Mississauga)        | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Joseph Schlenoff (S)    | С  | Florida State University                   | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Jennifer Swift (S)      | С  | Georgetown University                      | Chemistry                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Cameron Vojvodin (G)    | С  | Florida State University                   | Chemistry and Biochemistry                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Taylor Watts (G)        | С  | Georgetown University                      | Chemistry                                 |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Bradley Nilsson (S)     | PI | University of Rochester                    | Chemistry                                 | NSF              | CHE - Chemistry                                                       | CHE19045<br>28                    | P17957     | Structural interrogation of the<br>packing architecture in hydrogel<br>biomaterials: Towards rational | Biology,<br>Biochemistry,<br>Biophysics | 3    | 11   |
| Elena Quigley (G)       | С  | University of Rochester                    | Chemistry                                 |                  |                                                                       |                                   |            | design                                                                                                |                                         |      |      |
| Kendra Frederick (S)    | PI | University of Texas, Southwestern          | Biophysics                                | NIH              | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke | NS111236                          | P17968     | Protein conformation determined<br>in native cellular environments                                    | Biology,<br>Biochemistry,<br>Biophysics | 1    | 5    |
| Whitney Costello (G)    | С  | University of Texas, Southwestern          | Biophysics                                | NSF              | CAREER - Faculty Early<br>Career Development<br>Program               | 1751174                           |            |                                                                                                       |                                         |      |      |
| Jaka Kragelj (P)        | С  | University of Texas, Southwestern          | Biophysics                                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Frederic Mentink (S)    | С  | National High Magnetic Field<br>Laboratory | NMR Division                              |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Yiling Xiao (P)         | С  | University of Texas, Southwestern          | Biophysics                                |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Diana Bernin (S)        | PI | Chalmers University of Technology          | Chemistry and Chemical<br>Engineering     | No other support |                                                                       |                                   | P17969     | Resource-efficient wood chips<br>conversion to produce biobased                                       | Engineering                             | 1    | 5.5  |
| Ivan Hung (S)           | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                                 |                  |                                                                       |                                   |            | chemicals                                                                                             |                                         |      |      |
| Frederic Mentink (S)    | C  | National High Magnetic Field<br>Laboratory | NMR Division                              |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |
| Daniel Topgaard (S)     | С  | University of Lund                         | Department of Chemistry                   |                  |                                                                       |                                   |            |                                                                                                       |                                         |      |      |

|            | NMR       |              |  |  |  |  |  |  |
|------------|-----------|--------------|--|--|--|--|--|--|
| Discipline | Exp.<br># | Days<br>Used |  |  |  |  |  |  |
| Chemistry  | 1         | 10           |  |  |  |  |  |  |
| Biology,   | 9         | 78           |  |  |  |  |  |  |

|                                  |    | Participants<br>(Name, Role, Org., Dept.)  |                                             |                                                                      | Funding Sources<br>Agency, Division, Award | <b>#</b> )          | Proposal # | Proposal Title                                                                                                                  | Discipline                              | Exp.<br># | Days<br>Used |
|----------------------------------|----|--------------------------------------------|---------------------------------------------|----------------------------------------------------------------------|--------------------------------------------|---------------------|------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|--------------|
| Sungsool Wi (S)                  | PI | National High Magnetic Field               | NMR                                         | NSF                                                                  | CHE - Chemistry                            | #)<br>CHE18086      | P18056     | Solution State Overhauser DNP at                                                                                                | Chemistry                               | #<br>1    | 10           |
|                                  |    | Laboratory                                 |                                             |                                                                      |                                            | 60                  |            | 14 T                                                                                                                            |                                         |           |              |
| Shuhui Cai (S)                   | PI | Xiamen University                          | Department of Electronic Science            | National Natural<br>Science Foundation of<br>China                   | Other                                      |                     | P18057     | Development of high-resolution<br>two-dimensional (2D) J-resolved<br>NMR spectroscopy at high fields                            | Biology,<br>Biochemistry,<br>Biophysics | 9         | 78           |
| Zhong Chen (S)                   | С  | Xiamen University                          | Electronic Science                          | Xiamen University                                                    | Non US College and<br>University           |                     |            |                                                                                                                                 |                                         |           |              |
| Riqiang Fu (S)                   | С  | National High Magnetic Field<br>Laboratory | NMR                                         | Chinese Scholarship<br>council                                       | Non US Foundation                          |                     |            |                                                                                                                                 |                                         |           |              |
| Yuqing Huang (S)                 | С  | Xiamen University                          | Electronic Science                          | National Science<br>Foundation of China                              | Other                                      |                     |            |                                                                                                                                 |                                         |           |              |
| Chunhua Tan (G)                  | С  | Xiamen University                          | Department of Electronic Science            |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Guiming Zhong (S)                | PI | Chinese Academy of Sciences                | Xiamen Institute of Rare Earth<br>Materials | Xiamen University                                                    | Non US College and<br>University           |                     | P18086     | Probing storage mechanisms of<br>anode materials for potassium ion                                                              | Chemistry                               | 4         | 10           |
| Huixin Chen (T)                  | С  | Chinese Academy of Sciences                | Xiamen Institute of Rare Earth<br>Materials | Chinese Academy of<br>Sciences                                       | Non US Foundation                          |                     |            | batteries by employing high-<br>magnetic field MAS NMR                                                                          |                                         |           |              |
| Riqiang Fu (S)                   | С  | National High Magnetic Field<br>Laboratory | NMR                                         | National Natural<br>Science Foundation of<br>China                   | Non US Foundation                          |                     |            | spectroscopy                                                                                                                    |                                         |           |              |
| Joanna Long (S)                  | PI | University of Florida                      | Biochemistry & Molecular Biology            | NIH                                                                  | NIGMS - National Institute                 | GM12269             | P18089     | MAS-DNP Probe development                                                                                                       | Chemistry                               | 1         | 10           |
|                                  |    |                                            |                                             |                                                                      | of General Medical<br>Sciences             | 8                   |            |                                                                                                                                 | ,                                       |           |              |
| Thierry Dubroca (S)              | С  | National High Magnetic Field<br>Laboratory | EMR                                         |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Petr Gor'kov (S)                 | С  | National High Magnetic Field<br>Laboratory | CIMAR                                       |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Frederic Mentink (S)             | С  | National High Magnetic Field<br>Laboratory | NMR Division                                |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Naresh Dalal (S)                 | PI | National High Magnetic Field<br>Laboratory | Chemistry                                   | NSF                                                                  | CHE - Chemistry                            | CHE14649<br>55      | P18094     | Study of molecular dynamics on<br>metal organic framework                                                                       | Chemistry                               | 6         | 52           |
| Riqiang Fu (S)                   | С  | National High Magnetic Field<br>Laboratory | NMR                                         |                                                                      |                                            |                     |            | [(CH3)2NH2]Mg(HCOO)3] using<br>solid state NMR spectroscopy                                                                     |                                         |           |              |
| Sanath Kumar Rama Krishna<br>(G) | С  | Florida State University                   | Condensed Matter Physics                    |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Neeraj Sinha (S)                 | PI | Centre of Bio-Medical Research<br>(CBMR)   | Bio-medical department                      | Science and<br>Engineering Research<br>Board, Government of<br>India | Non US Foundation                          | EMR/2015<br>/001758 | P18099     | Structural and interaction study of<br>collagen protein in native bone and<br>cartilage through dynamic nuclear<br>polarization | Biology,<br>Biochemistry,<br>Biophysics | 1         | 2            |
| Sungsool Wi (S)                  | С  | National High Magnetic Field<br>Laboratory | NMR                                         | india                                                                |                                            |                     |            | polarization                                                                                                                    |                                         |           |              |
| Robert Silvers (S)               | PI | Florida State University                   | Chemistry and Biochemistry                  | Florida State University                                             | US College and University                  | STARTUP             | P19107     | Development of ssNMR methods                                                                                                    | Biology,                                | 2         | 3            |
| Yimin Miao (P)                   | С  | Florida State University                   | Chemistry & Biochemistry                    |                                                                      |                                            |                     |            | for structural elucidation of RNAs<br>and RNPs                                                                                  | Biochemistry,<br>Biophysics             |           |              |
| Ansgar Siemer (S)                | PI | University of Southern California          | Physiology and Neuroscience                 | NIH                                                                  | NIA - National Institute on<br>Aging       | AG061865            | P19109     | High MAS frequency fingerprint<br>spectra of Amyloid-ß fibrils or<br>mammalian origin                                           | Biology,<br>Biochemistry,<br>Biophysics | 1         | 2            |
| Yan-Yan Hu (S)                   | PI | Florida State University                   | Chemistry & Biochemistry                    | Solid Power                                                          |                                            |                     | P19111     | Structure-property correlation in Cl-                                                                                           | Chemistry                               | 4         | 46           |
| Xuyong Feng (P)                  | С  | Florida State University                   | Chemistry and Biochemistry                  | No other support                                                     |                                            |                     |            | doped tetragonal Na3PS4 (t-<br>Na3PS4)                                                                                          |                                         |           |              |
| Zhehong Gan (S)                  | C  | National High Magnetic Field<br>Laboratory | NHMFL                                       |                                                                      |                                            |                     |            | Nd3F34)                                                                                                                         |                                         |           |              |
| Ivan Hung (S)                    | С  | National High Magnetic Field<br>Laboratory | CIMAR/NMR                                   |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Pengbo Wang (G)                  | С  | Florida State University                   | Chemistry                                   |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |
| Xiangwu Zhang (G)                | PI | North Carolina State University            | Wilson College of Textiles                  | NSF                                                                  | DMR - Division of Materials<br>Research    | DMR1720<br>139      | P19119     | Interconnected Double Layers with<br>Ultrafast and Continuous Li+                                                               | Engineering                             | 3         | 16           |
| Yan-Yan Hu (S)                   | С  | Florida State University                   | Chemistry & Biochemistry                    |                                                                      |                                            |                     |            | Conduction from Cathode to Anode                                                                                                |                                         |           |              |
| Jin Zheng (G)                    | С  | Florida State University                   | Chemistry & Biochemistry                    |                                                                      |                                            |                     |            | for solid-state Li-S batteries                                                                                                  |                                         |           |              |
|                                  |    |                                            |                                             |                                                                      |                                            |                     |            |                                                                                                                                 |                                         |           |              |

| Participants             |    | Funding Sources                                                 |                                                     |                                                             | Proposal #                                                                          | al # Proposal Title | Discipline    | Exp.                                                                                                       | Days                        |      |     |
|--------------------------|----|-----------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------|---------------|------------------------------------------------------------------------------------------------------------|-----------------------------|------|-----|
|                          |    | (Name, Role, Org., Dept.)                                       | (Funding A                                          | Agency, Division, Award                                     | #)                                                                                  | Proposal #          | Proposal Inte | Discipline                                                                                                 | #                           | Used |     |
| Michael Harrington (S)   | PI | Huntington Medical Research<br>Institutes                       | Molecular Neurology                                 | NIH                                                         | NINDS - National Institute<br>of Neurological Disorders                             | NS201072            | P19167        | Evaluating Brain Dysfunction in<br>Migraine                                                                | Biology,<br>Biochemistry,   | 17   | 79  |
| Nastaren Abad (G)        | С  | Florida State University                                        | Chemical-Biomedical Engineering                     | NIH                                                         | and Stroke<br>NINDS - National Institute<br>of Neurological Disorders<br>and Stroke | NS010724            |               |                                                                                                            | Biophysics                  |      |     |
| Hannah Alderson (U)      | с  | Florida State University                                        | Chemical & Biomedical<br>Engineering                | NIH                                                         | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke               | NS072497            |               |                                                                                                            |                             |      |     |
| Samuel Grant (S)         | С  | National High Magnetic Field<br>Laboratory                      | Chemical & Biomedical<br>Engineering                |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Samuel Holder (G)        | С  | Florida State University                                        | Chemical & Biomedical<br>Engineering                |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Linda Petzold (S)        | C  | University of California, Santa<br>Barbara                      | Computer Science                                    |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Yan-Yan Hu (S)           | PI | Florida State University                                        | Chemistry & Biochemistry                            | NSF                                                         | DMR - Division of Materials<br>Research                                             | DMR1808<br>517      | P19169        | In-situ and Operando MRI studies<br>of All-solid-state Batteries                                           | Chemistry                   | 1    | 2   |
| Po-Hsiu Chien (G)        | С  | Florida State University                                        | Chemistry and Biochemistry                          |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Haoyu Liu (G)            | С  | Florida State University                                        | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      | 1   |
| Frederic Mentink (S)     | С  | National High Magnetic Field<br>Laboratory                      | NMR Division                                        |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Adam Veige (S)           | PI | * University of Florida                                         | Chemistry                                           | NSF                                                         | CHE - Chemistry                                                                     | CHE18082<br>34      | P19170        | Quantification of End Groups in<br>Cyclic vs. Linear Polyacetylenes by                                     | Biology,<br>Biochemistry,   | 1    | 7   |
| Clifford Bowers (S)      | С  | University of Florida                                           | Chemistry                                           |                                                             |                                                                                     |                     |               | Carbon-13 Magic Angle Spinning                                                                             | Biophysics                  |      |     |
| Alec Esper (G)           | С  | University of Florida                                           | Chemistry                                           |                                                             |                                                                                     |                     |               | Nuclear Magnetic Resonance                                                                                 |                             |      |     |
| Zhihui Miao (G)          | С  | University of Florida                                           | Department of Chemistry                             |                                                             |                                                                                     |                     |               | Spectroscopy                                                                                               |                             |      |     |
| Brent Sumerlin (S)       | С  | University of Florida                                           | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Sossina Haile (S)        | PI | Northwestern University                                         | Materials Science and<br>Engineering, and Chemistry | NSF                                                         | DMR - Division of Materials<br>Research                                             | DMR1720<br>139      | P19180        | Multinuclear Solid-state NMR<br>Investigations of Oxyhalides,                                              | Biology,<br>Biochemistry,   | 23   | 224 |
| Yan-Yan Hu (S)           | С  | Florida State University                                        | Chemistry & Biochemistry                            | NSF                                                         | DMR - Division of Materials<br>Research                                             | DMR1508<br>404      |               | Oxynitrides and Chalcohalides                                                                              | Biophysics                  |      |     |
| Mercouri Kanatzidis (S)  | С  | Northwestern University                                         | Chemistry                                           |                                                             | Research                                                                            | 404                 |               |                                                                                                            |                             |      |     |
| Haoyu Liu (G)            | C  | Florida State University                                        | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Tobin Marks (S)          | c  | Northwestern University                                         | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Sawankumar Patel (G)     | C  | Florida State University                                        | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Kenneth Poeppelmeier (S) | c  | Northwestern University                                         | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Joseph Noel (S)          | PI | * Salk Institute for Biological Studies                         | Chemical Biology and Proteomics                     | Harnessing Plants                                           | Other                                                                               |                     | P19225        | Structural, Quantitative and                                                                               | Biology,                    | 2    | 8   |
| ,                        |    | , , , , , , , , , , , , , , , , , , ,                           |                                                     | Initiative, The Salk<br>Institute for Biological<br>Studies |                                                                                     |                     |               | Genetic Characterization of Plant<br>Biopolymers by Solid-state NMR                                        | Biochemistry,<br>Biophysics |      |     |
| Thach Can (P)            | С  | Salk Institute for Biological Studies                           | Chemical Biology and Proteomics                     | Studies                                                     |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Riqiang Fu (S)           | C  | National High Magnetic Field<br>Laboratory                      | NMR                                                 |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Suzanne Thomas (P)       | С  | Salk Institute for Biological Studies                           | Chemical Biology and Proteomics                     |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Xueqian Kong (S)         | PI | Zhejiang University                                             | Chemistry                                           | Zhejiang university                                         | Non US College and<br>University                                                    |                     | P19234        | Solid state NMR Investigation of<br>highly conductive solid electrolytes                                   | Biology,<br>Biochemistry,   | 3    | 10  |
| Waseem Afzaal (G)        | С  | Florida State University                                        | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            | Biophysics                  |      |     |
| Lina Gao (G)             | С  | Florida State University                                        | Chemistry & Biochemistry                            |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Yan-Yan Hu (S)           | С  | Florida State University                                        | Chemistry & Biochemistry                            |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      |     |
| Xueqian Kong (S)         | PI | Zhejiang University                                             | Chemistry                                           | Zhejiang University                                         | Non US College and<br>University                                                    |                     | P19235        | Ultrahigh Field NMR Study of the<br>Formation and Decomposition                                            | Magnets,<br>Materials       | 5    | 21  |
| Zhehong Gan (S)          | С  | National High Magnetic Field<br>Laboratory                      | NHMFL                                               |                                                             | -                                                                                   |                     |               | Mechanisms of MOFs                                                                                         |                             |      |     |
| Hanxi Guan (G)           | С  | Zhejiang University                                             | Chemistry                                           |                                                             |                                                                                     |                     |               |                                                                                                            |                             |      | 1   |
| Frederic Mentink (S)     | PI | National High Magnetic Field<br>Laboratory                      | NMR Division                                        | NIH                                                         | NIGMS - National Institute<br>of General Medical<br>Sciences                        | GM12269<br>8        | P19241        | Improving biradicals for MAS-DNP<br>at high field: a combined approach<br>of Spin-Dynamics theory, DFT and | Chemistry                   | 2    | 10  |
| Gael De Paepe (S)        | С  | The French Alternative Energies and<br>Atomic Energy Commission | Institute for Nanoscience and<br>Cryogenics         |                                                             | Sectors                                                                             |                     |               | high-field EPR                                                                                             |                             |      |     |
|                          |    |                                                                 | 0.7050103                                           |                                                             |                                                                                     |                     | 1             |                                                                                                            | 1                           |      | 1   |

|                                            |        | Participants                                         |                                                                          |                                                                           | unding Sources                                               |                       | Dreams and th | Duenes ( This                                                                                                                        | Dissistant                              | Exp. | Days |
|--------------------------------------------|--------|------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|------|
|                                            |        | (Name, Role, Org., Dept.)                            |                                                                          |                                                                           | gency, Division, Award                                       | l #)                  | Proposal #    | Proposal Title                                                                                                                       | Discipline                              | #    | Used |
| Sami Jannin (S)                            | PI     | <ul> <li>École normale supérieure de Lyon</li> </ul> | CRMN                                                                     | Horozon 2020<br>(EUROPEAN<br>COMMISSION,<br>Research Executive<br>Agency) | Other Non US Federal<br>Agency                               | 766402                | P19284        | Study of 1H polarization transfers<br>through the spin diffusion barrier<br>indynamic nuclear polarization<br>using microwave gating | Chemistry                               | 1    | 4    |
| Quentin Chappuis (G)                       | С      | École normale supérieure de Lyon                     | High field NMR centre                                                    |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Frederic Mentink (S)                       | C      | National High Magnetic Field<br>Laboratory           | NMR Division                                                             |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Eric Gottwald (S)                          | PI     | Karlsruhe Institute of Technology                    | Institute for Biological Interfaces<br>(IBG 5)                           | University of<br>Heidelberg, Germany                                      | Non US College and<br>University                             |                       | P19285        | Cellular Responses from a Three<br>Dimensional Cell Culture in a<br>Microcavity Array-Based MR-                                      | Biology,<br>Biochemistry,<br>Biophysics | 2    | 4    |
| Lothar Schad (S)                           | С      | Heidelberg University                                | Computer Assisted Clinical<br>Medicine                                   | Heidelberg University                                                     | Non US College and<br>University                             |                       |               | Compatible Bioreactor: Application<br>of 23Na Triple-Quantum MRS/MRI                                                                 |                                         |      |      |
| Victor Schepkin (S)                        | С      | National High Magnetic Field<br>Laboratory           | CIMAR                                                                    |                                                                           |                                                              |                       |               | Methods                                                                                                                              |                                         |      |      |
| Jan Rainey (S)                             | PI     | Dalhousie University                                 | Biochemistry & Molecular Biology                                         | Natural Sciences and<br>Engineering Research<br>Council of Canada         | Non US Council                                               | RGPIN/05<br>907-2017  | P19288        | Solid-state NMR characterization of<br>spider wrapping and pyriform silks                                                            | Biology,<br>Biochemistry,<br>Biophysics | 7    | 26   |
| Tim Cross (S)                              | C      | National High Magnetic Field<br>Laboratory           | NHMFL/Chemistry &<br>Biochemistry                                        | Natural Sciences and<br>Engineering Research<br>Council of Canada         | Non US Council                                               |                       |               |                                                                                                                                      |                                         |      |      |
| Frederic Mentink (S)                       | С      | National High Magnetic Field<br>Laboratory           | NMR Division                                                             | Natural Sciences and<br>Engineering Research<br>Council of Canada         | Non US Council                                               | RGPAS/50<br>7805-2017 |               |                                                                                                                                      |                                         |      |      |
| Jeffrey Simmons (G)                        | С      | Dalhousie University                                 | Department of Biochemistry &<br>Molecular Biology                        |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Anamika Sulekha (G)                        | С      | Dalhousie University                                 | Department of Biochemistry &<br>Molecular Biology                        |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Hans Jakobsen (S)                          | PI     | Aarhus University                                    | Department of Chemistry                                                  | UCGP                                                                      |                                                              |                       | P19317        | 33S and 95Mo Solid-State NMR                                                                                                         | Chemistry                               | 3    | 28   |
| Henrik Bildsoe (S)                         | С      | Aarhus University                                    | Chemistry                                                                | Haldor Topsøe A/S                                                         |                                                              |                       |               | Studies of Single-, Few-, and Multi-<br>Layer MoS2 Materials                                                                         |                                         |      |      |
| Michael Brorson (S)                        | С      | Haldor Topsoe                                        | Catalysis                                                                | Haldor Topsoe, Lyngby,<br>Denmark                                         |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Zhehong Gan (S)                            | С      | National High Magnetic Field<br>Laboratory           | NHMFL                                                                    | Aarhus University                                                         | Non US College and<br>University                             |                       |               |                                                                                                                                      |                                         |      |      |
| Ivan Hung (S)                              | С      | NHMFL                                                | CIMAR/NMR                                                                |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Jim Zheng (S)                              | PI     | Florida Agricultural and Mechanical<br>University    | Department of Electrical<br>Engineering                                  | NSF                                                                       | Other                                                        | 520                   | P19319        | Solid State NMR Studies of sodium<br>ion batteries                                                                                   | Engineering                             | 1    | 4    |
| Zhehong Gan (S)                            | C      | NHMFL                                                | NHMFL                                                                    |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Hanxi Guan (G)                             | C      | Zhejiang University                                  | Chemistry                                                                |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Jin Liming (G)                             | С      | Florida State University                             | College of Engineering, Dep of<br>electrical and computer<br>engineering |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| William Brey (S)                           | PI     | National High Magnetic Field<br>Laboratory           | NMR                                                                      | NIH                                                                       | NIGMS - National Institute<br>of General Medical<br>Sciences | GM12269<br>8          | P19329        | Development of 13C detection<br>NMR experiment for long-range<br>correlation                                                         | Biology,<br>Biochemistry,<br>Biophysics | 1    | 1    |
| Taylor Johnston (G)<br>Matthew Merritt (S) | C<br>C | Florida State University<br>University of Florida    | Chemistry<br>Biochemistry and Molecular<br>Biology                       |                                                                           | Suches                                                       |                       |               |                                                                                                                                      | biophysics                              |      |      |
| Pingchuan Sun (S)                          | PI     | * Nankai University                                  | College of Chemistry                                                     | National Natural<br>Science Foundation of<br>China                        | Other                                                        |                       | P19331        | Probing the Transesterification<br>Reaction and Topology Freezing<br>Transition Temperature in Vitrimer                              | Chemistry                               | 2    | 30   |
| Rigiang Fu (S)                             | С      | NHMFL                                                | NMR                                                                      | Gillia                                                                    |                                                              |                       |               | by VT 17O and 13C Chemical                                                                                                           |                                         |      |      |
| Zhehong Gan (S)                            | С      | NHMFL                                                | NHMFL                                                                    |                                                                           |                                                              |                       |               | Exchange SSNMR                                                                                                                       |                                         |      |      |
| Fenfen Wang (P)                            | С      | Nankai University                                    | College of Chemistry                                                     |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Gianluigi Veglia (S)                       | PI     | University of Minnesota, Twin Cities                 | BMBB                                                                     | NIH                                                                       | NIGMS - National Institute<br>of General Medical<br>Sciences | GM50106<br>4          | P19333        | solid state nmr (Gopinath Tata)                                                                                                      | Biology,<br>Biochemistry,<br>Biophysics | 1    | 6    |
| Tim Cross (S)                              | С      | National High Magnetic Field<br>Laboratory           | NHMFL/Chemistry &<br>Biochemistry                                        |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Riqiang Fu (S)                             | С      | National High Magnetic Field<br>Laboratory           | NMR                                                                      |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
| Zhehong Gan (S)                            | С      | National High Magnetic Field<br>Laboratory           | NHMFL                                                                    |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |
|                                            |        |                                                      |                                                                          |                                                                           |                                                              |                       |               |                                                                                                                                      |                                         |      |      |

|                                         |        | Participants<br>(Name, Role, Org., Dept.)              | Participants<br>(Name, Role, Org., Dept.) |                  |                                                                                 | #)                    | Proposal # | # Proposal Title                                                                                                                                            | Discipline                              | Exp.<br># | Days |
|-----------------------------------------|--------|--------------------------------------------------------|-------------------------------------------|------------------|---------------------------------------------------------------------------------|-----------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|------|
| Robert Silvers (S)                      | PI     | Florida State University                               | Chemistry and Biochemistry                | No other support | g Agency, Division, Award                                                       | ,                     | P19340     | Structural Study of RNase P                                                                                                                                 | Biology,                                | 1         | 2    |
| Yimin Miao (P)                          | С      | Florida State University                               | Chemistry & Biochemistry                  | No other support |                                                                                 |                       | 1 15540    | Structural Study of Muse I                                                                                                                                  | Biochemistry,                           | -         | -    |
| Robert Griffin (S)                      | PI     | Massachusetts Institute of                             | Chemistry                                 | NIH              | NIA - National Insitute on                                                      | R01-                  | P19370     | Structural Studies on the Human                                                                                                                             | Biophysics<br>Biology,                  | 1         | 15   |
| Zhehong Gan (S)                         | С      | Technology<br>National High Magnetic Field             | NHMFL                                     |                  | Aging                                                                           | AG058504              |            | Voltage-Dependent Anion-Selective<br>Channel Protein 1 (VDAC1) by Solid-                                                                                    | Biochemistry,<br>Biophysics             |           |      |
|                                         |        | Laboratory                                             |                                           |                  |                                                                                 |                       |            | State NMR                                                                                                                                                   |                                         |           |      |
| Ivan Hung (S)                           | C      | National High Magnetic Field<br>Laboratory             | CIMAR/NMR                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Edward Saliba (P)                       | С      | Massachusetts Institute of<br>Technology               | Francis Bitter Magnet Laboratory          |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Robert Silvers (S)                      | С      | Florida State University                               | Chemistry and Biochemistry                |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Geoffrey Strouse (S)                    | PI     | * National High Magnetic Field                         | Chemistry                                 | NSF              | DMR - Division of Materials                                                     | DMR1905               | P19372     | Multinuclear solid-state NMR                                                                                                                                | Chemistry                               | 2         | 7    |
| Adam Altenhof (G)                       | С      | Laboratory<br>Florida State University                 | Chemistry and Biochemistry                | NSF              | Research<br>DMR - Division of Materials<br>Research                             | 757<br>DMR1644<br>779 |            | investigation of plasmonic and<br>photoluminescent nanocrystals                                                                                             |                                         |           |      |
| Nhat Nguyen Bui (P)                     | С      | National High Magnetic Field                           | CMS                                       | State of Florida | Research<br>Other                                                               | n/a                   |            |                                                                                                                                                             |                                         |           |      |
| Carl Conti (G)                          | С      | Laboratory<br>Florida State University                 | Chemistry & Biochemistry                  |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Zhehong Gan (S)                         | c      | NHMFL                                                  | NHMFL                                     |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Ivan Hung (S)                           | c      | NHMFL                                                  | CIMAR/NMR                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Jason Kuszynski (G)                     | c      | Florida State University                               | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Frederic Mentink (S)                    | c      | NHMFL                                                  | NMR Division                              |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Robert Schurko (S)                      | c      | Florida State University                               | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Likai Song (S)                          | c      | NHMFL                                                  | EMR                                       |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Cameron Vojvodin (G)                    | c      | Florida State University                               | Chemistry and Biochemistry                |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Hadi Mohammadigoushki (S)               | PI     | Florida State University                               | Chemical and Biomedical                   | Florida State    | Other                                                                           |                       | P19421     | Decking in site structure of                                                                                                                                | For size size s                         | 2         | 16   |
| Sungsool Wi (S)                         | C      | NHMFL                                                  | Engineering                               | University-CRC   | other                                                                           |                       | F13421     | Probing in situ structure of<br>monoclonal antibodies at water-air<br>and water-oil interfaces via high<br>field nuclear magnetic resonance<br>spectroscopy | Engineering                             | 2         | 10   |
|                                         |        |                                                        |                                           |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Liliya Vugmeyster (S)                   | PI     | University of Colorado, Denver                         | Chemistry                                 | NIH              | NIGMS - National Institute<br>of General Medical<br>Sciences                    | GM11168<br>1          | P19439     | Variant-specific dynamics of<br>amyloid-beta fibrils by solid-state<br>deuteron NMR.                                                                        | Biology,<br>Biochemistry,<br>Biophysics | 2         | 5    |
| Dan Au (G)                              | С      | University of Colorado, Denver                         | Bioengineering                            |                  |                                                                                 |                       |            |                                                                                                                                                             | ,                                       |           |      |
| Dmitry Ostrovsky (S)                    | С      | University of Alaska, Anchorage                        | Mathematics                               |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Elan Eisenmesser (S)                    | PI     | University of Colorado, Denver                         | Biochemistry & Molecular                  | NSF              | CHE - Chemistry                                                                 | CHE18073              | P19441     | SARS-CoV Nucleocapsid protein                                                                                                                               | Biology,                                | 6         | 138  |
| Kilsia Mercedes (G)                     | с      | University of Colorado, Denver                         | Genetics                                  | 1151             | ene enemistry                                                                   | 26                    | 115441     | dynamics and their role in host<br>protein interactions.                                                                                                    | Biochemistry,<br>Biophysics             | Ū         | 150  |
| Kiisia Wercedes (G)                     | t      | University of Colorado, Deriver                        | Biochemistry and Molecular<br>Genetics    |                  |                                                                                 |                       |            | protein interactions.                                                                                                                                       | Biophysics                              |           |      |
| Isabelle Marcotte (S)                   | PI     | <ul> <li>* University of Quebec at Montreal</li> </ul> | Chemistry                                 | NSF              | MCB - Molecular and<br>Cellular Biosciences                                     | MCB1942<br>665        | P19442     | Chlamydomonas reinhardtii cell-<br>wall and whole cell glycan                                                                                               | Biology,<br>Biochemistry,               | 7         | 47   |
| Alexandre Arnold (S)                    | С      | University of Quebec at Montreal                       | Chemistry                                 | NIH              | NIAID - National Institute of<br>Allergy and Infectious                         | AI194266              |            | architecture studied by high-field<br>and DNP Solid-State NMR                                                                                               | Biophysics                              |           |      |
| Malitha Dickwella Widanage<br>(G)       | С      | Louisiana State University                             | chemistry                                 | NIH              | Diseases<br>NIAID - National Institute of<br>Allergy and Infectious<br>Diseases | AI121149              |            |                                                                                                                                                             |                                         |           |      |
| Ivan Hung (S)                           | С      | NHMFL                                                  | CIMAR/NMR                                 |                  | 2.566565                                                                        |                       |            |                                                                                                                                                             |                                         |           |      |
| Alex Kirui (G)                          | c      | Louisiana State University                             | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Frederic Mentink (S)                    | c      | NHMFL                                                  | NMR Division                              |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Alexandre Poulhazan (G)                 | c      | University of Quebec at Montreal                       | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Tuo Wang (S)                            | c      | Louisiana State University                             | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Dror WARSCHAWSKI (S)                    | С      | French National Center for Scientific                  | Chemistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| 5.5. WANSCHAWSKI (5)                    | C      | Research                                               | e.emistry                                 |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Ashley Blue (T)                         | PI     | NHMFL                                                  | NHMFL                                     | No other support |                                                                                 |                       | P19456     | NMR System Maintenance                                                                                                                                      | Magnets,                                | 6         | 23   |
| Riqiang Fu (S)                          | С      | NHMFL                                                  | NMR                                       |                  |                                                                                 |                       |            |                                                                                                                                                             | Materials                               |           |      |
| Zhehong Gan (S)                         | c      | NHMFL                                                  | NHMFL                                     |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| 0 ()                                    |        |                                                        |                                           |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Samuel Grant (S)                        | С      | NHMFL                                                  | Chemical & Biomedical<br>Engineering      |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
|                                         |        |                                                        |                                           |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |
| Frederic Mentink (S)<br>Sungsool Wi (S) | с<br>с | NHMFL                                                  | NMR Division<br>NMR                       |                  |                                                                                 |                       |            |                                                                                                                                                             |                                         |           |      |

| NMR |  |
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|-----|--|

| David Fenning (S)<br>Yan-Yan Hu (S)<br>Sawankumar Patel (G)<br>Rivera de la Rosa (S)<br>Carolina Solis Maldonado (S) | PI<br>C<br>C<br>PI<br>C | <ul> <li>(Name, Role, Org., Dept.)</li> <li>* University of California, San Diego</li> <li>Florida State University</li> <li>Florida State University</li> <li>Florida State University</li> <li>* Autonomous University of Nuevo<br/>León</li> <li>Veracruzan University</li> </ul> | Nanoengineering<br>Chemistry & Biochemistry<br>Chemistry<br>Chemical Engineering<br>Chemical Sciences | NSF<br>NSF<br>NSF<br>EPA                                                                            | gency, Division, Award<br>DMR - Division of Materials<br>Research<br>CAREER - Faculty Early<br>Career Development<br>Program<br>CAREER - Faculty Early<br>Career Development<br>Program | <pre>#) DMR1720 139 DMR1848 371 1848371</pre> | Proposal # | Proposal Title<br>137Ba and 127I NMR of Halide<br>Perovskite Solar Materials<br>FABaxPb1-xI3                  | Discipline<br>Magnets,<br>Materials     | <b>#</b><br>3 | Usec<br>12 |
|----------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------|------------|
| Yan-Yan Hu (S)<br>Sawankumar Patel (G)<br>Rivera de la Rosa (S)<br>Carolina Solis Maldonado (S)                      | C<br>C<br>PI<br>C       | Florida State University<br>Florida State University<br>* Autonomous University of Nuevo<br>León                                                                                                                                                                                     | Chemistry & Biochemistry Chemistry Chemical Engineering                                               | NSF<br>NSF                                                                                          | Research<br>CAREER - Faculty Early<br>Career Development<br>Program<br>CAREER - Faculty Early<br>Career Development                                                                     | 139<br>DMR1848<br>371                         | P19478     | Perovskite Solar Materials                                                                                    |                                         | 3             | 12         |
| Sawankumar Patel (G)<br>Rivera de la Rosa (S)<br>Carolina Solis Maldonado (S)                                        | C<br>PI<br>C            | <ul> <li>Florida State University</li> <li>Autonomous University of Nuevo<br/>León</li> </ul>                                                                                                                                                                                        | Chemistry<br>Chemical Engineering                                                                     | NSF                                                                                                 | CAREER - Faculty Early<br>Career Development<br>Program<br>CAREER - Faculty Early<br>Career Development                                                                                 | DMR1848<br>371                                |            |                                                                                                               | Materials                               |               |            |
| Rivera de la Rosa (S)<br>Carolina Solis Maldonado (S)                                                                | PI<br>C                 | <ul> <li>Autonomous University of Nuevo<br/>León</li> </ul>                                                                                                                                                                                                                          | Chemical Engineering                                                                                  |                                                                                                     | Career Development                                                                                                                                                                      | 1848371                                       |            |                                                                                                               |                                         |               |            |
| Carolina Solis Maldonado (S)                                                                                         | С                       | León                                                                                                                                                                                                                                                                                 |                                                                                                       | EPA                                                                                                 |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
|                                                                                                                      |                         |                                                                                                                                                                                                                                                                                      | Chemical Sciences                                                                                     |                                                                                                     |                                                                                                                                                                                         | 2013206                                       | P19479     | The role of phosphorus in the self-<br>pillared pentasil siliceous zeolite                                    | Magnets,<br>Materials                   | 2             | 19         |
| Carlos Garcia (S)                                                                                                    | С                       |                                                                                                                                                                                                                                                                                      |                                                                                                       | Agribusiness Center for<br>Research and<br>Entrepreneurship<br>(ACRE)                               | Other                                                                                                                                                                                   | 2013590                                       |            | catalyst used for the dehydra-<br>decyclization reaction of<br>tetrahydrofuran in producing 1,3-<br>butadiene |                                         |               |            |
|                                                                                                                      |                         | Clemson University                                                                                                                                                                                                                                                                   | Chemistry                                                                                             | Facultad de Ciencias<br>Qui'micas, Universidad<br>Auto'noma de Nuevo<br>Leo'n (UANL)                | Non US College and<br>University                                                                                                                                                        | 02–<br>084347–<br>PST–<br>14/105              |            |                                                                                                               |                                         |               |            |
| Francisco José Morales-Leal<br>(S)                                                                                   | С                       | Autonomous University of Nuevo<br>León                                                                                                                                                                                                                                               | Chemical Sciences                                                                                     | Fondo Sectorial de<br>Investigacio'n para la<br>Educacio'n SEP-<br>CONACYT                          | Other                                                                                                                                                                                   | A1-S-<br>37606                                |            |                                                                                                               |                                         |               |            |
| Sungsool Wi (S)                                                                                                      | С                       | National High Magnetic Field<br>Laboratory                                                                                                                                                                                                                                           | NMR                                                                                                   | Universidad Autonoma<br>de Nuevo Leon (UANL)                                                        | Non US College and<br>University                                                                                                                                                        | 02-<br>084347-<br>PST-<br>14/105              |            |                                                                                                               |                                         |               |            |
|                                                                                                                      |                         |                                                                                                                                                                                                                                                                                      |                                                                                                       | Fondo Sectorial de<br>Investigacion para la<br>Education SEP-<br>CONACYT                            | Non US Foundation                                                                                                                                                                       | A1-S-<br>37607                                |            |                                                                                                               |                                         |               |            |
| Ildefonso Marin-Montesinos<br>(S)                                                                                    | PI                      | * Universidade de Aveiro                                                                                                                                                                                                                                                             | Chemistry                                                                                             | Universidade de Aveiro                                                                              | Non US College and<br>University                                                                                                                                                        |                                               | P19491     | Disclosing brewers spent yeast cell<br>wall polysaccharides: an in deep                                       | Biology,<br>Biochemistry,               | 1             | 5          |
| Ana Rita Bastos (G)                                                                                                  | С                       | Universidade de Aveiro                                                                                                                                                                                                                                                               | Chemistry                                                                                             |                                                                                                     | ,                                                                                                                                                                                       |                                               |            | structural characterization and                                                                               | Biophysics                              |               |            |
| Elisabete Coelho (S)                                                                                                 | C                       | Universidade de Aveiro                                                                                                                                                                                                                                                               | Chemistry                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            | network assignment                                                                                            |                                         |               |            |
| Manuel A. Coimbra (S)                                                                                                | C                       | Universidade de Aveiro                                                                                                                                                                                                                                                               | Department of Chemistry                                                                               |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Luís Mafra (S)                                                                                                       | C                       | Universidade de Aveiro                                                                                                                                                                                                                                                               | Chemistry                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Frederic Mentink (S)                                                                                                 | C                       | NHMFL                                                                                                                                                                                                                                                                                | NMR Division                                                                                          |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Mariana Sardo (S)                                                                                                    | С                       | Universidade de Aveiro                                                                                                                                                                                                                                                               | Chemistry                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Sungsool Wi (S)                                                                                                      | PI                      | NHMFL                                                                                                                                                                                                                                                                                | NMR                                                                                                   | No other support                                                                                    |                                                                                                                                                                                         |                                               | P19492     | Utilization of 1H-1H correlation                                                                              | Biology,                                | 4             | 38         |
| Lucio Frydman (S)                                                                                                    | С                       | NHMFL                                                                                                                                                                                                                                                                                | NMR                                                                                                   | NIH                                                                                                 | NINDS - National Institute<br>of Neurological Disorders<br>and Stroke                                                                                                                   | NS097490                                      |            | schemes for the structural study of<br>perdeuterated/non-perdeuterated<br>13C and/or 15N-labeled biosolids    | Biochemistry,<br>Biophysics             |               |            |
| Adam Lange (S)                                                                                                       | С                       | Leibniz-Forschungsinstitut für<br>Molekulare Pharmakologie, Berlin                                                                                                                                                                                                                   | Department of Molecular<br>Biophysics                                                                 | The European<br>Research Council<br>under the European<br>Union's Seventh<br>Framework<br>Programme | Non US Council                                                                                                                                                                          | ERC Grant<br>Agreemen<br>t 639907             |            |                                                                                                               |                                         |               |            |
| lózef Lewandowski (S)                                                                                                | С                       | University of Warwick                                                                                                                                                                                                                                                                | Chemistry                                                                                             | The European<br>Research Council<br>under the European<br>Union's Seventh<br>Framework Programe     | Non US Foundation                                                                                                                                                                       | 639907                                        |            |                                                                                                               |                                         |               |            |
| Kwang Hun Lim (S)                                                                                                    | С                       | East Carolina University                                                                                                                                                                                                                                                             | Chemistry                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Yining Huang (S)                                                                                                     | PI                      | University of Western Ontario                                                                                                                                                                                                                                                        | Chemistry                                                                                             | NSERC of Canada                                                                                     | Other                                                                                                                                                                                   |                                               | P19515     | 170 and 91Zr solid-state NMR of                                                                               | Chemistry                               | 1             | 11         |
| Zhehong Gan (S)                                                                                                      | С                       | NHMFL                                                                                                                                                                                                                                                                                | NHMFL                                                                                                 |                                                                                                     |                                                                                                                                                                                         |                                               |            | metal-organic frameworks at 35.2 T                                                                            |                                         |               |            |
| Ivan Hung (S)                                                                                                        | С                       | NHMFL                                                                                                                                                                                                                                                                                | CIMAR/NMR                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Vinicius Martins (G)                                                                                                 | С                       | University of Western Ontario                                                                                                                                                                                                                                                        | Chemistry                                                                                             |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
| Tim Cross (S)                                                                                                        | PI                      | NHMFL                                                                                                                                                                                                                                                                                | NHMFL/Chemistry &<br>Biochemistry                                                                     | NIH                                                                                                 | NIAID - National Institute of<br>Allergy and Infectious<br>Diseases                                                                                                                     | AI119178                                      | P19516     | Structural Characterization of SARS-<br>CoV-2 E protein in lipid bilayer with<br>Solid-State NMR              | Biology,<br>Biochemistry,<br>Biophysics | 6             | 43         |
| Huajun Qin (T)                                                                                                       | С                       | Florida State University                                                                                                                                                                                                                                                             | Chemistry & Biochemistry                                                                              |                                                                                                     |                                                                                                                                                                                         |                                               |            |                                                                                                               |                                         |               |            |
|                                                                                                                      |                         |                                                                                                                                                                                                                                                                                      |                                                                                                       |                                                                                                     |                                                                                                                                                                                         |                                               |            | Total Proposals:                                                                                              | Exp                                     | eriments:     | Days       |

# 7. Pulsed Field Facility

| Participants              |        |                                            | Funding Sources                        |     |                                                    | Proposal #   | Proposal Title | Discipline                                                 | Exp.                | Days |      |
|---------------------------|--------|--------------------------------------------|----------------------------------------|-----|----------------------------------------------------|--------------|----------------|------------------------------------------------------------|---------------------|------|------|
|                           |        | (Name, Role, Org., Dept.)                  |                                        |     | (Funding Agency, Division, Aw                      | vard #)      | Proposal #     | Proposal Title                                             | Discipline          | #    | Used |
| Janice Musfeldt (S)       | PI     | University of Tennessee,                   | Department of Chemistry                | NSF | DMR - Division of Materials                        | DMR1707846   | P16137         | High field spectroscopy of materials                       | Chemistry           | 1    | 8    |
|                           |        | Knoxville                                  |                                        |     | Research                                           |              |                |                                                            |                     |      |      |
| Avery Blockmon (G)        | C      | University of Tennessee,<br>Knoxville      | Chemistry                              |     |                                                    |              |                |                                                            |                     |      |      |
| Amanda Clune (G)          | С      | University of Tennessee,                   | Chemistry                              |     |                                                    |              |                |                                                            |                     |      |      |
|                           | -      | Knoxville                                  |                                        |     |                                                    |              |                |                                                            |                     |      |      |
| Kendall Hughey (G)        | С      | University of Tennessee,                   | Chemistry                              |     |                                                    |              |                |                                                            |                     |      |      |
|                           |        | Knoxville                                  |                                        |     |                                                    |              |                |                                                            |                     |      |      |
| Minseong Lee (P)          | с<br>с | Los Alamos National Laboratory             | MPA-MAG                                |     |                                                    |              |                |                                                            |                     |      |      |
| Vivien Zapf (S)           | L      | National High Magnetic Field<br>Laboratory | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Joseph Checkelsky (S)     | PI     | Massachusetts Institute of                 | Physics                                | NSF | DMR - Division of Materials                        | DMR1554891   | P16258         | High Field Studies of Magnetic Weyl                        | Condensed           | 2    | 25   |
| Aravind Devarakonda (G)   | С      | Technology<br>Massachusetts Institute of   | Physics                                | МІТ | Research<br>Other                                  |              |                | Semimetals                                                 | Matter<br>Physics   |      |      |
| , admini Devarancinaa (C) | c      | Technology                                 | , nysies                               |     | o their                                            |              |                |                                                            |                     |      |      |
| Minyong Han (G)           | С      | Massachusetts Institute of<br>Technology   | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Takashi Kurumaji (P)      | С      | Massachusetts Institute of                 | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Takehito Suzuki (P)       | С      | Technology<br>Massachusetts Institute of   | Department of Physics                  | 1   |                                                    |              |                |                                                            |                     |      |      |
|                           |        | Technology                                 |                                        | 1   |                                                    |              |                |                                                            |                     |      |      |
| Joshua Wakefield (G)      | С      | Massachusetts Institute of<br>Technology   | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Linda Ye (G)              | С      | Massachusetts Institute of<br>Technology   | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Junbo Zhu (G)             | С      | Massachusetts Institute of                 | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
|                           |        | Technology                                 |                                        |     |                                                    |              |                |                                                            |                     |      |      |
| Zhiqiang Mao (S)          | PI     | Pennsylvania State University              | Department of Physics                  | DOE | Office of Science - BES – Basic<br>Energy Sciences | DE-SC0019068 | P16316         | Studies of exotic quantum phenomena near the quantum limit | Condensed<br>Matter | 1    | 3    |
| Fedor Balakirev (S)       | С      | National High Magnetic Field               | PFF                                    |     | Lines Strenges                                     |              |                | in Dirac semimetals AMnSb2 (A=Sr,<br>Ba and Yb)            | Physics             |      |      |
| Marcelo Jaime (S)         | С      | Laboratory<br>National High Magnetic Field | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
|                           | -      | Laboratory                                 |                                        |     |                                                    |              |                |                                                            |                     |      |      |
| Ross McDonald (S)         | C      | National High Magnetic Field<br>Laboratory | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Lujin Min (G)             | С      | Pennsylvania State University              | Department of Physics                  |     |                                                    |              |                |                                                            |                     |      |      |
| Wei Ning (P)              | С      | Pennsylvania State University              | Department of Physics                  |     |                                                    |              |                |                                                            |                     |      |      |
| Yanglin Zhu (G)           | С      | Tulane University                          | Department of Physics and Engineering  |     |                                                    |              |                |                                                            |                     |      |      |
|                           |        |                                            | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Lu Li (S)                 | PI     | University of Michigan                     | Physics                                | NSF | DMR - Division of Materials<br>Research            | DMR1707620   | P17467         | Interaction-Driven Topological<br>Materials                | Condensed<br>Matter | 2    | 25   |
| Kuan-Wen Chen (P)         | С      | University of Michigan                     | Physics                                | DOE | Office of Science - BES – Basic                    | DE-SC0020184 |                | Waterials                                                  | Physics             |      |      |
|                           |        |                                            |                                        |     | Energy Sciences                                    |              |                |                                                            |                     |      |      |
| Lu Chen (G)               | С      | University of Michigan                     | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Zachary Fisk (S)          | С      | University of California, Irvine           | Physics and Astronomy                  |     |                                                    |              |                |                                                            |                     |      |      |
| Yuji Matsuda (S)          | С      | Kyoto University                           | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Colin Tinsman (G)         | С      | University of Michigan                     | Physics                                | 1   |                                                    |              |                |                                                            |                     | I    |      |
| Ziji Xiang (P)            | С      | University of Michigan                     | Physics                                |     |                                                    |              |                |                                                            |                     |      |      |
| Dechen Zhang (G)          | С      | University of Michigan                     | Department of Physics                  | 1   |                                                    |              |                |                                                            |                     |      |      |
| Guoxin Zheng (G)          | С      | University of Michigan                     | Department of Physics                  |     |                                                    |              |                |                                                            |                     |      |      |
| Haidong Zhou (S)          | С      | University of Tennessee,                   | Physics and Astronomy                  | 1   |                                                    |              |                |                                                            |                     |      |      |
| <b>C</b> (-7              |        | Knoxville                                  | . ,                                    |     |                                                    |              |                |                                                            |                     |      |      |
| Eric Bauer (S)            | PI     | Los Alamos National Laboratory             | MST-10                                 | DOE | Office of Science - BES – Basic                    | F100 Science | P17510         | The ground-state of cuprate high-                          | Condensed           | 1    | 5    |
| Joonbum Park (P)          | С      | Helmholtz-Zentrum Dresden-                 | Dresden High Magnetic Field Laboratory | 1   | Energy Sciences                                    | of 100 T     |                | temperature superconductors                                | Matter<br>Physics   |      |      |
|                           |        | Rossendorf (HZDR)                          |                                        | 1   |                                                    |              |                |                                                            |                     |      |      |
| Katherine Schreiber (P)   | С      | National High Magnetic Field<br>Laboratory | NHMFL Pulsed Field Facility            | 1   |                                                    |              |                |                                                            |                     |      |      |
|                           |        |                                            |                                        | 1   |                                                    |              |                |                                                            |                     |      |      |
|                           |        |                                            |                                        | 1   |                                                    |              |                |                                                            |                     |      |      |

|                                |    | Participants                                         |                                                      |                             | Funding Sources                 |                | Bronocal # | Bronocal Title                     | Dissipling | Exp. | Days |
|--------------------------------|----|------------------------------------------------------|------------------------------------------------------|-----------------------------|---------------------------------|----------------|------------|------------------------------------|------------|------|------|
|                                |    | (Name, Role, Org., Dept.                             |                                                      | (Fur                        | iding Agency, Division, Awa     | ard #)         | Proposal # | Proposal Title                     | Discipline | #    | Used |
| Eric Bauer (S)                 | PI | Los Alamos National Laboratory                       | MST-10                                               | No other                    |                                 | •              | P17522     | Electronic properties of putative  | Condensed  | 1    | 12   |
|                                |    |                                                      |                                                      | support                     |                                 |                |            | topological Kondo insulators.      | Matter     |      |      |
| Mun Chan (S)                   | С  | National High Magnetic Field                         | Pulsed field Facility                                |                             |                                 |                |            |                                    | Physics    |      |      |
| Daniel Jackson (P)             | С  | Laboratory<br>National High Magnetic Field           | MPA/MAG                                              |                             |                                 |                |            |                                    |            |      |      |
| Damei Jackson (F)              | C  | Laboratory                                           | WIF A/ WIAG                                          |                             |                                 |                |            |                                    |            |      |      |
| Mijkhail Eremets (S)           | PI | Max Planck Institute for                             | Chemistry and Physics at High Pressures              | Max Planck                  | Non US Foundation               |                | P17644     | High field superconducting phase-  | Condensed  | 1    | 5    |
|                                |    | Chemistry, Mainz                                     | Group                                                | Society                     |                                 |                |            | diagram of sulphur                 | Matter     |      |      |
| Fedor Balakirev (S)            | С  | National High Magnetic Field                         | PFF                                                  |                             |                                 |                |            | hydride/deuteride                  | Physics    |      |      |
| Luis Balicas (S)               | С  | Laboratory<br>National High Magnetic Field           | Condensed Matter Experiment                          |                             |                                 |                |            |                                    |            |      |      |
| Luis Dancas (S)                | C  | Laboratory                                           | condensed watter Experiment                          |                             |                                 |                |            |                                    |            |      |      |
| Laura Greene (S)               | С  | National High Magnetic Field                         | Management and Administration                        |                             |                                 |                |            |                                    |            |      |      |
|                                | -  | Laboratory                                           |                                                      |                             |                                 |                |            |                                    |            |      |      |
| Shirin Mozaffari (P)           | C  | National High Magnetic Field<br>Laboratory           | Condensed Matter Sciences                            |                             |                                 |                |            |                                    |            |      |      |
| Dan Sun (P)                    | С  | Los Alamos National Laboratory                       | MPA-MAG                                              |                             |                                 |                |            |                                    |            |      |      |
| Swee Goh (S)                   | PI | Chinese University of Hong                           | Department of Physics                                | Hong Kong                   | Other                           |                | P17646     | Pressure-driven quantum magneto-   | Condensed  | 2    | 20   |
| 51122 0011 (5)                 |    | Kong                                                 |                                                      | Research                    | outer                           |                | 12/010     | transport phenomena in topological | Matter     | -    | 20   |
|                                |    |                                                      |                                                      | Grants Council              |                                 |                |            | semimetals                         | Physics    |      |      |
| Fedor Balakirev (S)            | С  | National High Magnetic Field                         | PFF                                                  | Research                    | Non US Council                  |                |            |                                    |            |      |      |
|                                |    | Laboratory                                           |                                                      | Grants Council<br>Hong Kong |                                 |                |            |                                    |            |      |      |
| Yuen Chung Chan (U)            | С  | Chinese University of Hong                           | Physics                                              | nong nong                   |                                 |                |            |                                    |            |      |      |
| 0 ()                           |    | Kong                                                 |                                                      |                             |                                 |                |            |                                    |            |      |      |
| Kwing To Lai (P)               | С  | Chinese University of Hong                           | Physics                                              |                             |                                 |                |            |                                    |            |      |      |
| Leenhum Dark (D)               | С  | Kong                                                 | Dresden Llich Magnetic Field Leberatory              |                             |                                 |                |            |                                    |            |      |      |
| Joonbum Park (P)               | L  | Helmholtz-Zentrum Dresden-<br>Rossendorf (HZDR)      | Dresden High Magnetic Field Laboratory               |                             |                                 |                |            |                                    |            |      |      |
| Dan Sun (P)                    | С  | Los Alamos National Laboratory                       | MPA-MAG                                              |                             |                                 |                |            |                                    |            |      |      |
| Jianyu Xie (G)                 | С  | Chinese University of Hong                           | Physics                                              |                             |                                 |                |            |                                    |            |      |      |
|                                |    | Kong                                                 |                                                      |                             |                                 |                |            |                                    |            |      |      |
| Wei Zhang (G)                  | С  | Chinese University of Hong                           | Physics                                              |                             |                                 |                |            |                                    |            |      |      |
| Priscila Ferrari Silveira Rosa | PI | Kong<br>Los Alamos National Laboratory               | MPA-CMMS                                             | DOE                         | Office of Science - BES – Basic | F101           | P17682     | Pulsed field measurements on       | Condensed  | 3    | 19   |
| (P)                            |    | ,                                                    |                                                      |                             | Energy Sciences                 |                |            | topological semi-metals            | Matter     | -    |      |
| Eric Bauer (S)                 | С  | Los Alamos National Laboratory                       | MST-10                                               | DOE                         | Office of Science - BES – Basic | Science of 100 |            |                                    | Physics    |      |      |
|                                |    |                                                      |                                                      | 205                         | Energy Sciences                 | tesla          |            |                                    |            |      |      |
| Mun Chan (S)                   | С  | National High Magnetic Field<br>Laboratory           | Pulsed field Facility                                | DOE                         |                                 | DE-XW          |            |                                    |            |      |      |
| Neil Harrison (S)              | С  | National High Magnetic Field                         | Physics                                              |                             |                                 |                |            |                                    |            |      |      |
|                                |    | Laboratory                                           |                                                      |                             |                                 |                |            |                                    |            |      |      |
| Satya Kushwaha (P)             | С  | Los Alamos National Laboratory                       | MPA-MAG                                              |                             |                                 |                |            |                                    |            |      |      |
| Ross McDonald (S)              | С  | National High Magnetic Field                         | Physics                                              |                             |                                 |                |            |                                    |            |      |      |
| Scott Crooker (S)              | PI | Laboratory<br>National High Magnetic Field           | Nat High Magnetic Field Lab                          | DOE                         | LDRD - Laboratory Directed R&D  | DE-AA99-       | P17750     | Optical Spectroscopy of Excited    | Condensed  | 2    | 20   |
| (-)                            |    | Laboratory                                           |                                                      |                             |                                 | 99AA99999      |            | Rydberg Excitons (& Determination  | Matter     | _    |      |
| Mateusz Goryca (S)             | С  | University of Warsaw                                 | Institute of Experimental Physics, Solid             | LDRD                        | Other                           |                |            | of Exciton Mass) in Monolayer      | Physics    |      |      |
|                                | -  |                                                      | State Physics                                        |                             |                                 |                |            | Semiconductors                     |            |      |      |
| Jing Li (P)                    | С  | Los Alamos National Laboratory                       | MPA-MAGLAB                                           |                             |                                 |                |            |                                    |            |      |      |
| Xavier Marie (S)               | C  | National Institute for Applied<br>Sciences, Toulouse | Laboratoire de Physique et Chimie des<br>Nano-objets |                             |                                 |                |            |                                    |            |      |      |
| Andreas Stier (P)              | с  | National High Magnetic Field                         | MPA-CMMS                                             |                             |                                 |                |            |                                    |            |      |      |
| .,                             |    | Laboratory                                           |                                                      |                             |                                 |                |            |                                    |            |      |      |
| Bernhard Urbaszek (S)          | С  | National Institute for Applied                       | Laboratoire de Physique et Chimie des                | 1                           |                                 |                |            |                                    |            |      |      |
| Nathan Wilson (G)              | С  | Sciences, Toulouse<br>University of Washington       | Nano-objets<br>Physics                               |                             |                                 |                |            |                                    |            |      |      |
| Xiaodong Xu (S)                | c  | University of Washington                             | Physics<br>Physics                                   |                             |                                 |                |            |                                    |            |      |      |
| Alabaong Au (3)                | C  | Shive sity of Washington                             | 1 113063                                             | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      | 1                           |                                 |                |            |                                    |            |      |      |
|                                |    |                                                      |                                                      |                             |                                 |                |            |                                    |            |      |      |

| Participants               |      | Funding Sources                            |                          |                                              | Droposal #                                                     | Proposal Title       | Distriction | Exp.                                                                    | Days                           |   |      |
|----------------------------|------|--------------------------------------------|--------------------------|----------------------------------------------|----------------------------------------------------------------|----------------------|-------------|-------------------------------------------------------------------------|--------------------------------|---|------|
| (Name, Role, Org., Dept.)  |      |                                            |                          | (Funding Agency, Division, Award #)          |                                                                |                      | Proposal #  | Proposal fille                                                          | Discipline                     | # | Used |
| Neil Harrison (S)          | PI   | National High Magnetic Field<br>Laboratory | Physics                  | Los Alamos<br>National<br>Laboratory         | US Government Lab                                              |                      | P17768      | Electronic Structure and Equation<br>of State of Plutonium              | Condensed<br>Matter<br>Physics | 2 | 10   |
| John Singleton (S)         | С    | National High Magnetic Field<br>Laboratory | Physics                  | Los Alamos<br>National<br>Laboratory<br>LDRD | US Government Lab                                              |                      |             |                                                                         |                                |   |      |
| Paul Tobash (P)            | С    | National High Magnetic Field<br>Laboratory | MPA-cmms                 |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Mark Wartenbe (P)          | С    | Los Alamos National Laboratory             | MST-16                   |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Laurel Winter (S)          | С    | National High Magnetic Field<br>Laboratory | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Dagmar Weickert (S)        | PI   | National High Magnetic Field<br>Laboratory | MPA-Mag                  | NSF                                          | DMR - Division of Materials<br>Research                        | DMR1644779           | P17769      | Exotic ordered ground states in<br>low-dimensional spin systems         | Condensed<br>Matter            | 1 | 5    |
| Carolina Corvalan Moya (S) | С    | Los Alamos National Laboratory             | MPA-MAG                  |                                              |                                                                |                      |             | induced by high magnetic fields                                         | Physics                        |   |      |
| Myron Salamon (S)          | С    | University of Texas, Dallas                | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Andres Saul (S)            | C    | Aix-Marseille University                   | CINaM/CNRS               |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Hidekazu Tanaka (S)        | С    | Tokyo Institute of Technology              | Physics                  | -                                            |                                                                |                      |             |                                                                         |                                |   |      |
| Susanne Stemmer (S)        | PI   | University of California, Santa<br>Barbara | Materials                | DOD                                          | ONR - Office of Naval Research                                 | N00014-16-1-<br>2814 | P17876      | 3D Dirac Semimetal Thin Films                                           | Condensed<br>Matter            | 1 | 4    |
| Binghao Guo (G)            | С    | University of California, Santa<br>Barbara | Materials Department     |                                              |                                                                |                      |             |                                                                         | Physics                        |   |      |
| David Kealhofer (G)        | С    | University of California, Santa<br>Barbara | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| You Lai (P)                | c    | National High Magnetic Field<br>Laboratory | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Ross McDonald (S)          | С    | NHMFL                                      | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Timo Schumann (P)          | C    | University of California, Santa<br>Barbara | Materials Department     |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Ryan Baumbach (S)          | PI   | NHMFL                                      | CMS                      | DOE                                          | Office of Science - BES – Basic<br>Energy Sciences             | DESC0016568          | P17894      | Investigation of dual nature f-<br>electron intermetallics using high   | Condensed<br>Matter            | 1 | 5    |
| You Lai (P)                | С    | NHMFL                                      | Physics                  |                                              |                                                                |                      |             | magnetic fields                                                         | Physics                        |   |      |
| Minhyea Lee (S)            | PI   | University of Colorado, Boulder            | Physics                  | University of<br>Colorado<br>Boulder         | US College and University                                      |                      | P17906      | Investigation on unusual magnetic<br>responses in quantum magnets       | Condensed<br>Matter<br>Physics | 1 | 12   |
| Gang Cao (S)               | С    | University of Colorado, Boulder            | Department of Physics.   |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Ian Leahy (G)              | С    | University of Colorado, Boulder            | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Ross McDonald (S)          | С    | NHMFL                                      | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Christopher Pocs (G)       | С    | University of Colorado, Boulder            | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Arkady Shehter (S)         | С    | NHMFL                                      | NHMFL, DC Field Facility |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Peter Siegfried (G)        | С    | University of Colorado, Boulder            | Physics                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Laurel Winter (S)          | PI * | NHMFL                                      | Physics                  | No other<br>support                          |                                                                |                      | P18062      | Testing and development of pulsed<br>field probes                       | Magnets,<br>Materials          | 4 | 18   |
| Daniel Jackson (P)         | С    | NHMFL                                      | MPA/MAG                  | DOE                                          | Other                                                          | 20180025DR           |             |                                                                         |                                |   |      |
| You Lai (P)                | С    | NHMFL                                      | Physics                  | DOE                                          | Office of Science - EFRC - Energy<br>Frontier Research Centers | DE-AC02-<br>07CH1135 |             |                                                                         |                                |   |      |
| Johanna Palmstrom (P)      | C    | Los Alamos National Laboratory<br>(LANL)   | MPA-MAG                  | Los Alamos<br>National<br>Laboratory         | US Government Lab                                              |                      |             |                                                                         |                                |   |      |
| Mark Wartenbe (P)          | С    | Los Alamos National Laboratory             | MST-16                   | LANL LDRD                                    | US Government Lab                                              |                      |             |                                                                         |                                |   |      |
| Vivien Zapf (S)            | PI   | National High Magnetic Field<br>Laboratory | Physics                  | DOE                                          | Office of Science - BES – Basic<br>Energy Sciences             | 0                    | P19135      | Magnetic field induced spin liquids<br>and quantum phase transitions in | Condensed<br>Matter            | 1 | 5    |
| Sang Wook Cheong (S)       | С    | Rutgers University, New<br>Brunswick       | Physics and Astronomy    |                                              |                                                                |                      |             | orbital-assisted dimerized quantum magnets.                             | Physics                        |   |      |
| Minseong Lee (P)           | С    | Los Alamos National Laboratory             | MPA-MAG                  |                                              |                                                                |                      |             |                                                                         |                                |   |      |
| Haidong Zhou (S)           | С    | University of Tennessee,<br>Knoxville      | Physics and Astronomy    |                                              |                                                                |                      |             |                                                                         |                                |   |      |
|                            |      |                                            |                          |                                              |                                                                |                      |             |                                                                         |                                |   |      |

|                                           |        | Participants                               |                                                 |                     | Funding Sources                         |              |            |                                                                         |                     | Exp. | Days |
|-------------------------------------------|--------|--------------------------------------------|-------------------------------------------------|---------------------|-----------------------------------------|--------------|------------|-------------------------------------------------------------------------|---------------------|------|------|
|                                           |        | (Name, Role, Org., Dept.                   | )                                               | (                   | Funding Agency, Division, Awa           | ard #)       | Proposal # | Proposal Title                                                          | Discipline          | #    | Used |
| Arkady Shehter (S)                        | PI     | National High Magnetic Field               | NHMFL, DC Field Facility                        | NSF                 | DMR - Division of Materials             | DMR1157490   | P19136     | Longitudinal and Hall transport in                                      | Condensed           | 1    | 5    |
|                                           |        | Laboratory                                 |                                                 |                     | Research                                |              |            | critically doped cuprates at very                                       | Matter              |      |      |
| Alimamy Bangura (S)                       | C      | National High Magnetic Field<br>Laboratory | CMS                                             |                     |                                         |              |            | high magnetic fields. Field-<br>temperature competition as a            | Physics             |      |      |
| Jonathan Betts (S)                        | С      | National High Magnetic Field               | NHMFL-PFF                                       |                     |                                         |              |            | signature of quantum criticality.                                       |                     |      |      |
|                                           |        | Laboratory                                 |                                                 |                     |                                         |              |            |                                                                         |                     |      |      |
| Greg Boebinger (S)                        | С      | National High Magnetic Field               | Directors Office                                |                     |                                         |              |            |                                                                         |                     |      |      |
| Ross McDonald (S)                         | С      | Laboratory<br>National High Magnetic Field | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Koss MicDonald (3)                        | C      | Laboratory                                 | Filysics                                        |                     |                                         |              |            |                                                                         |                     |      |      |
| Kimberly Modic (G)                        | С      | National High Magnetic Field               | PFF                                             |                     |                                         |              |            |                                                                         |                     |      |      |
|                                           |        | Laboratory                                 |                                                 |                     |                                         |              |            |                                                                         |                     |      |      |
| Brad Ramshaw (S)                          | C      | Cornell University                         | Laboratory of Atomic and Solid State<br>Physics |                     |                                         |              |            |                                                                         |                     |      |      |
| James Analytis (S)                        | PI     | University of California,                  | Physics                                         | DOE                 | MSE - Materials Science and             | DE-SC0014039 | P19137     | High-field phase transitions in the                                     | Condensed           | 1    | 14   |
|                                           |        | Berkeley                                   |                                                 | _                   | Engineering                             |              |            | Kitaev hyperhoneycomb beta-                                             | Matter              |      |      |
| Nikola Maksimovic (G)                     | С      | University of California,                  | Physics                                         |                     |                                         |              |            | Li2IrO3                                                                 | Physics             |      |      |
| Kimbark Madia (C)                         | С      | Berkeley<br>National High Magnetic Field   | PFF                                             |                     |                                         |              |            |                                                                         |                     |      |      |
| Kimberly Modic (G)                        | Ľ      | Laboratory                                 | FLL                                             |                     |                                         |              |            |                                                                         |                     |      |      |
| Hsinhan Tsai (P)                          | PI     | Los Alamos National Laboratory             | MPA-11                                          | No other            |                                         |              | P19141     | New 2D perovskites for high                                             | Magnets,            | 2    | 10   |
|                                           |        |                                            |                                                 | support             |                                         |              |            | temperature multiferroics                                               | Materials           |      |      |
| Wanyi Nie (S)                             | С      | Los Alamos National Laboratory             | MPA-11                                          |                     |                                         |              |            |                                                                         |                     |      |      |
| Magdalena Owczarek (P)                    | C      | Los Alamos National Laboratory             | CINT                                            |                     |                                         |              |            |                                                                         |                     |      |      |
| Vivien Zapf (S)                           | С      | National High Magnetic Field<br>Laboratory | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Jamie Manson (S)                          | PI     | Eastern Washington University              | Chemistry and Biochemistry                      | NSF                 | DMR - Division of Materials             | DMR1703003   | P19143     | Determining phase diagrams in                                           | Condensed           | 1    | 12   |
|                                           |        |                                            |                                                 |                     | Research                                |              |            | bespoke S = 1 Ni(II) quantum                                            | Matter              |      |      |
| Fedor Balakirev (S)                       | С      | National High Magnetic Field<br>Laboratory | PFF                                             |                     |                                         |              |            | magnets                                                                 | Physics             |      |      |
| Sam Curley (G)                            | с      | University of Warwick                      | Physics and Astronomy                           |                     |                                         |              |            |                                                                         |                     |      |      |
| Paul Goddard (S)                          | c      | University of Warwick                      | Department of Physics                           |                     |                                         |              |            |                                                                         |                     |      |      |
| John Singleton (S)                        | C      | NHMFL                                      | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Dan Sun (P)                               | С      | Los Alamos National Laboratory             | MPA-MAG                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Krzysztof Gofryk (S)                      | PI     | Idaho National Laboratory                  | Fuel Performance & Design                       | DOE                 | Office of Science - ECRP - Early        | KG's early   | P19145     | Transport and magnetic properties                                       | Condensed           | 1    | 5    |
|                                           |        |                                            |                                                 |                     | Career Research Program                 | career award |            | of selected d- and f-electron                                           | Matter              |      |      |
| Xiaxin Ding (P)                           | С      | Idaho National Laboratory                  | NST                                             |                     |                                         |              |            | topological materials in high<br>magnetic fields                        | Physics             |      |      |
| Neil Harrison (S)                         | С      | NHMFL                                      | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Marcelo Jaime (S)                         | С      | NHMFL                                      | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Narayan Poudel (P)<br>Dagmar Weickert (S) | C<br>C | Idaho National Laboratory<br>NHMFL         | Nuclear Materials<br>MPA-Mag                    |                     |                                         |              |            |                                                                         |                     |      |      |
|                                           | PI     | NHMFL                                      | -                                               | DOE                 |                                         | DE-AA00-     | P19182     | No such field is done don't listed                                      | Condonard           |      | -    |
| Vivien Zapf (S)                           | PI     | NHMFL                                      | Physics                                         | DOE                 | LDRD - Laboratory Directed R&D          | 00AA00000    | P19182     | Magnetic field-induced spin liquids<br>and quantum phase transitions in | Condensed<br>Matter | 1    | 5    |
| Marcelo Jaime (S)                         | С      | NHMFL                                      | Physics                                         |                     |                                         |              |            | Kitaev materials                                                        | Physics             |      |      |
| Minseong Lee (P)                          | С      | Los Alamos National Laboratory             | MPA-MAG                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| David Mandrus (S)                         | С      | University of Tennessee,                   | Materials Science and Engineering               |                     |                                         |              |            |                                                                         |                     |      |      |
| Dise Coherena (D)                         | DI *   | Knoxville                                  |                                                 | No. others          |                                         |              | D10101     |                                                                         | Condensed           |      | -    |
| Rico Schoenemann (P)                      | PI *   | Los Alamos National Laboratory             | MPA-MAG                                         | No other<br>support |                                         |              | P19194     | Magnetostriction and thermal<br>expansion measurements in a             | Condensed<br>Matter | 1    | 5    |
| Shusaku Imajo (S)                         | С      | University of Tokyo                        | International MegaGauss Science                 |                     |                                         |              |            | frustrated spin system.                                                 | Physics             |      |      |
|                                           |        |                                            | Laboratory                                      |                     |                                         |              |            |                                                                         |                     |      |      |
| Marcelo Jaime (S)                         | С      | NHMFL                                      | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Stephen Nagler (S)                        | С      | Oak Ridge National Laboratory              |                                                 |                     |                                         |              |            |                                                                         |                     |      |      |
| Yasu Takano (S)                           | C      | University of Florida                      | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
| Dagmar Weickert (S)                       | C      | NHMFL                                      | MPA-Mag                                         | 1105                |                                         | 5145430000   |            |                                                                         |                     |      |      |
| Jamie Manson (S)                          | PI     | Eastern Washington University              | Chemistry and Biochemistry                      | NSF                 | DMR - Division of Materials<br>Research | DMR1703003   | P19233     | New topologies in Ni(II) quantum<br>magnets with XY anisotropy          | Condensed<br>Matter | 1    | 5    |
| Paul Goddard (S)                          | С      | University of Warwick                      | Department of Physics                           |                     |                                         |              |            |                                                                         | Physics             |      |      |
| John Singleton (S)                        | C      | National High Magnetic Field               | Physics                                         |                     |                                         |              |            |                                                                         |                     |      |      |
|                                           |        | Laboratory                                 |                                                 |                     |                                         |              |            |                                                                         |                     |      |      |
|                                           |        |                                            |                                                 |                     |                                         |              |            |                                                                         |                     |      |      |
|                                           |        |                                            |                                                 |                     |                                         |              | 1          |                                                                         | 1                   |      | l    |

| Participants<br>(Name, Role, Org., Dept.) |      |                                                |                                                                 | Funding Sources<br>(Funding Agency, Division, Award #) |                                                                |                       | Proposal Title | Discipline Exp                                                            | Exp.                | Days      |      |
|-------------------------------------------|------|------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------|-----------------------|----------------|---------------------------------------------------------------------------|---------------------|-----------|------|
|                                           |      |                                                |                                                                 |                                                        |                                                                |                       |                | 2.000.00.000                                                              | #                   | Used      |      |
| Na Hyun Jo (G)                            | PI   | Ames Laboratory                                | Division of Materials Science & Engineering                     | DOE                                                    | Office of Science - EFRC - Energy<br>Frontier Research Centers | DE-AC02-<br>07CH11358 | P19250         | Investigation of exotic topological<br>states using high magnetic fields  | Condensed<br>Matter | 2         | 23   |
| Paul Canfield (S)                         | С    | Ames Laboratory                                | Physics & Astronomy                                             | DOE                                                    | Office of Science - EFRC - Energy<br>Frontier Research Centers | DE-AC02-<br>07CH1135  |                |                                                                           | Physics             |           |      |
| Brinda Kuthanazhi (G)                     | С    | Ames Laboratory                                | Division of Material Sciences and<br>Engineering                |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| You Lai (P)                               | С    | National High Magnetic Field<br>Laboratory     | Physics                                                         |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Ross McDonald (S)                         | С    | National High Magnetic Field<br>Laboratory     | Physics                                                         |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Robert McQueeney (S)                      | С    | Ames Laboratory                                | physics & astronomy                                             |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Dmitry Yarotski (S)                       | С    | Los Alamos National Laboratory                 | Center for Integrated Nanotechnologies                          |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Haidong Zhou (S)                          | PI   | University of Tennessee,<br>Knoxville          | Physics and Astronomy                                           | DOE                                                    | Office of Science - BES – Basic<br>Energy Sciences             | 0                     | P19406         | Magnetic field-induced quantum<br>phase transitions in a Kitaev spin      | Condensed<br>Matter | 1         | 5    |
| Minseong Lee (P)                          | С    | Los Alamos National Laboratory                 | MPA-MAG                                                         |                                                        |                                                                |                       |                | liquid candidate.                                                         | Physics             |           |      |
| Vivien Zapf (S)                           | С    | National High Magnetic Field<br>Laboratory     | Physics                                                         |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Taehwan Jang (G)                          | PI * | Pohang University of Science<br>and Technology | Physics                                                         | DOE                                                    | Office of Science - BES – Basic<br>Energy Sciences             | 0                     | P19407         | Magnetic and Magnetoelectric<br>Measurements on 2D square-lattice         | Condensed<br>Matter | 1         | 10   |
| Minseong Lee (P)                          | С    | Los Alamos National Laboratory                 | MPA-MAG                                                         |                                                        |                                                                |                       |                | antiferromagnet                                                           | Physics             |           |      |
| Vivien Zapf (S)                           | С    | National High Magnetic Field<br>Laboratory     | Physics                                                         |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| Pei-Chun Ho (S)                           | PI   | California State University,<br>Fresno         | Physics                                                         | NSF                                                    | DMR - Division of Materials<br>Research                        | DMR1905636            | P19415         | Investigation of Valance Transition<br>in Ce1-xRxOs4Sb12 (R = Pr, Nd) and | Condensed<br>Matter | 1         | 5    |
| Paul Goddard (S)                          | С    | University of Warwick                          | Department of Physics                                           |                                                        |                                                                |                       |                | Fermi-Surface Topologies of                                               | Physics             |           |      |
| Kathrin Gotze (P)                         | С    | University of Warwick                          | Department of Physics, Superconductivity<br>and Magnetism group |                                                        |                                                                |                       |                | SmOs4Sb12                                                                 |                     |           |      |
| Brian Maple (S)                           | С    | University of California, San<br>Diego         | Inst for Pure & Applied Physical Sciences                       |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
| John Singleton (S)                        | С    | National High Magnetic Field<br>Laboratory     | Physics                                                         |                                                        |                                                                |                       |                |                                                                           |                     |           |      |
|                                           |      |                                                |                                                                 |                                                        |                                                                |                       |                | Total Proposals:                                                          | Expe                | eriments: | Days |
|                                           |      |                                                |                                                                 |                                                        |                                                                |                       |                | 29                                                                        |                     | 41        | 305  |

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