NATIONAL MAGLAB

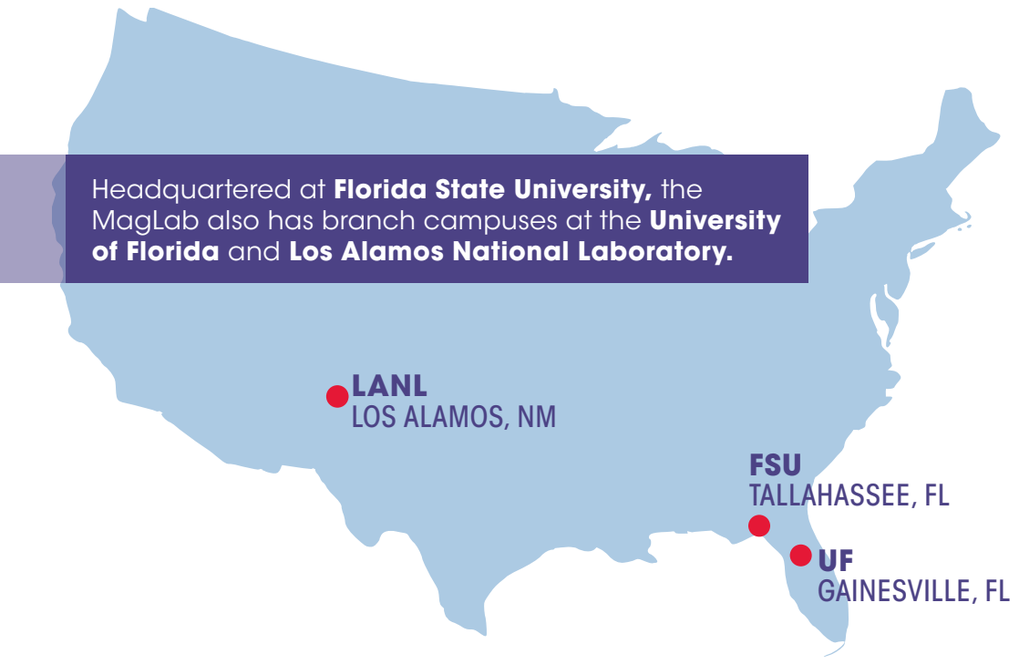
AT A GLANCE

Florida State University • University of Florida • Los Alamos National Laboratory

Supported by the National Science Foundation and the State of Florida

LEADING THE WORLD

The National High Magnetic Field Laboratory (National MagLab) is the largest and highest-powered magnet laboratory in the world. We are one lab across three sites representing the United States' investment in high magnetic field research.



By harnessing magnetic fields as important research tools, the National MagLab expands the boundaries of scientific knowledge and advances basic science, engineering and technology in the 21st century.

In 2020, the COVID-19 pandemic impacted normal operations at our lab, as it did organizations around the globe. After a brief disruption, new COVID-safe measures were implemented and research activities resumed. To meet user needs, the lab created new opportunities for researchers around the glove to remotely access our fleet of world record magnets and, in 2020, nearly 1,500 scientists conducted experiments at the lab.

High magnetic field research is highly interdisciplinary, bringing together physics, chemistry, biology and engineering from both our international user community and talented in-house team to explore fundamental questions about materials, energy and life. This collaborative work leads to exciting discoveries that are shared in more than 400 peer-reviewed publications each year and at community and educational events to lay the foundation for the explorers of the future.

MATERIALS

Scientists use our magnets to explore semiconductors and superconductors, crystals and atomically thin materials — research that reveals the secret workings of materials and empowers us to develop new technologies.

- **Correlated Electrons**
- **Graphene**
- **Kondo/Heavy Fermion Systems**
- **Magnetism and Magnetic Materials**
- **Molecular Conductors**
- **Quantum Fluids and Solids**
- **Qubits & Quantum Entanglement**
- **Semiconductors**
- **Superconductors**
- **Topological Matter**

ENERGY

Scientists work to optimize petroleum refining, advance potential biofuels such as pine needles and algae and fundamentally change the way we store and deliver energy by developing better batteries.

- **Biofuels**
- **Catalysis**
- **Dissolved Organic Matter**
- **Environmental Analysis**
- **Fuel Cell Membranes**
- **Geochemistry**
- **Lithium Battery Imaging**
- **Petroleomics**
- **Superconductivity - Applied Research**

LIFE

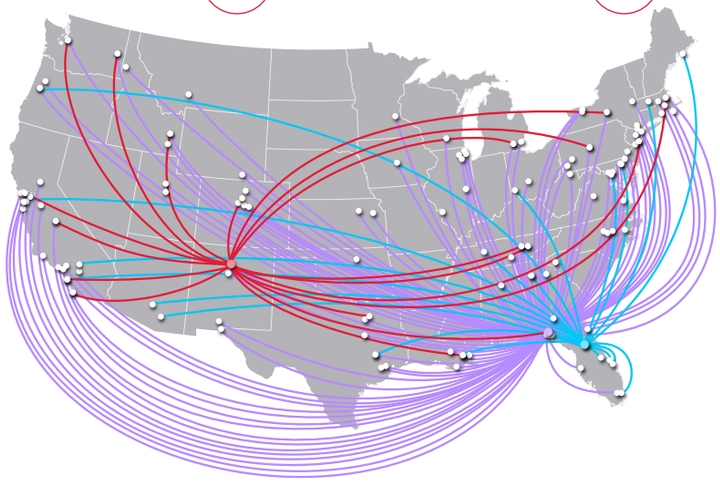
Scientists study the foundational science of protein and disease molecules that underlies the cells and creates life itself. This work could improve future treatment of AIDS, cancer, Alzheimer's and other diseases.

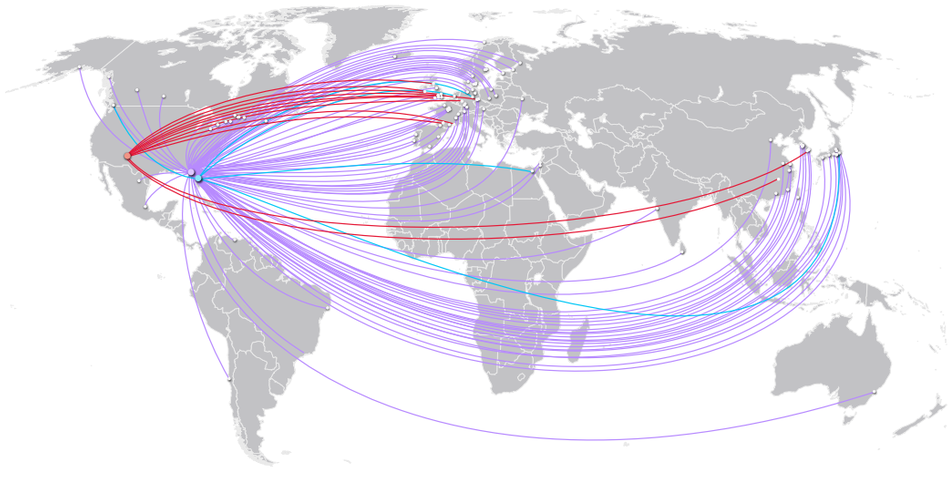
- **Biomarkers**
- **Dynamic Nuclear Polarization**
- **Membrane Proteins**
- **Metabolomics**
- **Natural Products**
- **Quadrupolar NMR**
- **Sodium MRI**

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.

78% UNIVERSITIES **14%** GOVERNMENT LABS **8%** INDUSTRY





2020 LAB STATS

USERS:
1,494

PERCENTAGE OF USERS WHO WERE NEW:
15%

ARTICLES PUBLISHED IN PEER-REVIEWED JOURNALS:
485

LECTURES, TALKS & PRESENTATIONS GIVEN TO ORGANIZATIONS AROUND THE COUNTRY & THE WORLD:
164

MAGLAB WORLD RECORDS:
17

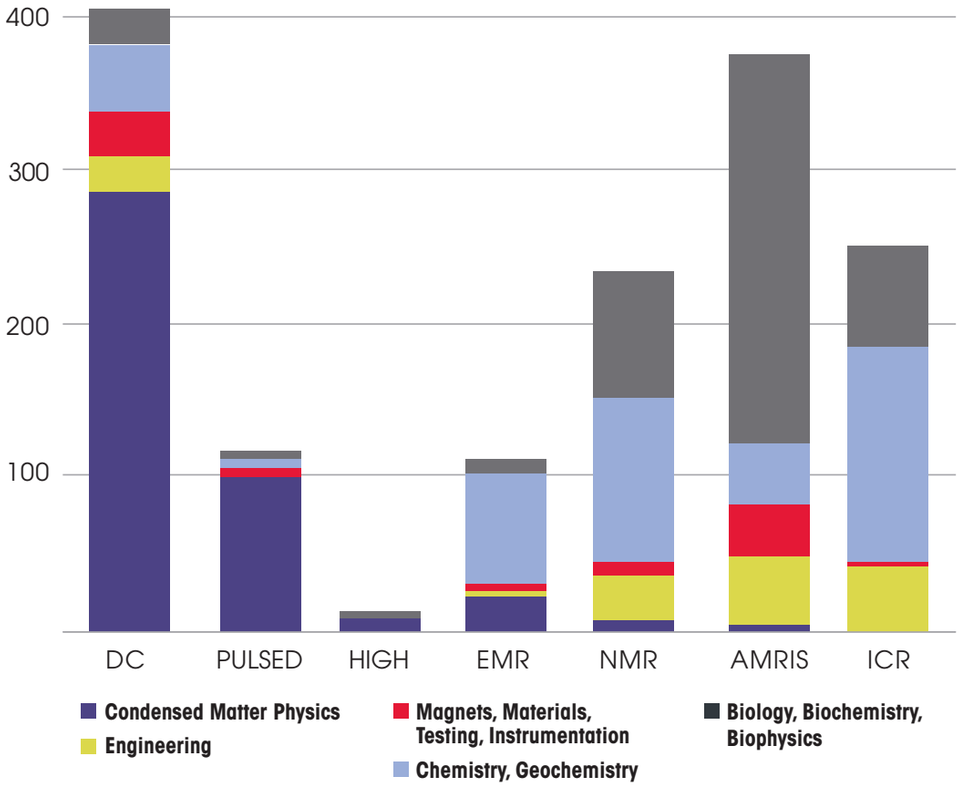
PERCENTAGE OF TALKS GIVEN VIRTUALLY:
67%

WHO OUR USERS ARE

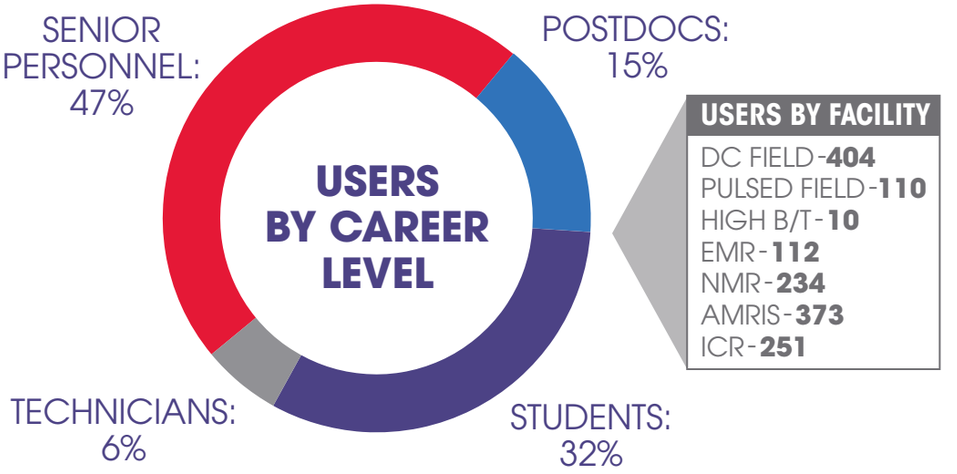
High magnetic fields are a powerful research tool across many disciplines leading to groundbreaking discoveries that impact your life. The lab comprises 7 distinct user facilities that offer our researchers a wide range of research capabilities:

- **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



39% OF STUDENT USERS ARE FEMALE. & **18%** OF POSTDOC USERS ARE FEMALE.



WHAT OUR USERS SAY

96% of users were satisfied with performance of the facilities & equipment.

97% of users were satisfied with the assistance provided by MagLab technical staff.

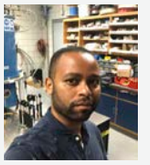
93% of users were satisfied with the proposal process.

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.



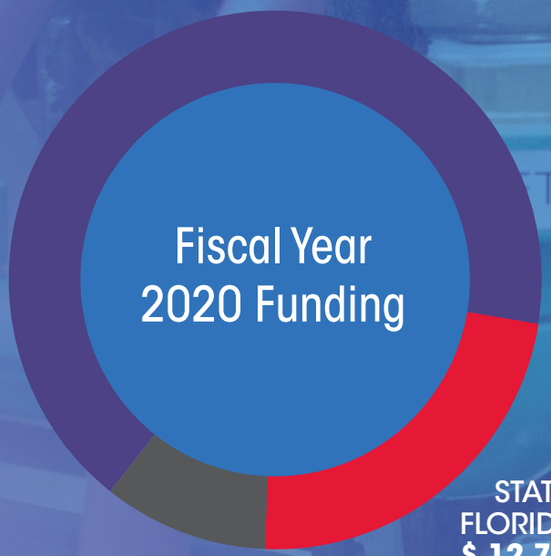
INVESTING IN THE FUTURE

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



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.

ECONOMIC IMPACT

RETURN ON INVESTMENT

IN THE U.S., THE MAGLAB **ANNUALLY GENERATES**
$709 million
in economic output
more than
4,550 jobs

OVER THE NEXT 20 YEARS, **PROJECTED TO GENERATE**
$14.2 billion
in economic output
more than
91,000 jobs

$1
INVESTED BY THE NSF CORE GRANT

$6.44
ECONOMIC ACTIVITY GENERATED IN THE STATE OF FLORIDA

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**

- Senior Personnel: **240**
- Other Professional: **92**
- Support Staff - Technical/ Managerial: **109**
- Support Staff - Clerical: **28**
- Postdoctoral: **63**
- Graduate Student: **156**
- Undergraduate Student: **48**

40%
of MagLab students are female.

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 **25th anniversary** with more than

10,000
VISITORS

28,000
YouTube subscribers added, bring our total subcriber number to over **130K!**

115
K-12 students in virtual mentorship or camp programs, **56%** of whom were from underrepresented minority groups.

1.59
MILLION+
website pageviews, with views to education sections of the website **increasing 45%** in 2020 compared to 2019.

Connect with us at **NationalMagLab.org** or by following us across social media.