

## INSTRUMENTATION FOR OPTICAL DYNAMIC NUCLEAR POLARIZATION NMR AT THE NHMFL AND THE UNIVERSITY OF FLORIDA

John T. Tokarski III,<sup>1</sup> Lauren A. McCarthy,<sup>1</sup> Ryan M. Wood,<sup>1</sup> Phillip L. Kuhns,<sup>2</sup> Stephen A. McGill,<sup>2</sup> Arneil P. Reyes,<sup>2</sup> Clifford R. Bowers<sup>1</sup>

<sup>1</sup>*University of Florida, Department of Chemistry, Gainesville, FL, 32611 USA*

<sup>2</sup>*National High Magnetic Field Laboratory, Tallahassee, FL, 32360, USA*

Optically Dynamic Nuclear Polarization (ODNP) in crystalline semiconductors utilizes interband optical excitation to orient conduction electrons that subsequently cross-relax with nuclei, generating hyperpolarization of order unity than can be detected by NMR spectroscopy. ODNP-NMR has been employed to interrogate electronic band structure, electron-nuclear spin interactions, and exotic many-body excitations in 2D electron systems. Recently, the NHMFL UCGP supported the construction of a special-purpose optical NMR probe for the NHMFL Ultrafast User Facility, where ODNP measurements can be combined with magneto-photoluminescence and magneto-absorption spectroscopy at multiple magnetic fields. The state-of-the-art optical NMR probe and magnet systems at the NHMFL provide unparalleled research capacity for such studies. Moreover, interpretation of data is facilitated by electronic band structure calculations in UF Physics.

To probe at the underlying spin physics that allow for the nuclear spin polarization enhancement, we acquired time-resolved Magneto-Photoluminescence and Magneto-Absorption spectroscopy at multiple magnetic fields at the National High Magnetic Field Laboratory (NHMFL) in multiple quantum well arrays of GaAs/AlGaAs. These results aim to aid in band structure calculations to elucidate spin-dependent transitions observed in the ODNP spectra.

The state-of-the-art optical systems and magnetic field capabilities at the NHMFL allow for unparalleled research capacity. At the University of Florida, we have developed instrumentation for staging experiments and to compliment facilities at the NHFML. A new NMR probe was constructed for ODNP experiments in pumped superfluid <sup>4</sup>He with a base temperature of 1.4 K and hold time >12 hr. Automated photon energy dependence studies are facilitated using a Labview/Arduino controller interfaced to the Bruker Avance NMR spectrometer. This poster presents data acquired at UF and the NHMFL and describes the instrumentation development at both sites.

FA: Facilities