**List of top three 2024 accomplishments for each facility:**

**MagLab Management**

* Researcher and industry leader Kathleen Amm became the **new director** of the National High Magnetic Field Laboratory in May. Before joining the lab, she was the director of the Magnet Division at Brookhaven National Laboratory and spent nearly 20 years at GE Global Research, first as a physicist in the electromagnetics and superconductivity lab, before moving into various leadership positions across the organization.
* Launched **organization-wide values** in July 2024 to build cooperation, collaboration, equity and cohesion around the lab as we work toward a shared purpose. The MagLab core values - Safety, Excellence, Leadership, Collaboration, and Impact - are built around the idea that each person makes a critical contribution to the lab.
* Built and initially released a proposed **organizational structure change** that will put the right people in place to facilitate research, improve efficiencies and create an environment for science to flourish. Eric Palm remains Deputy Lab Director with a focus on leading in-house research and new funding; Tim Murphy has been elevated to Deputy Lab Director focused on operations and synergistic connections between the entire NSF-funded User Program; Laura Greene remains the lab’s chief scientist overseeing science drivers and the discipline-specific chief scientists; Kristin Roberts will retain external communications/relations and add a new portfolio of internal communications tools; an HR Director position and a Finance Director position will be advertised as Debra Booth is retiring in early 2025; Alfie Brown now leads the lab’s Environmental Health & Safety Team working closely with the FSU-based safety team; Joanna Long and Ross McDonald will remain in the roles of Associate Lab Director representing the three site partnership of the National MagLab. Professor Kristina (Kicki) Hakansson also joined the FSU Chemistry & Biochemistry Faculty and is our new ICR Facility Director.

**Safety**

* The Safety team at the FSU-based headquarters site named Alfie Brown as the director. He also works closely with the broader FSU Environmental Health and Safety team and will maintain a safety committee with representation from the lab’s three sites.
* In May 2024, the MagLab experienced the impact of tornadic storms moving through the area. The MagLab safety team led crisis management and recovery efforts working with partners from both the lab and FSU facilities and EH&S teams. The storm resulted in damage to lab roofing, cooling towers, and water tanks as well as the loss of an estimated 1,000 trees. Damage to the lab is being repaired through the collaborative efforts of the Safety team, Maglab Facilities Department, and as well as FSU remaining engaged in all response work.

**Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) Facility**

* **Personnel:** Two user support scientists (James Rocca and Anil Mehta) retired this year and, following national searches, two new staff scientists joined the AMRIS Facility team. Drs. Luiza Nogueira and Ying Li both bring years of experience in solid-state and solution NMR spectroscopy with a focus on biomolecular systems. We look forward to expanding our user support in the areas of RNA, protein, and carbohydrate structure and dynamics and continued support of efforts in natural products and metabolism research.
* **Facility Improvements:** Our flagship 17.6 T MRI/NMR system was upgraded with state-of-the-art electronics and MRI coils that substantially improved sensitivity for our users’ challenging studies, with a particular focus on high resolution measurements of diffusion and transport in both biological tissues and materials designed for gas separations. We also enhanced our 19F NMR capabilities with the addition of an HFX magic angle spinning probe.
* **Users:** We are still gathering data on users’ publications, new students and postdoctoral researchers, and student dissertations in 2024. Early reporting indicates a substantive uptick in all these areas. We appreciated the support and enthusiasm of our Users’ Committee during our hosting, with HBT, of the annual UC meeting at our UF campus. Two workshops on high field magnets and quantum information science catalyzed many productive discussions of future directions for the MagLab.

**DC Field Facility**

* **Facility Accomplishments:**
  + Installation of new variable speed drives for the four 500HP magnet cooling water pumps.
  + Installation of a new 900HP magnet cooling water pump with associated variable speed drive.
  + Achieving a 94% helium recovery rate.
* **Personnel Accomplishments:**
  + Design and implementation of a multi-stage career ladder for engineering and technical staff to improve workforce retention and recruitment.
  + Hiring a new cryogenics engineer to lead the DC Field Facility Cryogenic operations group.
  + Hiring and training a new control room operator.
  + Hiring a new electrical engineer in the Electronics Shop.
* **User Science:**
  + Measuring the Fermi-Surface of the spin-triplet superconductor, UTe2, at low temperatures and high fields using the 32T all-superconducting magnet.
    - **Citation:** *Quasi-2D Fermi surface in the anomalous superconductor UTe* 2 , **Nature Communications**, **15**, 223 (2024) [**doi.org/10.1038/s41467-023-44110-4**](https://doi.org/10.1038/s41467-023-44110-4)
  + Using high field infrared spectroscopy to unravel the mysteries behind the magnetic field driven insulator-to-metal transition in Mn3Si2Te6.
    - **Citation:** Unconventional insulator-to-metal phase transition in Mn3Si2Te6, **Nature Communications** (2024) [**https://doi.org/10.1038/s41467-024-52350-1**](https://doi.org/10.1038/s41467-024-52350-1)
  + Understanding the complex electronic interactions responsible for materials properties using the structurally modulated superlattice SrTa2S5.
    - **Citation:** *Evidence of striped electronic phases in a structurally modulated superlattice*, **Nature** (2024), **doi.org/10.1038/s41586-024-07589-5**

**Electron Magnetic Resonance (EMR) Facility**

* **Facility improvements:** Received $3M worth of new hardware (two new magnets and a commercial pulsed EPR spectrometer) as part of the ongoing modernization of the EMR facility; also secured funding to support development of a unique and versatile pulsed wideband high-field EPR spectrometer identified in the recent NASEM report, Advancing Chemistry and Quantum Information Science.
* **Users:** Organized EPR symposia at several international conferences showcasing the remarkable research carried out by users of the EMR facility, which continues to be highlighted in high impact publications.
* **Personnel:** New hire, Tomas Orlando, received funding to support multiple projects, including a power upgrade and implementation of phase control on the EMR facility’s highest field pulsed EPR spectrometer and the development of new hyperpolarization methods for enhancing NMR sensitivity in heterogeneous systems.

**High B/T Facility**

* **Facility improvements:** At the start of January, the Blue Fors dilution refrigerator in Bay 1 of the Microkelvin Lab opened for user science up to 14 Tesla and down to 7 mK using pure 3He immersion cells.
* **Personnel:** In May, Sangyun Lee, who was a postdoc in the PFF at LANL, arrived at UF to become an Assistant Scientist, thereby filling the full-time scientific staff vacancy.
* **User Science:** In November, at the Users Committee Workshop hosted at UF, several speakers presented research results involving quantum phenomena in two-dimensional materials that emphasized the importance of immersion cells, along with filtering, to provide the unique combination of low electron temperatures in high magnetic fields.

**Ion Cyclotron Resonance (ICR) Facility**

* **Personnel:** Professor Kristina (Kicki) Hakansson from the University of Michigan was recruited to join the FSU Chemistry & Biochemistry Faculty and be the new ICR Facility Director. With Prof. Alan Marshall’s retirement, she is also a new co-PI on the NSF Cooperative Agreement. Furthermore, the ICR group hired Dr. Nathan Kaiser as Research Faculty III to strengthen instrumentation efforts.
* **Facility Upgrades:** Phase 2 of the front-end upgrade from a Velos Pro ion trap to an Eclipse state-of-the-art tribrid mass spectrometer (Thermo Fisher) on the flagship 21 Tesla FT-ICR instrument has been completed. This new configuration enables a suite of novel capabilities and delivers data in a format compatible with commercially available software for our users.
* **Research Output:** Research in the ICR Facility contributed to 42 publications in 2024. These publications span instrumentation, ICR fundamentals, complex mixture analysis, and biological applications. Two innovation disclosures on novel data analysis algorithms were also filed.

**Nuclear Magnetic Resonance/Magnetic Resonance Imaging (NMR/MRI) Facility**

* The construction, commissioning, and launch of a new, in-house built, dynamic nuclear polarization (DNP) magic-angle spinning NMR probe for the world-unique 600 MHz/395 GHz DNP NMR platform, with a 1.3 mm rotor size and three channels (HXY).
* The successful launch of the new 20.0T/850 MHz NMR spectrometer, plus one, in-house built 2.5 mm HX - this platform is dedicated largely to materials science and chemistry applications.
* We staged the first ever MagLab Summer School for Solid-State NMR Spectroscopy, aimed at graduate and undergraduate researchers (second edition will take place in 2025).

**Pulsed Field Facility (PFF)**

* Discovery of the Reverse Quantum Limit
  + An analogue of the quantum limit in metals, where very strong magnetic fields confine electrons to the lowest Landau level, has been discovered in the Kondo insulator YbB12. In an insulator, the Landau level filling is shown to take place in the reverse upon closing the gap with a magnetic field. (https://www.nature.com/articles/s41467-024-45801-2)
* Using 75T Pulsed Magnetic Fields to Detect Chern Pockets With Large Orbital Moments in CsV3Sb5
  + Pulsed magnetic fields of up to 75 T were applied at many different angles to a newly discovered metal, CsV3Sb5, in temperatures down to 0.5 K. Unusual oscillations in the metal’s electrical conductivity were found, giving definitive evidence of Chern pockets, a key indicator of a quantum mechanical property known as topology. Topology promises to be invaluable in future electronic devices that will work on completely new quantum principles. (https://www.nature.com/articles/s43246-023-00422-y)
* Potential Spin Liquid System Explored with Pulsed Magnetic Fields
  + MagLab users mapped out the regions in temperature and magnetic field in which different spin patterns form in Na2Co2TeO6. This compound is a candidate for spin liquid behavior that is expected to be manifested by the cobalt spins. A wide range of measurements in magnetic fields nailed down the different phases and the region of phase space that might be the sought-after spin liquid state. (https://journals.aps.org/prb/abstract/10.1103/PhysRevB.108.064421)

**Magnet Science & Technology (MST)**

* Completed first test of Large Scale Coil for 40 T all-superconducting design project.
* Developed higher-performing CuCrZr conductor for pulsed magnet production to replace CuAl whose supply of quality conductor was declining.
* Completed winding of 60 T CW pulsed coil and now setup for Vacuum-Pressure Impregnation to start in January 2025.

**Applied Superconductivity Center (ASC)**

* Oxford Instruments, in partnership with ASC and MagLab, construct and test first Bi-2212 HTS coil on path toward compact research magnets with unprecedented field.
* Private companies developing nuclear fusion for generation of electric power sign multiple contracts with ASC for testing and conductor development expertise.
* “Little Big Coil 4”, a model magnet that can be tested inside MagLab’s resistive 31 T magnets, achieves near-record 44 T by improved mitigation of manufacturing flaws in the HTS REBCO conductor.
* National Institute of Health selects ASC for development of frontier nuclear magnetic resonance systems with Oxford Instruments.

**Center for Integrating Research and Learning (CIRL)**

* 1600 5th-12th grade students received a tailored tour of the MagLab through fieldtrips led by CIRL’s Director of K12 Education, Carlos R. Villa. And an additional 100 students across middle, high school and college spent extended time with scientists at the MagLab to learn more about the research conducted here and for some to actually contribute to this research.
* CIRL’s Mentoring Director Dr. Kawana Johnson was awarded a $5,000 mini-grant from the ECMC Foundation, a national foundation working to improve postsecondary outcomes for underrepresented minority students and students from underserved backgrounds, to develop a CTE (Career & Technical Education) program at the MagLab that will occur in February 2025
* CIRL’s Director Dr. Roxanne Hughes was announced as an American Association for the Advancement of Science (AAAS) Fellow for her distinguished contributions to teaching and mentoring, particularly in understanding and fostering STEM identity development for women and underrepresented minorities in both formal and informal education environments.

**Public Affairs (PA)**

* Hosted a 2024 toy-themed Open House for more than 8,500 visitors. In addition to our classic demonstrations like the popular Quarter Shrinker, Potato Launcher, Human Levitator, and Cryogenic Ice Cream, the 2024 event invited visitors of all ages to come **channel their inner child and explore the science of toys and the creative fun that comes from play.** Special experiences included: a giant **PlayLab** that offered pretend play spaces inspired by MagLab labs that give kids the chance to put on their lab coats and play the role of a researcher; a classic **Lite Brite** that was used to explain the science of light; **Giant magnetic pioneer toys** - Fuzzy Faraday, Tousled Tesla & Coifed Conwell - inspired by Wooly Willie; **Barbie** was the basis for learning about chemistry and painting with pink pigments (plus dressing up like Scientist Barbie and taking photos in a Barbie Box); A special Lego-themed scavenger hunt took visitors around the MagLab to locate pieces for a mystery build.
* Calendar year 2024 stretches between two very successful school years and Science Night seasons. In 2024, we held seven Science Night events (Jan, Feb, March, April, Sept, Oct, Nov) for 675 children and parents who joined us to learn about MagLab science, experience hands-on STEAM activities and meet MagLab researchers. The 2023/2024 season results show that most student participants are elementary school aged and nearly 100% of participants leave supporting the statement that science is fun.
* Led tours for hundreds of visitors including 200 participants on our monthly public tours, as well as dozens of specialty tours for legislative spouses and staff, industry representatives, community leaders and other key stakeholders.