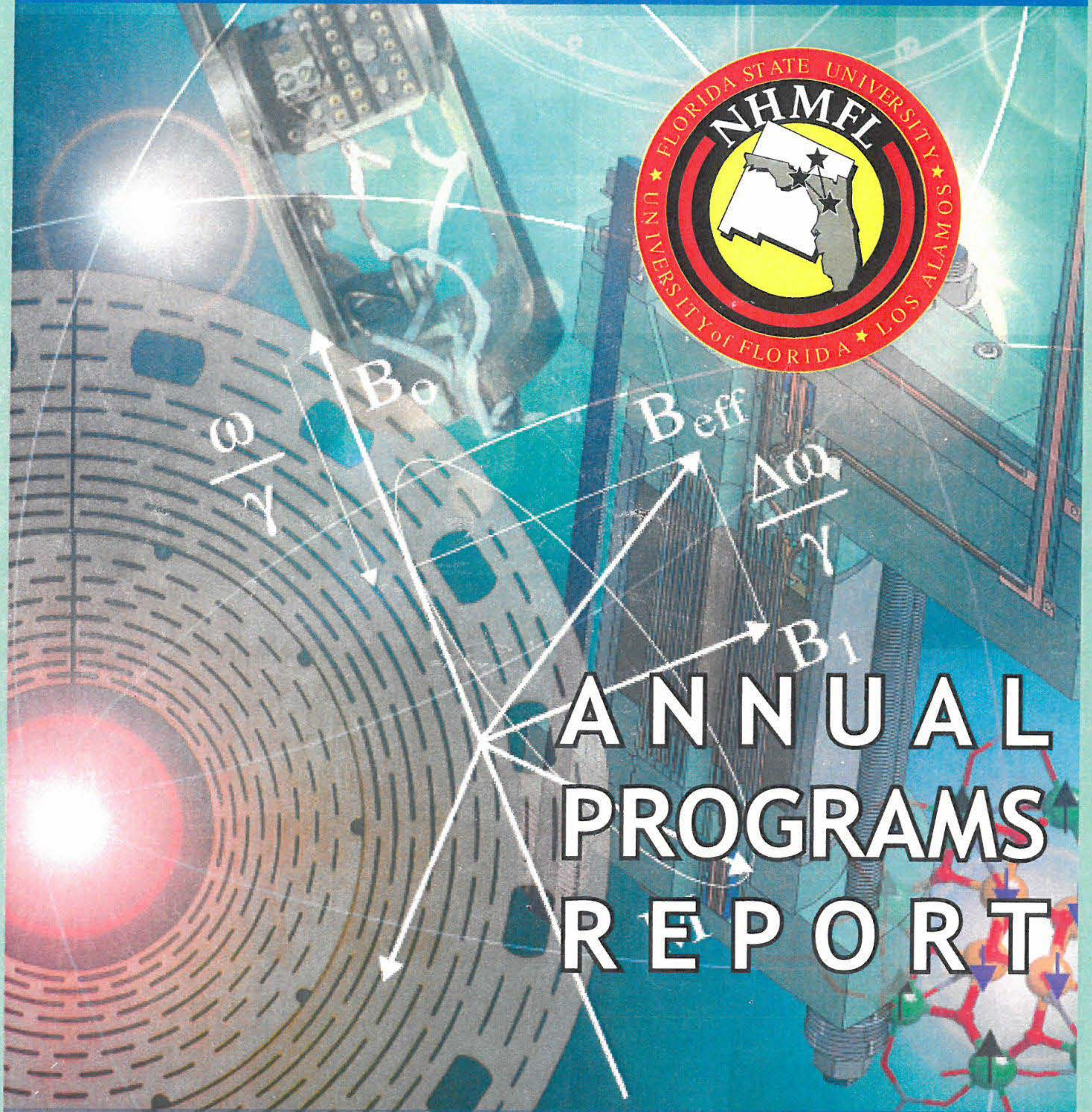
NATIONAL HIGH MAGNETIC FIELD LABORATORY

2003



ANNUAL PROGRAMS REPORT

OPERATED BY: FLORIDA STATE UNIVERSITY • UNIVERSITY OF FLORIDA • LOS ALAMOS NATIONAL LABORATORY

2003 Annual Programs Report

of the

National High Magnetic Field Laboratory

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1. INTRODUCTION—*YEAR IN REVIEW*

The year ***2003*** was an extremely active and productive one for the National High Magnetic Field Laboratory. User activity continued to be strong at all facilities—the DC Field, NMR, ICR, EMR, and Geochemistry Facilities at Florida State University in Tallahassee; the High B/T and Advanced Magnetic Resonance Imaging Facilities at the University of Florida in Gainesville; and the Pulsed Field Facility at Los Alamos. External researchers and NHMFL faculty published 5 articles in *Nature*, 5 in the *Journal of Magnetic Resonance*, 4 in *Science*, 4 in the *Journal of American Chemical Society*, and 28 in *Physical Review Letters*. More than 370 peer-reviewed publications, covering a wide range of science and engineering disciplines, were reported for the year.

A four-year summary of the number of research reports by NHMFL users and affiliated faculty is presented in the table on the right. These brief reports are published in a companion document, the *2003 NHMFL Annual Research Review*. A review of the reports indicates broad collaborative activities among users and in-house scientists, which helps to ensure broad benefit to the scientific communities of the unique facilities of the laboratory. At least 41 of the 372 research efforts were supported in some part by the NHMFL In-House Research Program.

Research Report Categories	2000	2001	2002	2003	Total
Biochemistry	-	-	-	44	44
Biology	47	49	54	27	177
Chemistry	27	31	39	27	124
Cryogenics	5	5	3	6	19
Engineering Materials	6	5	10	12	33
Geochemistry	13	10	13	12	48
Instrumentation	16	10	9	10	45
Kondo/Heavy Fermion Systems	19	21	26	24	90
Magnet Technology	6	7	17	4	34
Magnetic Resonance Techniques	19	24	24	32	99
Magnetism and Magnetic Materials	36	45	48	50	179
Metal-Insulator Transitions	-	-	-	6	6
Molecular Conductors	19	24	27	23	93
Other Condensed Matter	10	13	15	19	57
Quantum Fluids and Solids	3	6	4	6	19
Semiconductors	27	32	38	30	127
Superconductivity - Applied	16	11	32	13	72
Superconductivity - Basic	26	29	21	27	103
Total	**295**	**322**	**380**	**372**	**1369**

New instrumentation and techniques are critical to the success of all user facilities. For example, at the NHMFL Pulsed Field Facility, a new experimental technique of ultra-fast, coherent THz spectroscopy for measurement of high frequency complex conductivity in the range from 100 GHz to 2000 GHz was developed. Magic angle spinning probes developed in Tallahassee have made it possible to do solid state NMR in resistive and hybrid magnets up to 40 T, and continue to expand the range of experimental capabilities of the spectrometers based on persistent superconductive NMR magnets. The world-class MRI facilities in Gainesville are supporting some rich science, including the first images of single living cells. New ultrafast pulse optics facilities at the DC Facility in Tallahassee have been used to study exciton kinetics in InGaAs quantum wells.

The laboratory completed fabrication and bucket testing of the 900 MHz NMR magnet, which will be one of the world's largest bore, high resolution NMR system at this field strength. In April 2003, the 16 ton, 900 MHz magnet was moved from its assembly/testing site to a specially designed location in the NMR building that will provide an excellent, safe environment and easy user access. Its final cryostat was then assembled around the magnet and raised onto the vibration isolation stand.

The NHMFL 45 T Hybrid continuous field magnet operates routinely for users approximately nine months of the year. User demand for the Hybrid is high, and magnet time is allocated by a very competitive proposal process.

In August, 2003, researchers at the NHMFL, in collaboration with Oxford Superconducting Technology, Inc., successfully tested an innovative 5 T high temperature superconductor insert coil in a 20 T powered magnet. This test represents the first time that a superconducting magnet has ever generated magnetic fields approaching 25 T.

Education underpins all activities of the laboratory, and opportunities are offered for students, as well as for the general public. Two signature programs, *Research Experiences for Teachers* and *Research Experiences for Undergraduates*, attract an ever-increasing number of highly qualified applicants. Participants are fully integrated into research activities during the summer and return to classrooms excited about science.

2003
Research Experiences for Undergraduates

2003
Research Experiences for Teachers

2. USERS PROGRAMS

The strength and success of NHMFL users programs and facilities are carefully built around the synergies of the highest field magnets, unique instrumentation, and strong supportive services of faculty and staff. The narratives in this chapter describe the measurement capabilities of each facility with special emphasis on magnet systems, instruments, and techniques that were new in 2003. The tables list magnet systems and illustrate the amount of user activity. Appendix A shows the breadth of research activity by users of the NHMFL.

GENERAL PURPOSE DC FIELD FACILITIES–TALLAHASSEE

The DC magnetic field facility at the NHMFL's headquarters in Tallahassee provides the user community with the strongest and quietest DC and slowly varying magnetic fields in the world. The magnet systems are coupled with state-of-the-art instrumentation. Expert experimental staff members provide scientific and technical support to researchers using the DC facilities.

Figure 1. Tim Murphy installs portable dilution refrigerator into 33 T magnet at the DC Field Facility.

Several major systems provide a broad magnetic field-temperature-pressure-angle-frequency "parameter space" to researchers. Two dilution refrigerators offer 20 mK to 40 mK base temperatures in fields up to 20 T in a superconducting magnet and up to 45 T in the Hybrid magnet. Diamond anvil high-pressure cells permit optical and transport measurements to 20 GPa at temperatures from 20 mK to 350 K. Larger volume metallic piston cylinder cells can be used for similar experiments in pressures to 2 GPa and temperatures down to 40 mK. Magneto-optical measurements can cover wavelengths from the near ultraviolet to far-infrared. Non-optical measurements of transport properties can be done at DC through audio frequency AC to millimeter and microwave frequencies. Magnetic properties of materials can be measured optically, by AC susceptibility, cantilever force and torque, and vibrating sample magnetometry. Nuclear magnetic resonance, electron magnetic resonance (both spin and cyclotron resonance), and the new sub/millimeter wave spectroscopy facility provide unique insights into materials, including many of interest to biologists and chemists. Sample rotators allow researchers to vary not only the amplitude of the applied magnetic field but also its angle with respect to the sample. NHMFL staff members often help visitors develop new instruments for unique experiments not possible with the general purpose instrumentation that is kept on hand for everyone.

The research in the DC general-purpose facility is supported by eight magnet plant and cryogenic system operators and mechanical, electronic, and computer engineers and technicians. Twelve scientists and an engineer whose specialties cover the kinds of measurements needed for most of the science done at the NHMFL work directly with users. Other members of the NHMFL's scientific staff and faculty also support the user program by developing instrumentation and collaborating with visitors.

Computer hardware and software at the NHMFL allow any member of a research group to connect directly to the experimental areas at all three NHMFL sites. Collaborators far from the NHMFL facilities can view data and modify experimental strategies "live" during the magnet runs.

Further information on the facilities and services available to users of the continuous field, general purpose magnets can be obtained by contacting Bruce Brandt at 850-644-4068 or *brandt@nhmfl.gov,* or by viewing *http://www.magnet.fsu.edu/users/facilities/dcfield/.*

Table 1. Magnet Systems for Users of the Continuous Field Facility, Tallahassee, as of January 2004

RESISTIVE and HYBRID MAGNETS		
Field (T), Bore (mm)	**Power (MW)**	**Supported Research**
45, 32	32	Magneto-optics – ultra-violet through far infrared, Magnetization, Specific heat, Transport – DC to microwaves, High Pressure, Temperatures from 40 mK to 1500 K, Dependence of optical and transport properties on field, orientation, etc. Low to medium resolution NMR, EMR, and sub/millimeter wave spectroscopy.
33, 32	20	
32, 32	20	
30, 32	18	
25, 32 to 50[1]	15.7	
25, 52[2]	19	
24.5, 32[2]	13.1	
20, 195	20	

SUPERCONDUCTING MAGNETS		
Field (T), Bore (mm)	**Temperature**	**Supported Research**
18/20, 52	20 mK – 2 K	Magneto-optics – ultra-violet through far infrared, Magnetization, Specific heat, Transport – DC to microwaves, High pressure, Temperatures from 20 mK to 300 K, Dependence of optical and transport properties on field, orientation, etc.
18/20, 52	0.3 K – 300 K	
17.5, 47[3]	4 K – 300 K	
15, 45	10 mK – 1 K	

1 32 mm bore tube supports a coil for modulating the magnetic field.
2 Higher homogeneity magnet.
3 Special system for optical measurements.

Highlights of Research and New Instrumentation for Users of the Continuous Field General Purpose Magnets

- **A new Oxford 18/20 T superconducting magnet has replaced the one labeled SCM2.** It will be equipped with a top-loading ^{3}He refrigerator and a variable-temperature insert. The combination will support measurements between 270 mK and 310 K. This magnet may also be used for certain far-infrared experiments.
- **^{3}He refrigerators for ≤350 mK have been delivered by Janis Research and tested.** They add to the low temperature capabilities of the lab, providing more readily available alternatives to the dilution refrigerators.
  - System ^{3}He-A allows top-loading of the sample into the liquid ^{3}He in the 18/20 T superconducting magnet. It has a base temperature of 270 mK and can provide sample temperatures to 300 K.
  - System ^{3}He-B allows top-loading of the sample into the liquid ^{3}He in the 50 mm bore resistive magnets.
  - System ^{3}He-C provides temperatures down to 350 mK in the 32 mm bore Bitter and Hybrid magnets. The sample is mounted in vacuum from the bottom of the refrigerator. This configuration allows low temperature heat capacity and other thermal measurements. It will also make some variable temperature experiments easier.
- **Ultrasound Spectroscopy is being supported by Alexei Souslov, a new scientific staff person.**
  - Two ultrasonic techniques, the pulse-echo transmission technique and resonant ultrasound spectroscopy, will allow users to study elastic properties of matter in magnetic fields near metamagnetic and phase transitions, for example.
  - These techniques provide information about the electron and magnetic systems of studied solids by revealing information about electron-phonon and magnon-phonon interactions.
  - The combination of these ultrasonic techniques with other experimental methods will allow users to carry out acousto-optic or high hydrostatic pressure measurements in strong magnetic fields.

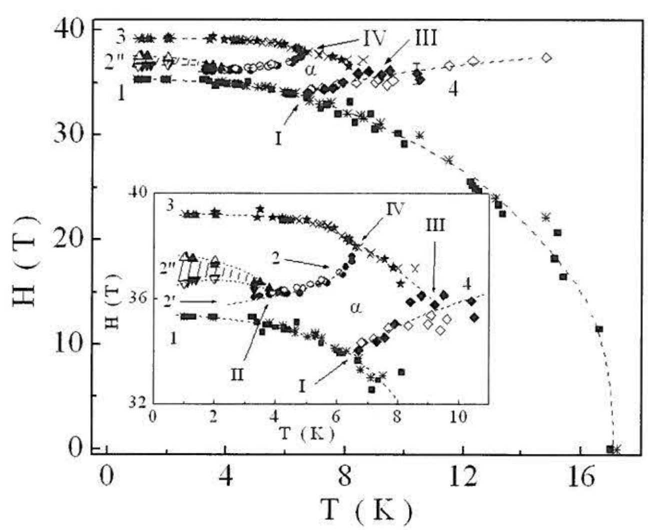


Figure 2. H-T phase diagram for URu_2Si_2. This phase diagram was derived mainly from magnetization and ultrasound velocity measurements. The inset shows the hysteresis in the transition labeled 2". The work has been published in: Suslov, A., *et al.*, H-T phase diagram of URu_2Si_2 in high magnetic fields, *Phys. Rev. B*, **68**, 020406, 2003.

- **Ultra-fast Pulse Optics Facilities have been developed through an IHRP grant to Chris Stanton and David Reitze of the University of Florida.** The main instrumentation consists of a chirped pulse amplifier (CPA), an optical parametric amplifier (OPA), and a Ti:sapphire laser. It is capable of probing over an energy range of 0.06 to 4.0 eV with 150 fs time resolution. Sample temperatures can be controlled between 4.2 K and 300 K. The maximum magnetic field is now 25 T, and will be upgraded to 32 T in the second quarter of 2005. The facilities will be used for magneto-exciton spectroscopy, "quantum optics" of excitons, spin relaxation characterization, quantum information science, and novel coherent control methods in high magnetic fields.

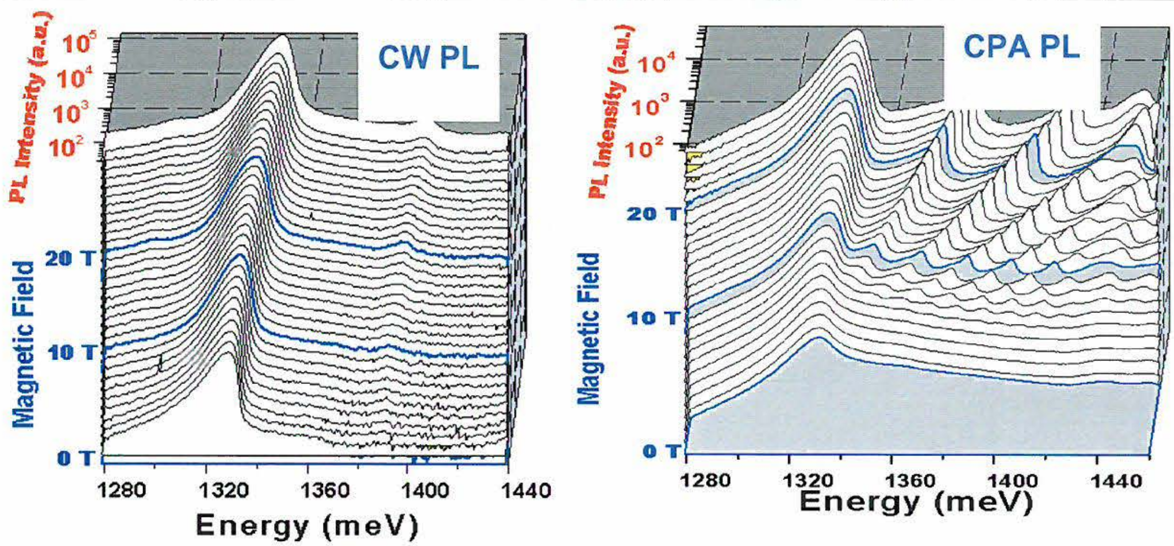


Figure 3. Both linear 632 nm ("CW PL") and 775 nm fs-pumped ("CPA PL") magneto-photoluminescence from undoped InGaAs quantum wells from 0 to 25 T at the same average powers. The dramatic difference in the PL spectra and the appearance of multiple Landau levels in the CPA-pumped case may arise from the inability of hot carriers to relax and scatter during the pump pulse.

  - **Magneto-Photoluminescence from Highly Excited Quantum Wells**. The CPA and OPA have been used for magneto-photoluminescence studies of undoped InGaAs quantum wells in high magnetic fields. The extremely high intensities of the CPA and OPA permitted probing of the properties of highly energetic electron-hole pairs in quantizing magnetic fields.

- **Radiation-Emitting Quantum Nanostructures. Instrumentation is being developed by Dmitri Smirnov, a new scientific staff person.** Mid-infrared light emission from nanostructures can now be measured as a function of sample current. Current-voltage characteristics of the samples can also be determined. The wavelength range covered is 5 to 30 μm, and the temperature range is 4.2 K to 300 K. The measurement range is being extended so that far-infrared (THz) frequencies should be accessible by early 2005. This line of research and instrumentation development will allow and include the study of inter-subband transitions in nanostructures and should lead to the development of new materials and designs for infrared and THz sources.

- Other improvements to instrumentation during 2003:
  - Two new Lake Shore Cryotronic model 370 AC resistance bridges are available for low power resistance measurements.
  - The existing temperature controllers are being replaced with Lake Shore Model 340 and Cryo-Con Model 62 controllers.
  - Piston cylinder pressure cells capable of pressures in the range of 2 to 3 GPa are now available.
  - More leads were added to the standard far-infrared spectroscopy probe and one user did simultaneous measurements of sample resistance and infrared absorption.

Planned Improvements

- Cells 3 and 5 are being modified to serve as "optics cells".

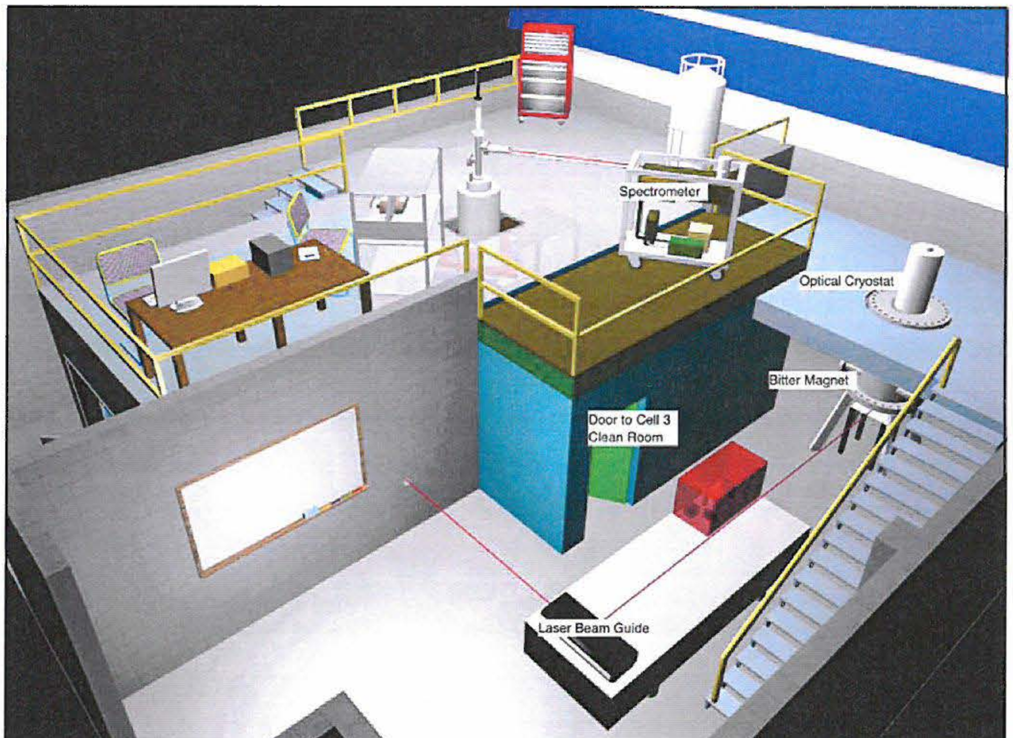


Figure 4. View of cells 3 and 5 with the new platform covering the clean room in cell 3.

- A 17.5 T superconducting magnet with optical windows in the bottom of the cryostat is being installed on a stand in cell 3. It will allow direct access optics experiments from below and either far infrared or sub/millimeter wave spectroscopic measurements from the top.
- A mezzanine floor is being installed to provide a clean, climate controlled environment for the fast pulse optics mentioned above, as well as access to the top of the superconducting magnet.
- Holes in the wall between cells 3 and 5 will allow direct optical access to a cryostat in the cell 5 magnet.

- The 50 mm bore resistive magnet in cell 5 will remain accessible for non-optics experiments. It provides 25 T now and will be upgraded to ~32 T by the second quarter of 2005.
- A platform in cell 3/5 will provide a stable base for the Bruker Far Infrared Spectrometer from which it will be able to access the 17.5 T superconducting magnet in cell 3 and the 25 T, 50 mm bore resistive magnet in cell 5.
- A Bruker model 66v FT-IR spectrometer will be delivered in early 2004. It updates the existing model 112v, is much more portable, and will be used for experiments in cells other than 3 and 5.
- Several microcalorimetry techniques and instrumentation are being developed in collaboration with users with funding from the State of Florida Visitors' Program and the IHRP.
- The President of Florida State University and the Governor of Florida have supported the NHMFL's request for several million dollars to renew and upgrade the resistive magnet power supplies and cooling water systems. If approved by the legislature, the funds will become available in the fall of 2004. The NHMFL has a prioritized list of improvements that have been discussed with and approved by the Users' Committee.

Table 2. DC Facility User Statistics for 2003 (1/1/03 – 12/31/03)

User and Project Data	Total	Minority	Female
Number of Research Projects	108	4	7
Number of Senior Investigators, U.S.	154	4	8
Number of Senior Investigators, non-U.S.	45	0	5
Number of Students, U.S.	61	10	9
Number of Students, non-U.S.	17	NA	0
Number of Postdocs, U.S.	28	0	1
Number of Postdocs, non-U.S.	5	NA	1

Table 3. DC Facility Operations Statistics for 2003 (1/1/03 – 12/31/03)

Number of Magnet-Days	Resistive	Superconductor
NHMFL, UF, FSU, FAMU, LANL	337	199
U. S. University	218	222
U. S. Govt. Lab.	18	14
U. S. Industry	16	0
Non-U.S.	141	80
Test, Calibration, & Maintenance	16	113[1]
Idle	3	21
Total:	**749**	**649**

1 This figure was higher than usual this year because we purchased and installed a new magnet and moved an old one to a new location.

NHMFL PULSED FIELD FACILITY—LOS ALAMOS

The unique NHMFL Pulsed Field Facility experimental capabilities and in-house scientists continue to drive the world's science in pulsed magnetic fields. During 2003, NHMFL – Los Alamos researchers and collaborators have published in *Physical Review Letters* (4 articles), the *Journal of Low Temp. Physics* (2), *Nature* (2), and *Science* (1). Table 4 summarizes the NHMFL-Los Alamos experimental capabilities and magnets. More information and guidelines for proposal submission can be found at: *http://www.lanl.gov/mst/nhmfl/*

Additional information on magnets, instrumentation, and personnel, as well as the Research Proposal Form maybe obtained by contacting Charles H. Mielke at *cmielke@lanl.gov* or 505-665-1500.

Figure 5. Users prepare for a liquid Helium transfer in cell 2 where the 50 T "mid-pulse" magnet is in operation. Due to the high volume of requests for use of this magnet system a second "mid-pulse" is now installed in cell 1.

Table 4. Summary of Scientific Capabilities at the NHMFL Pulsed Field Facility

CAPACITOR-BANK-DRIVEN MAGNETS	
Field (T), Duration, Bore (mm)	**Supported Research**
Cell#1: 50 T Short Pulse, 25 msec, 24 mm Cell#1: 50 T Mid-Pulse, 400 msec, 15 mm Cell#2: 40 T Mid-Pulse, 400 msec, 24 mm Cell#2: 50 T Mid-Pulse, 400 msec, 15 mm Cell#3: 60 T Short Pulse, 25 msec, 15 mm Cell#4: 65 T Short Pulse, 25 msec, 15 mm Cell#5: 60 T Short Pulse, 40 msec, 9.8 mm Cell#6: Test Cell 100kA peak current	Magneto-optics (IR through UV), magnetization, and magneto-transport from 350 mK to 300 K Pressure from 10 kbar typical, up to100 kbar 60 T Long Pulse Magnet *to return to service in 3rd quarter 2005. See the Magnet Science and Technology section for details.*
SUPERCONDUCTING MAGNETS	
Field (T), Bore (mm)	**Supported Research**
20 T magnet, 52 mm	Same as pulsed fields, plus thermal-expansion, specific heat, and 20 mK to 600 K temperatures
15 T magnet, 52 mm	Heat Capacity, THz
14 T-PPMS magnet	Resistivity, Heat Capacity

Status of the 60 T Long Pulse (60T-LP) and the 100 T Multi Shot (100T-MS) Magnet Projects

Everson-Tesla has been selected as the follow-on vendor to complete the 60T-LP and 100T-MS coil winding efforts. A team of NHMFL engineers has already visited Everson-Tesla and set the schedule for the coil fabrication. Important progress has also been made on the 100T-MS insert magnet, as a result of this important R&D initiative the short pulse magnets have been upgraded to the 65 T level.

Figure 6. The 100 T magnet project's 2 mega-Joule capacitor bank is being built and will be operational in the spring of 2004.

The 300 T Single-Turn Project

Recently, the Department of Energy funded a 300 T single-turn magnet project through LANL. This project began in October 2002. The principal objective of the project is to unravel the puzzling electronic properties of plutonium with a state-of-the-art phase sensitive GHz detection system. Theoretical models predict that the structural phases of plutonium could be altered with intense magnetic fields. The facility will enable actinide measurements in a controlled atmosphere. 60 T pulsed fields are expected to become operational in the spring of 2004, while the 300 T fields are expected in the summer of 2004.

Figure 7. The single-turn magnet containment tank will house the 55 T pulsed magnet (milli-second duration) and the 300 T (micro-second duration) magnet system. The containment tank provides a safety barrier and control device for experiments on actinides and actinide compounds.

Capabilities of the Pulsed Field Facility, Illustrated by Scientific Highlights

The strongly correlated f-electron system, URu_2Si_2 has attracted considerable attention owing to the existence of an enigmatic hidden order parameter, and also because of its unusual metamagnetic properties at high magnetic fields. The energy scales for the hidden order and metamagnetism are comparable. Neil Harrison (NHMFL-LANL), Kee-Hoon Kim (NHMFL-LANL Postdoctoral Fellow), Marcelo Jaime (NHMFL-LANL) in collaboration with John Mydosh (Leiden University, The Netherlands and the Max Planck Institute, Dresden – Germany) experimental work utilizing the 45 T Hybrid and the 60 T Short Pulse magnets revealed unseen high field properties. Figure 8 shows a color intensity plot of the magnetic susceptibility of URu_2Si_2 measured in pulsed magnetic fields (using the mid-pulse magnet). Symbols denote phase transitions and/or crossovers. These susceptibility measurements show that the hidden order phase is destroyed before appearing in the form of a re-entrant phase between 36 T and 39 T. Evidence for conventional itinerant electron metamagnetism at higher temperatures suggests that the re-entrant phase is created in the vicinity of a quantum critical end point. The existence of a quantum critical point has recently been confirmed by electrical resistivity measurements (Kim, *et al., Phys. Rev. Lett.*, **91**, 256401 (2003)).

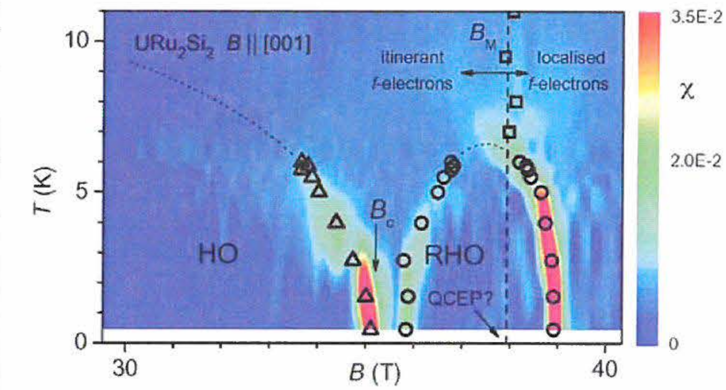


Figure 8. Susceptibility contour plot of URu_2Si_2 at high magnetic fields. Cover page of *Phys. Rev. Lett.*, **90**, 096402 (2003).

After almost two decades since the discovery of high temperature superconductors, the mechanism of high temperature superconductivity is not yet established. In fact, the origin of superconductivity in the cuprates remains a central controversy in condensed matter physics. Fedor Balakirev's (NHMFL-LANL) pulsed magnetic field research, in collaboration with Y. Ando's group (Central Research Institute of Electric Power Industry - Tokyo, Japan), will help the understating of the unconventional nature of the normal state of high temperature superconductors. Among the various normal state properties that have often proved to be unlike most metals, the Hall effect has been notoriously difficult to understand. Balakirev's development of a reliable Hall effect measurement in pulsed high magnetic fields is central to bringing necessary details of the Hall coefficient forward. Achieving this in pulsed high magnetic fields (to 65 T) is necessary as the superconducting state must first be suppressed to reveal the normal state metal at low temperatures where thermal broadening is less severe.

A startling evolution of the low-temperature Hall coefficient in the normal state of the high-temperature superconductor $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ as a function of temperature and hole doping, p, by suppressing high-temperature superconductivity with an intense magnetic field was revealed. The low temperature Hall number per unit cell, $n_{Hall} \equiv V_{cell}/eR_H$, is found to increase rapidly from nearly zero value at the onset of the high-temperature superconducting state (p=0.10) to approximately one hole per unit cell near optimal doping (p=0.16) corresponding to roughly 7 carriers per each hole introduced with doping. At about the same hole doping level where superconductivity is most robust, n_{Hall} variation with doping exhibits a sharp change suggesting that two competing ground states underlie the high temperature superconducting phase.

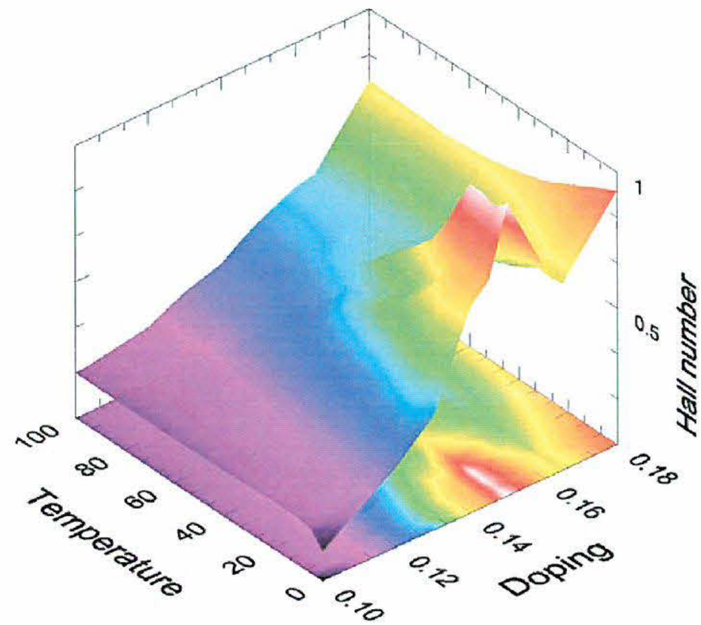


Figure 9. Plot of the Hall number, $n_{Hall} \equiv V_{cell}/eR_H$, as a function of temperature and doping. While the high temperature data shows a monotonic evolution of $n_{Hall}(p)$ with increasing doping, upon cooling to ~50 K the anomalous cusp at p=0.15 becomes apparent. It takes an extremely high magnetic field to suppress the superconductivity and reveal a clear signature of a phase transition in the normal state in the zero temperature limit. (*Nature,* **424**, 912 (2003).

Measurement of the frequency response of important physical quantities has always played a central role in modern science. Implicit in such measurements is an information-theory limit on the rate at which data may be acquired because one must "count" a sufficient number of cycles to determine frequency adequately. In many static measurements, this is not only easy but provides useful signal averaging with a concommitant reduction in noise. At the NHMFL-LANL pulsed magnet facility, however, we do not have the luxury to take our time because the magnetic fields last only milliseconds. Accordingly, we have developed techniques in the GHz (Figure 10: R. McDonald (NHMFL-LANL Postdoctoral Fellow) and C. H. Mielke (NHMFL-LANL)); THz (Figure 11: S. Crooker (NHMFL-LANL)); and RUS (Figure 12: A. Migliori, and J. Betts (NHMFL-LANL) and A. Souslov (NHMFL-Tallahassee)) range for electronic transport, where careful attention to experimental design enables rapid frequency-domain studies in high magnetic fields. In addition, we have developed slower, high-precision techniques in the MHz range for studies of sound speeds and attenuation of magnetic materials in multi-tesla superconducting magnets for the first time.

Figure 10. All dielectric photonic band gap resonator: tunable between 45 and 65 GHz. Development of this device is funded by the NHMFL In-House Research Program.

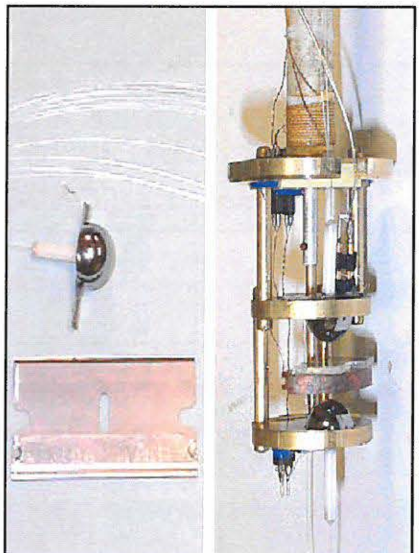


Figure 11. A miniaturized, fiber coupled THz antenna, for use directly in the cryogenic bore of high-field magnets. (right) the low-temperature, high-field THz probe.

Figure 12. RUS (Resonant Ultrasound Spectroscopy. Temperature range 290 mK to 350 K.

Table 5. NHMFL-Los Alamos Facility User Statistics for 2003 (1/1/03 – 12/31/03)

User and Project Data	Total	Minority	Female
Number of Research Projects	119	N/A	N/A
Number of Senior Investigators, U.S.	42	3	3
Number of Senior Investigators, non-U.S.	10	N/A	0
Number of Students, U.S.	20	1	3
Number of Students, non-U.S.	6	N/A	2
Number of Postdocs, U.S.	66	1	8
Number of Postdocs, non-U.S.	6	N/A	0

Table 6. NHMFL-Los Alamos Facility Operations Statistics for 2003

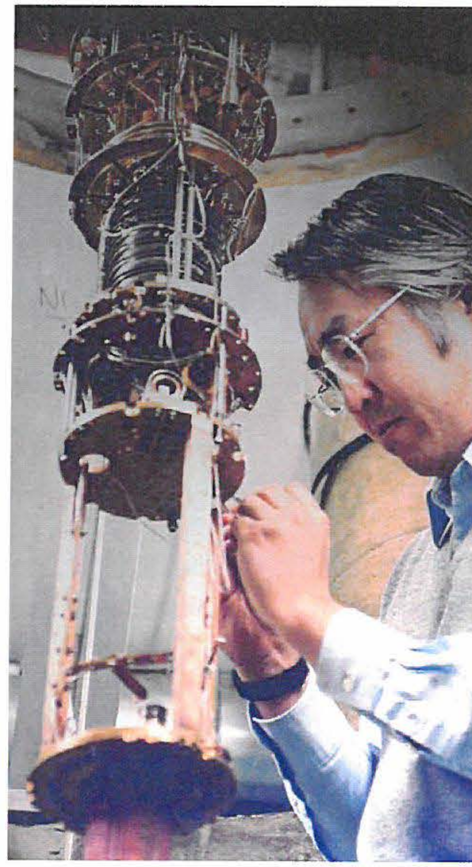
Number of Magnet Days	SC Magnets*	Cell 1**	Cell 2**	Cell 3,4**	Total
NHMFL	261	15	10	44	**330**
LANL	105	21	51	28	**205**
Other Nat'l Labs	60	0	5	21	**86**
U.S. University	101	15	25	30	**171**
Industry	23	0	0	0	**23**
Non-U.S.	29	12	50	10	**101**
Total	**579**	**63**	**141**	**133**	**916**

*SC Magnets include: 1) 100% of a 20 T SC magnet's usage
2) 50% of a 15 T SC magnet's usage
3) 20% of a 14 T PPMS magnet's usage

Cell #1 contains a 50 T short pulse magnet
Cell #2 contains a 50 T mid-pulse magnet
Cell #3 contains a 60 T short pulse magnet
Cell #4 contains 65 T short pulse magnets

**8 Days of magnet time in Cells 1, 2, 3 and 4 were lost due to capacitor bank failures (aging capacitors) in 2003.

HIGH B/T FACILITY–GAINESVILLE



The NHMFL High B/T Facility at the University of Florida is operated as part of the Microkelvin Laboratory, which is located in the Physics Department at the University of Florida. The Facility is designed to meet the needs of NHMFL users who wish to conduct experiments in high magnetic fields (currently up to 15.2 T) and at very low temperatures (down to 0.4 mK) simultaneously. Faculty members in the facility work with users in the design of experiments where needed. Instrumentation is available for studies of magnetization, thermodynamic quantities, transport measurements, magnetic resonance, viscosity, diffusion and pressure. The facility is housed in an ultra-quiet environment with "tempest" quality electromagnetic shielding and vibration isolation of the experimental station to permit high sensitivity measurements.

Access to the facility is through submission of a proposal that is evaluated by the High B/T Facility staff. The use of the High B/T Facility is restricted to experiments that need the special low temperature and high field configurations. Experiments needing higher temperatures should contact Bruce Brandt at *brandt@magnet.fsu.edu*. Many of the experiments require special assemblies and direct interaction with personnel on site, as well as having need for long running times. Prospective users should contact the facility manager and resident research scientist, Dr J.S. Xia (352-392-8871, *jsxia@phys.ufl.edu*), and E. Dwight Adams (*adams@phys.ufl.edu*), or Neil S. Sullivan (sullivan@phys.ufl.edu), well in advance.

Instrumentation and Services Update

By using the specially designed cooling system, the fractional quantum Hall effect (FQHE) state at the even-denominator $\nu = 5/2$ in a single heterojunction of GaAs/AlGaAs has been carefully measured. A very complex electronic transport behavior in the second Landau level, showing repeated switching between various quantum phases, has been observed. For example, the even-denominator FQHE state at $\nu = 5/2$ is very strong and its energy gap is determined to be ~ 0.45 K, the largest measured so far. Immediately after $\nu = 5/2$, a reentrant integer quantum Hall effect (RIQHE) state is observed. What is more interesting is that at low temperatures this RIQHE state is split into two plateaus and, at same time, R_{xx} shows a series of R_{xx} dips at ν = 2+2/7, 2+12/43, 2+8/29, 2+3/11, indicating a more complicated reentrance. The detailed results are shown in Figure 13.

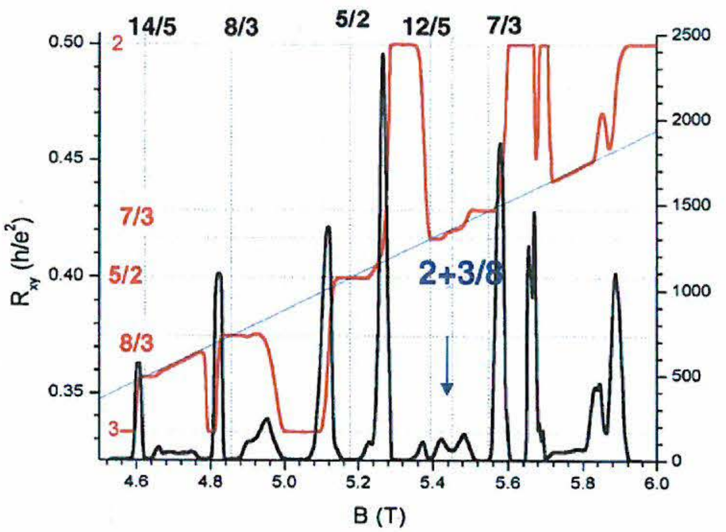


Figure 13. R_{xx} and R_{xy} obtained at T = 9.0 mK with density n = 3.1 x 10^{11} cm^{-2} and mobility μ = 31 x 10^{6} cm^{2}/Vs.

Recently we carried out high frequency (~9 MHz) shear impedance measurements on superfluid ^{3}He confined in 98% porosity silica aerogel at ultra-low temperatures (down to 1.7 mK) and high magnetic fields (up to 15.82 T). The aerogel is grown inside the acoustic cavity formed by two quartz transducers (developed by W.P. Halperin's group at Northwestern University). Using 8.69 MHz continuous wave excitation, and combining a vibrating wire viscometer, the A_1-A_2 transitions of superfluid ^{3}He (both in bulk and confined in aerogel at cell pressures of 28.5 and 33.5 bar) were systematically studied. The results provide the first confirmation of the A_1 phase in superfluid ^{3}He in aerogel at low mK temperatures and high magnetic fields.

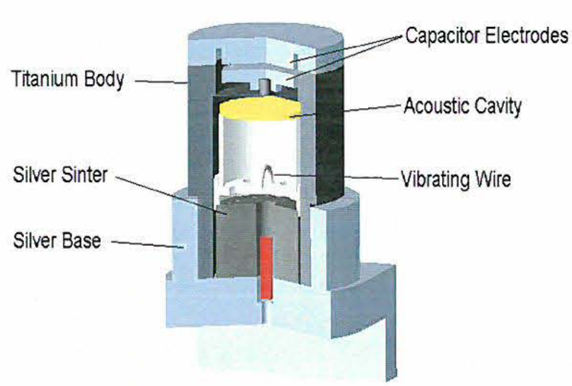


Figure 14. Experimental set up for acoustic measurement.

Goals and Future Plans

Current capabilities allow experiments to be conducted to temperatures as low as 0.4 mK and magnetic fields up to 15.2 T (16.5 T if the superconducting magnet is operated at 2.2 K). The highest priority for the High B/T facility in the near term is to replace this magnet with one capable of reaching 21 T. Our long term goal is to achieve a 25 T capability. That will include a 21 T conventional superconducting magnet with a 25 mm ID experimental volume and a high-T_c insert capable of bringing the full field above 25 T with a 12.5 mm experimental access.

The specifications of the 20+ T magnet system, including full 3 magnets ($\geq$8 T demagnetization magnet, $\geq$5 T active shielding magnet, and $\geq$20 T experimental high field magnet) have been sent out to qualified manufacturers for bidding. Some complete design and collaboration proposals have been received and reviewed.

Table 7. New Instrumentation at the High B/T Facility

Equipment	Feature	Usage
Kapton Capacitance Thermometer	Low temperature High magnetic field	Thermodynamic measurements in high magnetic fields
Capacitance Pressure Transducer	Very high sensitivity Wide range	Pressure measurement at low temperature in high magnetic fields

Table 8. High B/T Facility User Statistics (1/1/03 through 12/31/03)

	Total	Minority	Female
Number of Research Projects	2		
Number of Senior Investigators, U.S.	11		
Number of Senior Investigators, non-U.S.			
Number of Students, U.S.	4		
Number of Students, non-U.S.	2		
Number of Postdocs, U.S.	3	1	
Number of Postdocs, non-U.S.			

Table 9. High B/T Facility Operations Statistics (1/1/03 through 12/31/03)

Number of Magnet-Days	Number Per Category	Percent of Total
NHMFL, UF, FSU, FAMU, LANL	281	77%
U. S. University	41	11%
U. S. Govt. Lab.		
Industry		
Non-U.S.		
Experiment setup & Maintenance	43	12%
Idle		
Total	**365**	**100%**

CENTER FOR INTERDISCIPLINARY MAGNETIC RESONANCE (CIMAR)

The NHMFL's Center for Interdisciplinary Magnetic Resonance supports a broad range of research in the biological, chemical, and physical sciences, as well as cross-disciplinary programs in areas like environmental science. The techniques available to users include nuclear magnetic resonance (NMR), magnetic resonance imaging and spectroscopy (MRI/S), electron magnetic resonance (EMR), and Fourier transform ion cyclotron resonance mass spectrometry (ICR). Cross-fertilization among the four fields is a unique feature of the Center that is facilitated by broadly based external and internal users programs.

Table 10. CIMAR Facilities in Tallahassee, as of January 2004

MAGNETIC RESONANCE SYSTEMS in Tallahassee			
NMR Frequency	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
1.7 GHz	40, 32	10 ppm	Solid State NMR
1066 MHz	25, 52	1 ppm	Solid State/Solution NMR
900 MHz+	21.1, 105	1 ppb	Solid State/Solution NMR, MRI
830 MHz	19.6, 31	100 ppb	Solid State/Solution NMR
720 MHz	16.9, 50	1 ppb	Solution NMR
600 MHz	14, 89	1 ppb	MRI and Solid State NMR
600 MHz	14, 52	1 ppb	Solution State NMR
500 MHz	11.75, 50	1 ppb	Solution State NMR
400 MHz	9.4, 89	1 ppb	Solid State NMR
400 MHz	9.4, 50	1 ppb	Solution State NMR
300 MHz	7, 50	1 ppb	Solution State NMR
300 MHz	7, 89	1 ppb	Solid State NMR
EMR Frequency	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
Up to 7 THz	30, 32	100 ppm	ECR*
700 GHz	25, 52	10 ppm	Multi-frequency EMR
470 GHz	17, 61	3 ppm	Multi-frequency EMR
336 GHz	12.5, 88	3 ppm	Transient EMR
95 GHz	≤6 T	1 ppm	W-band Pulsed EPR
9 GHz		1 ppm	X-Band EPR
ICR	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
	14.5, 103+	1 ppm	MALDI, ESI, FD FT-ICR
	9.4, 220	1 ppm	ESI FT-ICR
	9.4, 155+	1 ppm	FD, APPI, MALDI FT-ICR
	7, 155+	1 ppm	EI, CI, FT-ICR
	7, 150	1 ppm	ESI FT-ICR

+ Under development * ECR: Electron Cyclotron Resonance

Table 11. CIMAR Facilities at the University of Florida, as of January, 2004

MAGNETIC RESONANCE SYSTEMS in Gainesville			
Frequency	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
750 MHz	17.6, 89	1 ppb	Solution/solid state NMR and MRI
600 MHz	14, 52	1 ppb	Solution state NMR and MRI
500 MHz	11.7, 52	1 ppb	Solution/solid state NMR
500 MHz	11.1, 400	0.1 ppm	MRI and NMR of animals
200 MHz	4.7, 330	0.1 ppm	MRI and NMR of animals
130 MHz	3, 600	0.1 ppm	MRI of human heads and larger animals

NMR SPECTROSCOPY AND IMAGING PROGRAM

This program is a joint effort between the NHMFL in Tallahassee and Gainesville through collaboration with the AMRIS (Advanced Magnetic Resonance Imaging and Spectroscopy) program in the McKnight Brain Institute at the University of Florida. This NHMFL NMR program has a mission to develop technology, methodology, and applications at the highest magnetic fields through both in-house and external user activities. This is a very broad mission in solution and solid-state NMR spectroscopy as well as imaging and diffusion measurements. Both locations have experienced research faculty, engineers, and technicians spanning these disciplines who are available to facilitate user activities on a wide range of unique instrumentation and to develop novel experiments and new instrumentation.

Tallahassee Update

25 T to 45 T resistive magnets. The 25 T resistive magnet has a short term temporal stability of ~5 ppm and its field inhomogeneity can be reduced below 1 ppm using small sample magic-angle spinning (MAS). Thus 25 T and 45 T magnets can be used for NMR experiments with medium resolution. We can use the 2 mm, 40 kHz, MAS probe for NMR measurement of any nuclei other than $^{1}H/^{19}F$. A ^{1}H high resolution MAS solution probe and $^{1}H/^{19}F$ 2 mm, 40 kHz, MAS probe are now available to extend the NMR capability of resistive magnets to solution samples and high frequency nuclei. A Tecmag Discovery NMR console is available for NMR spectroscopy on these magnets, and the other resistive magnets. This instrument has three RF transmit channels, two independent receive channels, and three gradient channels. With a frequency range to 1.92 GHz, it is capable of ^{1}H NMR up to 45 T. Recently, flux-stabilization has been improved such that Hahn echos can be obtained with echo times up to 3 ms.

830 MHz. The 19.6 T, 30 mm bore superconducting magnet is being routinely used for solid state NMR of quadrupolar (2 mm, 40 kHz, MAS) and low-gamma nuclei (4 mm, 10 kHz, MAS). The instrument also has 2.75 mm, 24 kHz, CPMAS and STRAFI imaging capabilities. A variable temperature static probe was added in 2002, and a 7 mm, 12 kHz, MAS large sample volume probe for insensitive nuclei was added in 2003.

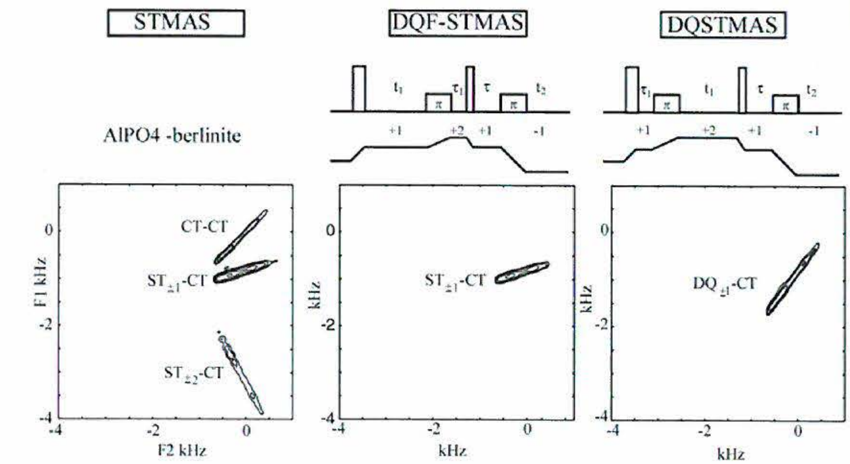


Figure 15. Methodological developments as well as technological advancements are needed to take full advantage of the high magnetic fields. Z. Gan and coworkers have advanced the satellite transition MAS methodology for obtaining quantitative quadrupolar data. Double quantum filtering eliminates unwanted peaks and DQSTMAS enhances resonance selection.

720 MHz solution NMR spectrometer. The console for the 720 MHz instrument has been upgraded to an Inova class. This console has four independent rf channels with improved rf linearity and time resolution. A new triple-resonance probe was also purchased. Similar console upgrades have been made for the 500 and 600 MHz high resolution instruments. The 500 MHz console is being equipped with a triple-resonance 5 mm cryoprobe for biomolecular studies.

600 MHz, 89 mm bore. This system has been used routinely for solid state, both biological and chemical solids, and some microimaging NMR. The console has been upgraded to a Bruker Avance system for state-of-the-art solid-state NMR experiments. A Variable Temperature upper stack has been built to extend the temperature range for the 6 mm, T3 triple-resonance MAS NMR probe. A double-resonance ^{15}N-^{1}H wide line probe with a balanced circuit has been tested and demonstrates excellent RF homogeneity and superior sensitivity and is now available to users for NMR studies of membrane protein samples.

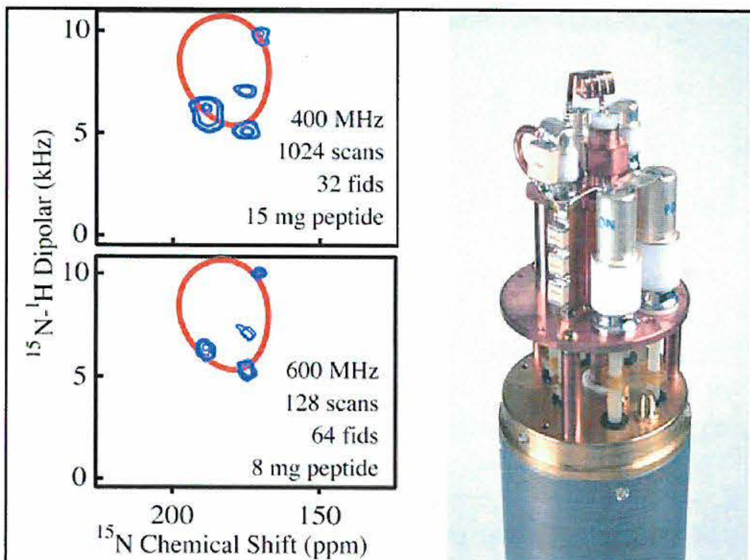


Figure 16. Solid state NMR spectra from aligned lipid bilayers containing the transmembrane domain of the M2 protein from Influenza A virus obtained by T. Cross and coworkers. New technology developed at the NHMFL (by W. Brey and P. Gor'kov) combined with higher magnetic fields has improved signal averaging times by a factor of 16. Here spectra of this proton channel, a primary drug target shows the presence of an alpha helical structure. The data at 600 MHz is not only more sensitive but also shows substantially improved resolution. Spectra at 900 MHz are likely to demonstrate similar imorovements above those shown here.

Gainesville Update

Bruker Avance 500 MHz. This system has been used routinely for solution and more recently solid state NMR. Prof. Joanna Long, our new hire in solid-state NMR, has upgraded this instrument to full triple resonance solid-state capabilities with a Doty MAS probe. This instrument is utilized 50% of the time for solids and 50% for solution.

Bruker Avance 600 MHz. A Bruker triple resonance cryoprobe has been installed and is fully functional. As expected, the signal-to-noise (S/N) gain from the probe is close to 4x for non-conducting samples. The spectrometer is completely equipped for all solution state NMR experiments. The instrument also has a microimaging accessory for samples up to about 20 mm in diameter. The instrument switches about every two months between cryoprobe and imaging. In the near future, we hope to use state support to the NHMFL to purchase a second shielded 600 MHz system that will be dedicated to the cryoprobe and a new shielded wide-bore 600 MHz magnet to replace the current unshielded magnet. The second system will be devoted to imaging and solid-state NMR. Bill Brey (NHMFL) and Richard Withers (Bruker) are designing and building a 1 mm triple resonance HTS probe for this instrument as part of the UF NIH/NCRR resource grant.

Bruker Avance 750 MHz wide bore. This instrument is fully functional for solution-state, solid-state ^{2}H studies, and imaging. A number of microcoils have been developed for this instrument for both solution state NMR and microimaging through the NIH/NCRR resource grant. We have had trouble with a high drift rate on this magnet, but with drift compensation we are able to collect most routine datasets.

Bruker 4.7 T, 33 cm. This horizontal imaging system is fully functional for routine animal imaging. It is now equipped with four receiver channels and has phased-array detection capabilities. A large number of in-house custom built coils are available.

Bruker/Magnex 11.1 T, 40 cm. This magnet system is fully functional for imaging and *in vivo* spectroscopy. Several new coils have been designed and built through the NIH resource grant. Phased array detection is working for a limited number of sequences, and we are attempting to make this more general. Volume imaging of large samples at ^{1}H frequencies is problematic because of interference effects between the conductive sample and the RF, because the wavelength of the RF is approaching the same size as the sample. One of the best applications at high field strength is spectroscopy and imaging with lower gamma nuclei, as shown in the Figure 17.

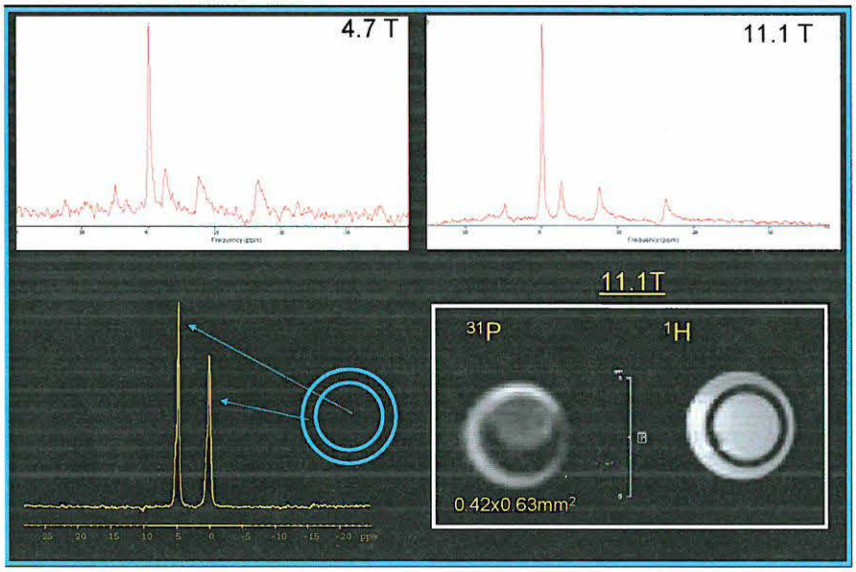


Figure 17. Spectroscopy and ^{31}P imaging at 11.1 T.
Top: ^{31}P *in vivo* spectra collected from a localized region of a mouse leg. The data at 11.1 T (top right) have much better S/N than at more conventional 4.7 T (top left).
Below: Demonstration of ^{31}P imaging using a phantom with different pH on the inside and outside tubes. On the left is a 1D ^{31}P spectrum of the phantom. The lower right shows ^{31}P and 1H images of the phantom. (Data collected by the research groups of Glenn Walter and Krista Vandenborne.)

Siemens 3 T, 60 cm head magnet. This system works very well and provides some of the finest human brain images available. It is being used for several different human fMRI studies and work on recover from brain injury or repair on research subjects. No clinical work is done with this system. It is also being used for larger animal studies, and in the near future we will develop an animal cardiac imaging project on this magnet.

Table 12. NMR Spectroscopy and Imaging Facility User Statistics

	Total	Minority	Women
Number of Projects	90		
Number of Research Groups	84		
Number of Users	171		
Number of Senior Investigators (U.S.)	111	0	18
Number of Senior Investigators (non-U.S.)	10	0	1
Number of Postdocs (U.S.)	10	1	3
Number of Postdocs (non-U.S.)	1	0	0
Number of Students (U.S.)	39	1	12
Number of Students (non-U.S.)	0	0	0

Table 13. NMR Spectroscopy and Imaging Facility Operations Statistics

	833 NB	720 SB	600WB
User Affiliation	**Number of Magnet Days**		
NHMFL	182	205	180
U.S. Universities	24	135	129
U.S. Government Labs	24	0	0
Industry	27	0	0
Non-U.S.	52	11	25
Development & Maintenance	26	14	18
Idle	30	0	13
Total	**365**	**365**	**365**

Note 1: In addition, 374 days of spectrometer time have been used by external users and collaborators on Tallahassee low field instruments.

Note 2: In Gainesville a total of 189 days of spectrometer time has been used by in-house and external users on various instruments described in Table 11.

Fourier Transform Ion Cyclotron Resonance Mass Spectroscopy

During 2003, the ICR 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 directors for instrumentation, biological applications, environmental applications, and user services as well as a machinist, technician, and six rotating postdocs who are available to collaborate and/or assist with projects.

FT-ICR Magnet and Instrumentation Update

An actively-shielded, 14.5 T, 103 mm bore magnet was installed and shimmed in 2003. Components for the associated FT-ICR mass spectrometer are on order and should arrive in early 2004. The target date for availability of this system to users is mid-2004. The highest-field superconducting ICR magnet in the world, combined with our other unique capabilities for sample introduction, ion external storage/mass selection/transmission, and ion excitation/detection/phasing should extend the performance of this instrument beyond any other.

The 9.4 T, 220 mm bore system continues to be the highest performance electrospray FT-ICR mass spectrometer in the world. It offers unrivaled mass resolving power ($m/\Delta m$ = 10,000,000 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 (MS^n as high as MS^8), and long ion storage period. 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 (~100 ms timescale) MS/MS. Available dissociation techniques include collisional (CAD), photon-induced (Infrared Multiphoton Dissociation (IRMPD), and electron-induced (ECD). A robotic sample-handling system allows for unattended (and even geographically remote) operation.

An unshielded 7 T electrospray FT-ICR instrument has been dedicated to high sensitivity biological analysis. HPLC and CE interfaces are available. Picomolar concentration detection limit has been demonstrated. Sample amounts as low as 300 amol loaded (in biological matrix) have been detected. The instrument is currently available for use.

9.4 and 7 T actively shielded FT-ICR instruments are under development. The 9.4 T magnet is currently used for electron ionization (EI), field desorption (FD), matrix-assisted laser desorption/ionization (MALDI), and atmospheric pressure photoionization (APPI). The 7 T magnet will be optimized for volatile mixture analysis. Samples will be volatilized in a heated glass inlet system (at 200-300 °C) and externally ionized by an electron beam (0-100 eV, 0.1-10 μA). The ions will be collected in a linear multipole trap and injected into the FTICR cell. Mass resolving power ($m/\Delta m$) greater than 10^5 and mass accuracy within 1 ppm have been achieved. Hundreds of components in a complex mixture (e.g., petroleum distillates) can thus be resolved and identified. The 9.4 T system is available for FD (including continuous-flow FD), and MALDI experiments and both instruments should be capable of glass inlet/EI experiments by mid-2004.

ICR Applications

Biomolecular sequence verification continues to be in high demand. Protein and oligonucleotide masses can be determined with ppm accuracy. Molecules can be fragmented (by collisions, photons, or electron capture by multiply-charged positive ions) to yield sequence-specific products (*Anal. Chem.*, **75**, 3256-3262 (2003)). Sites and nature of post-translational modification (e.g., glycosylation, phosphorylation, etc.) are readily determined (*J. Proteome Res.*, **2**, 581-588 (2003). In-house software has been developed for rapid data analysis.

Tertiary structure can also be probed. Hydrogen/deuterium exchange can be carried out (in solution or gas phase) and monitored with the mass spectrometer. Details of biomolecular conformation and surface contact between molecules in a noncovalent complex can be deduced. For example, in a cover article (*J. Mol. Biol.*, **325**, 759-772 (2003)), we discovered the key contact sites that bind hexamers of the capsid protein that envelops RNA in the HIV-1 RNA virus *in vitro*. Subsequent experiments *in vivo* confirm that observation.

The 7 and 9.4 T instruments are primed for immediate impact in environmental, petrochemical, and forensic analysis, where intractably complex mixtures are common. For example, post-blast soil samples can be extracted and compared with a library of commercial and military explosives to identify the active agent and the source of the product (*Anal. Chem.*, **74**, 1879-1883 (2002)). Further, fossil fuel samples can be analyzed and components resolved without chromatographic separation. In a recent study more than 10,000 distinct chemical components were resolved and identified (elemental formulas) in a single electrospray FT-ICR mass spectrum of coal (*Energy & Fuels*, **17**, 946-953 (2003)). Recent automation of the analysis of data from complex organic mixtures shortens data reduction from weeks to minutes.

Table 14. ICR User Statistics, 1/1/03 through 12/31/03

	Total	Minority	Women
Number of Projects	108		
Number of Research Groups	76		
Number of External Users	124		30
Number of Senior Investigators (U.S.)	53		8
Number of Senior Investigators (non-U.S.)	31		6
Number of Postdocs (U.S.)	5		3
Number of Postdocs (non-U.S.)	0		0
Number of Students (U.S.)	22		7
Number of Students (non-U.S.)	10		4
Number of Collaborators (U.S.)	2		1
Number of Collaborators (non-U.S.)	1		1

Table 15. ICR Operations Statistics, 1/1/03 through 12/31/03

	9.4 T, 220 mm	
User Affiliation	**Number of Magnet Days**	**Percentage**
NHMFL, UF, FSU, FAMU, LANL	100	27%
U.S. Universities	79	22%
U.S. Government Labs	0	0%
Industry	27	7%
Non-U.S.	76	21%
Development & Maintenance	35	10%
Idle	48	13%
Total	**365**	**100%**

ELECTRON MAGNETIC RESONANCE PROGRAM

The development of EMR spectroscopy toward higher fields and frequencies is providing a multitude of advantages for a broad variety of applications. The applications of high field/high frequency EMR can be roughly classified into two categories: studies of highly concentrated spin systems, typical for material sciences, and investigations into chemical, biochemical, and biological paramagnetic spin systems that are usually characterized by low spin concentrations. The various spectrometers available for the EMR user program described below are optimized for either of these categories and today the EMR users program spans biology, chemistry, and condensed matter physics, with an emphasis on physical chemistry and a clear trend toward more biological science. Major developments in 2003 have been an extensive use of pulsed EPR in the Bruker X- and W-band spectrometer, and CW-ENDOR at 240 GHz.

From a technological viewpoint there are two different regimes in the frequency domain for EMR spectroscopy, (a) from 1 to about 150 GHz, and (b) above 150 GHz. From 1 GHz up to about 150 GHz, the electromagnetic waves propagate in single-moded or over-moded waveguides, and one generally uses single mode cavities. Above 150 GHz, single mode cavities become less efficient and impractical due to the extremely small size. In this situation, either a Fabry-Perot type cavity is used for small samples, or measurements are performed without cavity for larger samples. In EMR spectroscopy, increasing the frequency increases the absolute sensitivity in the case of single mode cavities, but as the sample size has to decrease at the same time, the concentration sensitivity is not significantly affected. Also, it should be noted that pulsed techniques are only available up to 100 GHz, mostly due to the unavailability of high power sources and pulse switches at higher frequencies.

Multi-Frequency EMR Spectrometers

The development of EMR spectrometers at the NHMFL has focused on very high field/very high frequency machines. All the instruments we have developed are multifrequency. Presently there are five high field EMR spectrometers. The first two are based on a 17 T Teslatron superconducting magnet made by Oxford Instruments Inc. This magnet consists of a main 17 T coil with a +/- 0.1 T sweep coil. The third is a quasi-optical CW/Transient spectrometer also with a superconducting magnet, while the fourth uses the 25 T resistive "Keck" magnet. The fifth spectrometer is a low/medium frequency Bruker spectrometer for pulsed EPR and ENDOR.

Very Broad Band CW Spectrometer. We use different sources in the 23 GHz to 3 THz range. The detector is either a Schottky diode or a "hot electron" InSb bolometer. This instrument is a direct transmission system, has very broadband capabilities, allows for fast frequency change, and accepts a great variety of sample holders. The sensitivity is around 10^{12} spins/gauss at room temperature, g-determination error: +/- $3x10^{-5}$, resolution: 1 to 10 ppm. Temperature range: 1.6 to 300 K.

High Sensitivity CW Quasi Optical Instrument for EPR and ENDOR. The sources operate from 190 GHz up to 475 GHz for a g = 2 paramagnetic center. The system, optimized at 220 and 330 GHz, employs very low loss quasi optical (QO) techniques; these techniques allow for phase information. The detector is an InSb mixer. The sensitivity of the QO machine is approximately 10^{10} spins/gauss at room temperature; all other specifications are identical to the specifications of the very broad band CW spectrometer. The homodyne spectrometer is now equipped with a probe for CW Electron Nuclear DOuble Resonance. For nuclear resonance, the RF is within the 1 to 1000 MHz range.

Transient and CW EMR/ENDOR Instrument. The design of the spectrometer, which operates at 120 and 240 GHz, combines quasi-optical techniques and a super-heterodyne detection scheme based on Schottky diode mixers and with a 1 GHz detection bandwidth. The combination of sub-ns time-resolution and high g-resolution make it especially suited for time-resolved EPR. The room-temperature sensitivity in CW-mode is of the order of 10^{11} spins/gauss without cavity and $3x10^8$ spins/gauss in a Fabry-Perot cavity. The maximum time resolution is 600 ps. Nd-YAG lasers and an Optical Parametric Oscillator are available for optical excitation. In addition, this spectrometer is now equipped with an RF coil for high-field ENDOR. Temperature range is 3 K to 400 K. The superconducting magnet was upgraded from 9 T to 12.5 T at the end of 2003, which will enable operation at 336 GHz in April 2004.

25 T "Keck" Magnet Spectrometer. This instrument is built around the 25 T, high homogeneity resistive magnet. The "Keck" magnet is perfectly poised for EMR thanks to fast ramping to the magnetic field of interest, very convenient sweepability, homogeneity better than 10 ppm over a typical sample size (a few mm^3), and good field stability. It uses backward wave oscillators as sources for the 150 to 700 GHz range, and a far-infrared molecular gas laser for higher frequencies. An InSb "fast electron" liquid helium-cooled bolometer is used as detector. The sensitivity is ca. 10^{12} spins/gauss at room temperature, g-determination error: $\pm 3x10^{-5}$, resolution: better than 10 ppm. Temperature range: 1.5 to 300 K.

Bruker Elexsys E680 X- and W-Band Pulsed Spectrometer. This commercial spectrometer provides advanced pulsed techniques that are not available at higher frequencies. 20% of the total spectrometer time is available for external users. The two pulsed microwave channels and two RF channels at both 9.4 (X-band) and 95 GHz (W-band) offer a diverse range of pulsed experiments like ESEEM, HYSCORE, DEER, pulsed ENDOR and TRIPLE, etc., and are especially valuable for measuring electron-electron and electron-nuclear spin couplings. In the past year, modifications were made to the X-band bridge allowing the spectrometer to perform saturation recovery experiments as well. The spectrometer is equipped with a 1.5 T electromagnet for X-band, and a 6 T split coil superconducting magnet for W-band. The temperature range at both frequencies is 3.8 to 300 K.

Table 16. EMR Facility User Statistics, 1/1/2003 to 12/31/2003

Research Projects/Groups	Total	U.S.	Overseas
Number of Research Projects	55	38	17
Number of Research Groups	61	32	29
Users	**Total**	**Minority**	**Female**
Numbers of Users	111	5	14
Number of Senior Investigators, U.S.	40	2	2
Number of Senior Investigators, non-U.S.	31	2	3
Number of Students, U.S.	19	1	4
Number of Students, non-U.S.	8		2
Number of Postdocs, U.S.	8		2
Number of Postdocs, non-U.S.	5		1

Table 17. EMR Facility Operations Statistics, 1/1/2003 to 12/31/2003

	17 T	9 T	W-band
User Affiliation	**Number of Magnet Days**		
NHMFL, UF, FSU, FAMU, LANL	51	70	120
U.S. University	72	49	32
U.S. Government Lab	-	-	-
Industry	-	-	5
Non-U.S.	61	41	11
Development	10	12	-
Maintenance/Repair	12	20	30
Total	**206**	**192**	**198**

Geochemistry Program

The Geochemistry Program has concentrated on using existing instrumentation for geochemical and environmental research for the past year. Geochemistry group members have been successful in obtaining external funding for these programs, primarily from the NSF Earth Science and Ocean Sciences Division. The program has seven active research grants (six from NSF and one from EPA). The research funded through these programs concerns the study of the chemical evolution of the solid Earth through trace element and isotope analyses as well as the use of isotopes to study several aspects of environmental geochemistry and global change. In 2003, we received NSF funding (matched by FSU) to add a stable isotope gas source mass spectrometer (Thermo-Finnegan Delta XP) to our arsenal of analytical tools. This instrument allows rapid and precise analysis of oxygen, carbon, and nitrogen isotope ratios as well as the elemental concentrations in a large variety of geological materials, which is essential for our studies on climate change as well as studies that determine the source, fate and transport of nutrients through an ecosystem.

This year the program added a faculty member, Philip Froelich, who holds an endowed Eppes professorship in the department of Oceanography. Froelich's labs will be housed in the Geochemistry Program. Existing efforts and the arrival of Froelich have led to the initiation of a new research direction in Biogeochemical Processes. This research direction is building on our previous collaborations with the FT-ICR program and on our successful research funded through a Program Enhancement grant at FSU. In the past years we have developed a capillary electrophoresis technique that allows separation of metal-organic complexes based on their mass charge ratio. We have interfaced this technique with our ICP-MS, which is used as an element specific detector. With this technique we can now, through competition experiments, determine the binding constants for metal-organic complexes. The combination of characterizing the organic matter by FT-ICR-MS and quantifying its metal binding capacity allows new insights and a predictive understanding of the transport and fate of metals through aquatic ecosystems.

Table 18. Types and Configuration of Mass Spectrometers for Geochemistry

Name	Type of Ionization	Mass Analyzer Configuration	Detection Systems	Measurements	Sample Introduction
Isolab	Thermal and Sputtering	E-M-D1-E-D2	D1: 4 faraday cups after M D2: Daly Ion counting and faraday cup	Isotope ratios: Th, Hf and Hg	Solids and chemical separates
262/RPQ	Thermal	M-D1-E-D2	D1: 7 faraday cups, 1 electron multiplier D2: Electron multiplier	Isotope ratios: Pb, Sr, Nd, Os	Chemical separates
ICP-MS	Thermal-Plasma	M-E-D	D: Electron multiplier	Concentrations and isotope ratios	Solutions
Delta XP	Thermal	M-D	D: 5 faraday cups	Isotope ratios: H, C, N, O	Gas

E = energy filter M= Magnetic mass filter

Table 19. Geochemistry Facility User Statistics, 1/1/03 through 12/31/03

	Total	Minority	Female
Number of Research Projects	19	n/a	n/a
Number of Senior Investigators (U.S.)	9	2	2
Number of Senior Investigators (non-U.S.)	-	-	2
Number of Students, U.S.	10	-	8
Number of Students, non-U.S.	-	-	-
Number of Postdocs, U.S.	1	-	-
Number of Postdocs, non-U.S.	-	-	-

Table 20. Geochemistry Magnet Day Statistics, 1/1/03 through 12/31/03

Number of Magnet-Days	Isolab	262/RPQ	ICP-MS	Total
NHMFL, UF, FSU, FAMU, LANL	110	140	190	440
U.S. University	80	50	30	160
U.S. Govt. Lab	-	-	-	-
U.S. Industry	-	-	-	-
Non-U.S.	-	-	-	-
Maintenance	50	40	30	120
Total	**240**	**230**	**250**	**720**

ACCESS TO NHMFL FACILITIES

User access to the NSF-funded NHMFL Continuous and Pulsed Field Facilities is controlled by a two-step proposal and review process that is administered by the Directors of the Continuous and Pulsed Field User Programs. A brief initial proposal is reviewed by NHMFL staff and approved or denied by the Director of the NHMFL. Then, every year, a summary listing of all user programs is compiled and ranked in order of magnet use. Users who have consumed a significant portion of resources (about 1% to 2%) within the previous twelve months are required to submit a more extensive proposal based on their present and future work in high fields. Users in this category are the largest users and collectively account for at least 80% of the annual total facility use. In addition, all users of the 45 T Hybrid and 60 T Long Pulse magnets will be required to submit such a proposal. Each major proposal is reviewed by a panel of scientists chosen for their familiarity with the fields of research commonly done at the NHMFL. The panel can also seek input in the form of mail reviews. A grade from A to C is given to each proposal with an A being required for heavy use of facilities, and especially, use of "expensive" or high demand facilities. A "C" grade means the user has access only after other demands are met. (Work that would merit a failing grade is blocked or stopped before it reaches the major proposal process.) The final decision for use of the High Field Facility rests with the Director of the NHMFL.

Access to The High B/T Facility is described in more detail in the "High B/T section" above.

The ICR mass spectrometer facilities, Electron Magnetic Resonance facilities using the superconducting magnets and X-band spectrometer, isotope geochemistry facilities, and many of the magnetic resonance spectroscopy and imaging facilities are supported by grants other than the NHMFL Cooperative Agreement with the NSF. The fraction of time on these systems available to general users equals the fraction of the facility cost paid by the NHMFL. Collaborative access to them is governed by the terms of the grants and the principal investigators.

User access to the NSF-funded NHMFL NMR Spectroscopy and Imaging facilities is controlled by submission of a brief proposal that is reviewed by the Program Director or Assistant Program Directors. The potential users are notified of the decision and put in contact with the appropriate NHMFL staff to schedule spectrometer time.

Access to the ICR equipment requires a one page proposal and is at the discretion of the Director. Long term use (more than 2-3 days), equipment, or salary support requires a 2-3 page proposal (and budget) that is reviewed by an advisory panel.

The isotope geochemistry facilities are in general open to any user for research projects. Access to the geochemistry facilities is done on an individual basis through contacting Dr. Salters. Although there is a charge for the use of the facilities, pilot projects and development of analytical techniques are regularly accommodated without a charge.

3. Magnet Science & Technology Program

The primary mission of the Magnet Science and Technology Group is to provide state-of-the-art magnet systems for users. MS&T sustains a constant effort toward that mission through a variety of major internal projects. It also maintains and replenishes its capabilities for pushing the frontiers of magnet technology through:

- Vigorous research and development activities
- Education of new scientists, engineers, and technologists
- Involvement in external activities that have synergy with the primary mission.

MS&T's major internal projects typically fall into one of the following three categories.

- Powered DC magnets, which comprise a variety of "Florida Bitter" resistive magnets and the 45 T Hybrid
- Pulsed magnets, which comprise short-pulse, capacitively-driven magnets and long-pulse, extended-life magnets powered by a motor-generator
- Persistent magnets, which comprise all-superconducting, research magnets such as the 900 MHz NMR system.

Outside these core areas, MS&T engages in projects and programs that provide unique service to external organizations and that are also congruent with development toward long-term internal goals. Some examples are as follows.

- The superconducting "Sweeper" magnet system for the National Superconducting Cyclotron Laboratory at Michigan State University
- The repeating pulse magnet for the LANSCE neutron facility at Los Alamos National Laboratory
- The 5 T HTS insert model coil, shown above, built in collaboration with Oxford Superconductor Technologies.

Over the past year, there has been significant progress in all the above areas, as well as in other basic support technologies. The project reports that follow in this section present additional details and highlights of the achievements.

MAJOR PROJECTS

PROJECT TITLE: HIGH FIELD MAGNETIC RESONANCE MAGNET SYSTEMS
REPORT DATE: DECEMBER 31, 2003

Objective

The development of magnet technology toward the realization of a 1.1 GHz NMR magnet has been a long term objective for the Magnet Science and Technology group at the NHMFL. The production of an Ultra-Wide Bore 900 MHz NMR magnet represents a major milestone toward achieving that goal. The NHMFL 900 MHz system, built with conventional low temperature superconductor (LTS) is comparable in stored energy and scale to a small bore 1.1 GHz magnet due to the 900 MHz NMR magnet's extremely large 105 mm warm bore. The large bore allows a future generation magnet design to replace the innermost Nb_3Sn coil with a coil constructed of high temperature superconductor (HTS) or other emerging conductors to create a magnet capable of producing 25 T.

Status

Fabrication and assembly of the 900 MHz NMR magnet has been completed and the magnet and quench detection and protection system has been rigorously tested prior to 2003. The significant accomplishments achieved in 2003 were the construction of the cryostat, transportation to the final user location, integration of the magnet and cryostat to the final user facility, safety reviews, and cryostat pressure verification tests.

Fabrication centered on the construction of the cryostat. The magnet was integrated with the room temperature feedthroughs; the magnet vessel, 4.2 K and 77 K shields, multi-layer insulation, vacuum vessel, and support legs were designed, fabricated, and installed around the cryostat assembly; and the system was transported to the final user facility. Subsequently, the user facility operations center for control and monitoring of the cryostat and magnet was constructed and connected to the magnet system, and a platform for convenient access to the upper bore and helium fill port was built.

An External Safety Committee was formed to provide independent technical oversight regarding the safety of the magnet system and adequacy of the safety controls and procedures. The committee comprised experts in the fields of cryogenic and magnet technology. The committee convened at the NHMFL and reviewed the system design and analyses that were previously performed, both in-house and by external consultants, on the structural aspects of the cryostat. The committee also reviewed the system design, testing, and controls to be implemented during the commissioning phase and final user operations.

The year was completed with a proof pressure test of the cryostat that structurally verified the integrity of the vessel in the event of a quench. The test was performed at 77 K rather than at room temperature to better simulate the final operating conditions. The helium vessels within the cryostat were pressurized to a level 25% greater than the maximum expected pressure that would develop during a quench.

By the end of 2004, it is anticipated that much progress will have been made in the commissioning of the 900 MHz system. In March 2004, the initial cool down of the system in the final user facility is expected to begin. In June 2004, the magnet system is expected to undergo its initial energization, signifying the start of the commissioning phase. Note that the commissioning phase involves extensive characterization of the cryogenic, magnetic, and NMR scientific subsystems, which will be operated together for the first time as a single operating system. The operation and characterization of all the magnet system components will be confirmed, including the main coils, the superconducting switches and shims, the bucking coils, and the magnet instrumentation. The temporal and spatial homogeneity will be mapped and the current injection system will be tested to verify its ability to correct for current drift. The final user cryostat, being operated for the first time, will be monitored closely and the system controls will be tested. After the magnet and cryogenic systems have been characterized, a period of time will be required to ensure the quality of the NMR science. Table 1 lists the major milestones expected for 2004.

Table 1. Projected Milestones in 2004 for the Ultra-Wide Bore 900 MHz System

Milestone	Current Schedule
Initiate Cool Down to 4.2 K in the Final User Facility	March 2004
Begin Commissioning Phase	June 2004

MAJOR PROJECTS

PROJECT TITLE: RESISTIVE MAGNET PROGRAM
REPORT DATE: DECEMBER 31, 2003

Objective

The Resistive Magnet Program designs, builds, and maintains high field DC magnets for the scientific user community. The scope of activity ranges from Hybrid inserts providing fields up to 45 T and consuming up to 30 MW of power to small wire-wound coils that are inserted in the bore of high field magnets. The scientific community to whom we provide service consists primarily of the users of the Tallahassee powered magnet facility, but we also provide contract services to facilities in Tsukuba, Japan, and Nijmegen, The Netherlands, among others.

Status

Over the past year we have built and installed nine new coils to maintain the seven resistive magnets and one hybrid insert in Tallahassee. In addition, the Nijmegen lab reached 33 T in April of 2003, providing the highest DC fields in Europe. Three different 33 T magnets have been installed at the Nijmegen facility, all of them designed in Tallahassee and the first of which was fabricated in Tallahassee.

Following is a prioritized list of development activities for the resistive magnet facilities at the NHMFL. Priorities have been established in consultation with the NHMFL Users' Committee.

1. Upgrade the field in the 50 mm bore magnet from 25 T to 32 T. A design review was held in June 2003. Detailing and purchasing of materials started immediately afterwards. Detailing is now complete and price quotes for the last parts are being sought.
2. Upgrade the field in our existing 32 mm bore magnets from 33 T to 35 T by introducing current density grading in the coils. Coil design will be completed in January 2004. A design review will be held in April 2004.
3. Upgrade the field in the 50 ppm magnet from 23 T to 29 T by modifying the new 32 mm bore magnet design listed in 2 above. The design of this magnet will be dependent upon the final specifications for the planned upgrade of the power supplies.
4. Installation of wire wound, water-cooled, modulation and gradient coils in the bore of the 50 mm bore magnet. The modulation coil is complete and testing will start during the summer of 2004. Final design and fabrication of the gradient coil will start after successful testing of the modulation system.
5. Design and build a magnet to provide field perpendicular to the access tube, using no more than 20 MW of DC power. We have selected a split magnet design (as opposed to a tilted coil design). There is a large-bore, split, superconducting pair of coils presently at the NHMFL that would be suited for use as the outsert of a hybrid system. We have developed a draft of the users' requirements for the magnet including sample size, scattering angles, types of windows, bore size, etc. that we hope to get the user community to approve in the near future. We are starting on the design of the "mid-plate" of the magnet that must accommodate 500 to 600 tons of compressive force between the two halves of the magnet,

support several tons of Lorenz forces on the gap-side bus bars, and provide space for 150 l/s of cooling water, etc. It is not yet clear whether a 20 MW resistive system or a 10 MW hybrid using the existing SC coil pair will be the preferred approach. The field should be between 20 and 30 T. We expect to have a conceptual design review in late 2004 where projections of performance, cost, and schedule would be reviewed.

6. Upgrade the field homogeneity of the 52 mm bore, 25 T magnet from 12 ppm to 1 ppm over a 1 cm diameter spherical volume by installing resistive shim coils in the bore of the existing magnet. This project will be staffed upon completion of other projects that have a higher priority.

Table 2. Project Schedule: 50 mm Bore High Field Magnet

Milestone	Current Schedule
Project Starts	December 2001
Coil Design Complete	October 2002
Layout Design Complete	June 2003
Detailing Complete	April 2004
Magnet Operational	Second quarter 2005

Table 3. Project Schedule: 32 mm Bore High Field Magnet

Milestone	Current Schedule
Project Starts	November 2002
Coil Design Complete	January 2004
Layout Design Complete	February 2004
Detailing Complete	May 2004
Magnet Operational	Third quarter 2005

Table 4. Project Schedule: 50 ppm over 1 cm DSV Magnet

Milestone	Current Schedule
Project Starts	First quarter 2003
Power Supply Specifications Known	May 2004
Coil Design Complete	July 2004
Mechanical Design Complete	Fourth quarter 2004
Magnet Operational	Fourth quarter 2005

Major Projects

Project Title: Pulsed Magnet Program
Report Date: December 31, 2003

Objectives

The project objectives are:

1. Manufacture pulse coils to sustain aggressive physics research programs at the NHMFL Pulsed Field Facility at Los Alamos
2. Develop and improve pulsed magnet technology
3. Upgrade magnet performance in terms of field, reliability, and pulse frequency
4. Identify and pursue the needed engineering and materials R&D to continuously advance the magnet technology.

Status

The NHMFL pulse magnet program presently supplies the user facility with four short-pulse magnet configurations:

1. "50 T-UG" pulsed magnets, which have the following attributes: 50 T peak magnetic field, 24 mm bore, 10 ms rise time, and a 20 minute cycle time between shots. Typically these magnets achieve a full field shot life in excess of 800 cycles. The 50 T-UG has remained in production because of the larger bore and a rapid shot-to-shot cycle time. Three 50 T-UG units were produced in 2003. We are reviewing upgrade options to increase the peak field to 55 T in a 24 mm bore. Upgrade technology will be based upon the cooling technology developed for the 65 T gap-cooled prototypes.
2. "50 T mid-pulse" magnets, which have the following attributes: 50 T peak magnetic field, 15 mm bore, 30 ms rise time, and a 120 minute cycle time between shots. The 50 T mid-pulse magnets were developed to provide longer-time pulse physics at 50 T as a necessary alternative to the to the 60 T long-pulse system. The first 50 T mid-pulse science magnet began operation in November 2000 and has operated since that date accumulating in excess of 600 full field shots. A second improved 50 T mid-pulse unit was delivered to the NHMFL facility at Los Alamos in August 2001. The second coil remains in reserve as a replacement coil when the first unit ends its life cycle. We will continue production of the 50 T mid-pulse magnets in 2004 on an as-required basis. The performance specification of the mid-pulse class magnets will be upgraded contingent upon capacitor bank upgrades to the user facility.
3. "60 T-ZMD" pulsed magnets, which have the following attributes: 60 T peak magnetic field, 15 mm bore, 6 ms rise time, and a 30-35 minute cycle time between shots. Presently there are three coils in inventory at the user facility. Three 60 T-ZMD magnets were produced in 2003. Production of the 60 T-ZMD design is being discontinued due the success of the higher performance 65 T Gap Cooled magnet.
4. "65 T Gap Cooled" pulsed magnets, which have the following attributes: 65 T peak magnetic field, 15 mm bore, 9 ms rise time, and a 25-30 minute cycle time between shots. The new design was developed using 100 T insert magnet technology and the gap-cooling concept.

Gap cooled pulsed magnet assemblies comprise nested coils with cooling annuli between coils. Presently there are two prototype coils at the user facility. The first prototype has accumulated over 400 full field science shots. The second unit has passed its testing protocol and is presently servicing researchers.

The prioritized performance objectives for pulsed magnet user systems are: (1) reliability, (2) higher fields, and (3) increased shot-to-shot cycle time. The 65 T user-magnet has successfully met these objectives. The pulsed magnet program is engaged in the concurrent technology development for the 100 T pulsed insert and the user magnet program at the pulsed science facility. In 2004, user magnet development will focus on: (1) a 75 T pre-prototype user coil using CuNb conductor, (2) an 80 T pre-prototype user coil, (3) a 24 mm, 55 T user coil built with gap-cooling technology. These pulse magnet activities form a synergy with the requirements of the 100 T.

Table 5. Project Schedule: Pulse Magnets for User Facility

Milestone	Current Schedule
Delivery of 5 T Pre Prototype for Test	June 2004
Delivery of additional 6 T User Magnets	October 2004

Major Projects

Project Title: 100 T Insert Magnet Project
Report Date: December 31, 2003

Objective

The objective of this activity is to design, construct, and test a 15 mm bore, capacitively-driven insert coil for use with a long pulse outer coil set operated at the Los Alamos facility. Together, the two systems will be capable of producing a total field of 100 T. Design, development, and production of the short-pulse inner coil is the responsibility of MS&T in Tallahassee. The outer coil is sponsored by the Department of Energy and is being developed at Los Alamos.

Status

Technology development for the 100 T and short-pulse programs entails concurrent development providing a synergy to the NHMFL pulsed magnet program. The group is responsible for the maintenance and improvement of the user facility, and the development of the 100 T insert. We identified several technical features requiring new engineering development for both the 100 T insert and the user magnet systems. The principal requirement was the development of a new fabrication technology to remove mechanically unstable layer-to-layer transitions. Secondary development work entailed the evaluation of the new assembly process to understand and accurately model accumulated tolerances in the design of high field coils. We are also systematically evaluating the operational limits of our reinforcement and bus-interconnect technology to the benefit of both NSF programs.

An important insert program objective is to gain as much operational experience as possible with low risk "insert-like" coils operating in the same temperature, stress, and strain parameter space as will be encountered in the 100 T coil. This grounded, experience-based process is deemed essential to properly evaluate the materials and engineering design. We are following through with a classical engineering program based upon data gleaned from experiments. This incremental development process will mitigate the risks associated with 100 T operations.

We have, for this reason, created a small coil test program to evaluate the engineering structures and materials in a low risk environment. Our baseline pulsed magnet experience, at the start of the 100 T program, was with 50 T to 60 T monolithic coils operating at the 300 KJ to 500 KJ energy level. The 100 T insert will entail coil operation in the 1.5 MJ to 2.0 MJ range. This is an energy level 3 - 4 times above the existing technology. We also recognized that we are operating this system inside a 132 MJ magnet assembly. We are engaged in high-risk technology development. Therefore, to improve quality, we have upgraded our entire engineering and manufacturing organization to meet the 100 T challenge and the requirements for future upgrades of the user facility. The small coil program's structure is outlined in Table 6.

Table 6. Outline of Technology Development Program for 100 T Insert Project

Dev. Seq.	Magnet System	Geometry	Inner Coil	Outer Coil	Benefit	Energy [MJ]	Prototype Testing	Status 05/11/04
1	6 T Gap Cooled	Nested Two Coil	Insert Structure	Improved Monolith	User & 100 T	1.3	Completed 10/15/03	User Operation
2	5 T Insert Development	Nested Two Coil	Improved Insert	Improved Monolith	User & 100 T	1.4	Scheduled 604	Final Assembly
3	8 T Insert Development	Nested Two Coil	Improved Insert	Improved Monolith	User & 100 T	1.5	Scheduled 12/04	Dev
4	9 Insert (Version #)	Insert Only	Improved Insert	N/A	100 T	1.42.0	Scheduled 3/05	Dev

The 75 T and 80 T coils required the full development of a new, nested two-coil design template. The initial 75 T schedule was to fabricate and test by December of 2003. The schedule logic required the operational development of the 65 T system by June 2003. During prototype testing in June 2003, however, we experienced a soft failure mode in the outer monolithic coil of the 65 T. Several theoretical mechanisms were developed to explain the behavior of the outer coil. Modifications were made to the second prototype assembly to evaluate these engineering hypotheses. The second prototype assembly was tested in July 2003. A soft failure was also observed in the second prototype confirming an insulation breakdown failure mode on the bore of the outer coil. The coil assembly was completely redesigned in August 2003. We accomplished the following: (1) developed and a new insulation configuration on the inner bore, (2) developed a toughened epoxy system for the wet lay-up windings, (3) developed an entirely new layer to layer transition geometry, (4) redesigned the outer support shell to limit conductor strain, and (5) successfully implemented the design changes in prototype construction.

The second coil assembly was fabricated in September 2003. Performance testing started in October 2003. The third prototype passed its testing protocol and is now in user operation. A fourth 65 T prototype was delivered in December 2003. Both units will be used as scientific user magnets. The engineering team demonstrated the ability to design a totally new system while addressing multiple engineering challenges. In 2004, we plan to continue with the fabrication of the reinforcement test and 75 T coil systems test by June 2004.

Summary

We are now in a hardware test and evaluation mode. Significant technical progress has been achieved. We are now operating 65 T user coils at the 1.3 MJ energy level. We should also recognize that the 65 T system's zylon and MP35N reinforcement stress levels correspond to insert operation at 90 T. The 75 T testing program is planned for summer 2004. The 75 T magnet project will, together with the successful 65 T magnet project, form solid technical ground for proceeding with the construction of the 100 T insert.

Research and Development Projects

Project Title: NHMFL/NSCL Sweeper Magnet
Report Date: December 31, 2003

The NHMFL at Florida State University has completed the design, fabrication, and will soon begin testing of a large-gap, super-ferric dipole magnet for use in radioactive beam experiments at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University. The magnet will be tested at the NHMFL and subsequently shipped to Michigan in April 2004. The magnet is expected to be in-service performing experiments along the nuclear drip-lines using the coupled-cyclotron sometime this summer. The National Science Foundation (NSF) is the primary funding source for both laboratories as well as this project.

Electromagnetically, the sweeper magnet consists of two "D"-shaped NbTi superconducting coils, a twenty-ton "C"-shaped iron yoke, and two square resistive trim coils. From an assembly perspective, the magnet consists of four major sub-assemblies: the iron yoke, the magnet cryostat, the satellite cryostat, and the resistive coils.

Frequently, large-gap superconducting dipole magnets experience numerous "training quenches" before reaching their design current. Related magnets developed at other labs have required over 100 training quenches. Occasionally, magnets fail to reach their design currents at all and are either re-built or operated at less than design expectations. It is expected that the NHMFL/NSCL Sweeper magnet will reach its design current after only a single training quench.

The predicted exceptionally good performance of this magnet may be attributed to the extreme attention to detail that was provided by the magnet design and fabrication staff of the NHMFL. Innovations that were developed include: (1) increasing the stiffness of the bobbin, (2) minimizing stress concentrations in the coil, (3) providing a mechanically stiff, ventilated coil support, (4) providing a slip surface and thermal barrier.

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: HIGH FIELD HTS INSERT COILS AND COIL TECHNOLOGY
REPORT DATE: DECEMBER 31, 2003

Objectives

The goal of this activity is the development of high field magnet sections using high temperature superconductor (HTS) materials. Immediate objectives are:

- Electrical and mechanical characterization under representative conditions of conductor, reinforcement, and coil windings, the latter in the form of both double pancakes and layer wound sections
- Development of winding and insulation techniques and design tools
- Sub-size and full-size prototype production and testing to verify models and techniques
- A milestone toward the development of 25 T, 1.1 GHz NMR magnets is the generation of 5 T in a 20 T background using a separately powered HTS insert magnet.

Accomplishments

Major progress and several very significant successes were achieved in the 5 T insert project. The 5 T insert is a three-section magnet comprised of concentric double pancake stacks and a layer wound section, all of which were fabricated according to the React & Wind approach. In continued close collaboration with Oxford Superconducting Technology (OST), the NHMFL has produced an additional 47 double pancake units, which were all characterized at self-field. Critical current measurements showed an upward trend resulting from improved conductor properties. Four units underwent additional stress tolerance and $I_c(B)$ tests to verify our models and sharpen qualification criteria. Development of layer winding techniques, using the same conductor and reinforcement as in the double pancake units, progressed and resulted in a sub-size (half-thickness) and a full-size section conforming to the 5 T geometry specification. The sub-size unit was also found to exceed the stress tolerance and in-field critical current criteria. The full size section and 34 double pancake units were selected to construct the 5 T insert.

Assembly techniques and procedures were developed, allowing for extensive instrumentation with strain gages and voltage taps while providing mechanical support and electrical insulation adequate for normal operation and worst-case scenarios of trips and possible shorts in the resistive background magnet. Development of a stand-alone trip detection system plus very fast acting switches was required to protect the insert power supply and electronics equipment. Operating procedures for the resistive magnet were set up allowing operation near 20 T for prolonged periods, as opposed to default procedures allowing 19.4 T for 1 hour maximum at a time.

The insert successfully generated 5.11 T in a 19.94 T background for a total of 25.05 T, which is the highest field generated using an HTS insert and the first time a superconducting coil operated at or above 25 T. The main targets of this demonstration project have been met, showing that electrical and mechanical properties of current generation HTS conductor are sufficient, and sufficiently understood, for application in 25 T class magnets.

The quench behavior of the full insert coil differs from its constituent units, and is a subject for continued research. The insert was instrumented with 10 strain gages from which data was recorded. Analysis thereof is in its initial stages.

Additional fruitful activities with HTS conductors with a focus on high field applications include development of an in-field uni-axial stress-strain-I_c facility for short conductor samples, stability of Bi and YBCO-based conductors against pulsed thermal loads at temperatures above 4.2 K, improvement of grain alignment by in-field conductor processing, as well as determination and modeling of anisotropy in $I_c(B)$ properties with field orientation to the highest fields available (33 T now and 45 T in 2004).

Research and Development Projects

Project Title: High Strength Materials
Report Date: December 31, 2003

Objectives

The high strength material activities made significant strides in development and characterization of high strength materials used for high field magnets, and promotion of fundamental material research by examination and utilization of nanostructures in selected high strength conductors and reinforcement materials. This program focuses on:

- Investigation of materials that have the potential to be used for various magnets
- Assessing and developing various fabrication routes for different conductors and reinforcement materials for magnets in collaboration with industrial partners
- Evaluating the impact of the microstructure and phase transformation on the performance of both types of materials in high field magnets
- Performing failure analyses of selected materials used for high field magnets.

Accomplishments

Characterization Methodology Development. High field magnets require high strength materials. The characterization of high strength materials is difficult, however, particularly when the materials have special geometries, such as wires under compression. Various specialized characterization apparatuses and methodologies were developed to assess the tensile strength of the composites, fatigue endurance, fracture toughness and microstructure. An example is a special grip developed for performing cyclic tests in both tension and compression at various temperatures. The data generated can help the designer to predict the service life of the magnets. Another example is the characterization of the nanosized particles at both grain boundaries and in the matrix in some reinforcement materials. Such nanoparticles can either strengthen materials or render materials brittle.

Cryogenic Deformation of Conductors. Achievement of both high strength and electrical conductivity in bulk materials is a challenging mission in the development of multi-functional materials, because the majority of the strengthening methods reduce the electrical conductivity of the materials significantly. At room temperatures, dislocations have little scattering effect on conducting electrons. Thus, a high density of dislocations can strengthen conductors without significantly increasing the resistivity. At room temperature, RT (which is defined as 295 ± 2 K in this report), however, deformation can only introduce a limited number of dislocations in pure metals due to dislocation annihilation, i.e. recovery. This limitation is expanded by a well-controlled 77 ± 0.5 K liquid nitrogen temperature, LNT, deformation process that permits accumulation of both nano-twins and a high density of dislocations accompanied by much less recovery than that in RT-deformed samples. The dislocations are organized into refined dislocation cells with thicker cell boundaries in LNT-deformed samples than those deformed at RT. The LNT-deformation stored more energy in the materials than RT-deformation. The LNT-deformation produces bulk pure Cu with a yield strength about 1.5 times that of RT deformed Cu. The RT resistivity increase of LNT-deformed sample is less than 5% compared with that of annealed Cu.

Cu-Ag and Cu-Nb. The co-deformation of Cu-Ag or Cu-Nb composite wires used for high-field magnets have a number of important microstructural consequences, including the production of very fine-scale structures, the development of very high internal surface area to volume ratios during the drawing, and the storage of defects at interphase interfaces. In addition, the fabrication and co-deformation of the Cu and Ag/Nb, which differ in crystal structure, thermal expansion, elastic modulus and lattice parameter, lead to the development of short wavelength internal stresses in both composites. These internal stresses are characterized by neutron diffraction and transmission electron microscopy as a function of the imposed drawing strain. The internal stresses lead to important changes in the elastic-plastic response, which is related to both magnet design and service life. The second derivative of the stresses with respect to strain ($\partial^2\sigma/\partial^2\varepsilon$) is used to describe the low strain anelasticity of the composites. The internal stresses in Cu-Nb are higher than in Cu-Ag, and consequently, the absolute values of $(\partial^2\sigma/\partial^2\varepsilon)_{Cu\text{-}Nb}$ are higher than those of $(\partial^2\sigma/\partial^2\varepsilon)_{Cu\text{-}Ag}$ at low strain.

Nickel Alloys. The reinforcement materials investigated are stainless steels, nickel-cobalt and nickel tungsten alloys in sheet form for various pulsed and hybrid magnets. It is recognized that improvement in strength and modulus in reinforcement materials has the potential to enhance the magnetic field. In order to improve the properties of such materials in a rational manner, a quantitative measurement was undertaken to relate the properties to structure and fabrication routes in selected materials. The cobalt-nickel alloys are strengthened mainly by dislocations and nano-platelets that are only a few atomic layers thick, whereas in nickel-tungsten alloys, the strength was enhanced by the precipitation during the aging. The size, density, and volume fraction of the nano-platelets and precipitates are quantified and related to the heat treatment and mechanical properties of the alloys.

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: 45 T HYBRID
REPORT DATE: DECEMBER 31, 2003

Objective

The goal of this project is to restore the superconducting outsert magnet to its full design performance, i.e. to 10 kA operating current and 14 T on-axis field contribution. At that level, and with the recently upgraded performance of the resistive insert, it is reasonable to expect the full system to operate in the 47 T to 48 T range when the restoration is complete. The restoration will involve extracting the existing Coil A from the superconducting outsert and replacing it with a completely remanufactured one. The project scope also includes replacement of the existing cryogenic current leads with HTS leads for a significant reduction in the predominant cryogenic refrigeration load, allowing an overall improvement in system performance and reliability.

Status

Presently, operation of the superconducting outsert of the Hybrid Magnet System is limited to 8 kA (11.4 T on-axis field contribution) due to degradation in the innermost Nb_3Sn coil (Coil A) caused by an unprotected quench. Work is underway to build a replacement for that coil. As fabrication nears completion, the Hybrid will be shut down, the outsert removed, and the degraded coil replaced.

Internal activity on this project has been minimal during 2003 because technical staff members were diverted to other more critical projects starting in November 2002. The materials and equipment necessary to complete the project, however, have been preserved in a state of readiness to continue when additional personnel become available. For example:

- A production facility has been established at the NHMFL that is fully capable of processing superconductor cable into finished cable-in-conduit conductor (CICC), winding the coil, heat-treating it to form the Nb_3Sn superconductor, vacuum-pressure impregnating the coil to complete the turn-to-turn and layer-to-layer insulation, and all other concomitant tasks necessary to finish the magnet.
- A special-order ingot of modified-316LN steel has been successfully produced, converted to sheet, and used to produce tubing for the conductor jacket. This material has undergone rigorous mechanical testing to confirm acceptability in the heat-treated condition.
- Cable-design modifications have been verified with the cable vendor and trial lengths have been used internally for process-development activities, confirming, for example, the NHMFL cable-insertion process, the butt-welding and leak-checking procedures for the CICC jacket, and the final jacket shaping process.
- After overcoming a variety of issues, Nb_3Sn wire is being delivered to the cabling vendor for final twisting and conversion to finished cable. Certified data confirming the wire will meet the required specifications are still needed.

At present, we anticipate restarting the project in July 2004. Milestones and the schedule to complete the project are listed in Table 7. The task of removing the existing Coil A is straightforward but projected to be a lengthy six months. With the continual demand for the 45 T Hybrid, it is important to coordinate that effort carefully with the manufacturing tasks to ensure minimal down time.

Table 7. Outline of Technology Development Program for 100 T Insert Project

Milestone	Current Schedule
80 m conductor jacketed	December 2004
Coil wound	April 2005
Coil heat-treated	June 2005
Vacuum-pressure impregnation complete	July 2005
Coil form removed, coil finished (Begin Coil-A extraction 6 months earlier)	September 2005
Reassembly complete	November 2005
Outsert reinstalled in cryostat and ready for cooldown	January 2006

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: CRYOGENIC COMPONENT DEVELOPMENT
REPORT DATE: DECEMBER 31, 2003

Objective

The primary objective of this program is to support the development of cryogenic systems for NHMFL superconducting magnet technology and to do contracted, relevant R&D. The program actively seeks funded research opportunities in the general area of cryogenic engineering. To this end, the Cryogenic Component Development (CCD) program has three main tasks:

- Develop cryogenic technology in support of large-scale superconducting magnet systems
- Conduct externally funded R&D to advance cryogenic technology
- Collaborate with industry and other laboratories in development and application of cryogenic technology.

Status

Over the last year the CCD group has concentrated its efforts on two main projects as follows.

- Continued support for the development for the 900 MHz NMR magnet cryostat. During 2003, the NHMFL took over fabrication of this cryostat and conducted several reviews of the overall project. Throughout this process, the CCD program has continued to provide technical assistance.
- A project to analyze and develop a cryogenic system for HTS transformers was completed in 2003. This work was jointly funded between the NHMFL and the Center for Advanced Power Systems (CAPS) at FSU and a grant from the Korean government. Over the past year, the primary activity has consisted of optimizing the subcooled liquid nitrogen heat transfer environment and performing an experimental confirming test.

In addition, the CCD group is pursuing several independently funded R&D activities as follows in the area of liquid helium fluid dynamics applicable to magnet technology. This work is supported by outside grants as indicated.

- Liquid Helium Flow Visualization Studies (grant from the National Science Foundation), which involves experimental application of modern particle imaging techniques to flow conditions in liquid helium
- Liquid Helium Fluid Dynamics Studies (grant from the Department of Energy), which focuses on cryogenics issues for cooling of future particle accelerators
- Studies of Transport Properties of Densified Cryogens (grant from NASA), which involves measurements of the thermal transport properties of subcooled LH_2 and LO_2.

4. NHMFL In-House Research Program

The National Science Foundation charged the National High Magnetic Field Laboratory (NHMFL) with developing an in-house research program that utilizes the NHMFL facilities to carry out high quality research at the forefront of science and engineering and advances the facilities and their scientific and technical capabilities.

To this end, the NHMFL established in 1996 an in-house research program that stimulates magnet and facility development and provides intellectual leadership for experimental and theoretical research in magnetic materials and phenomena. The NHMFL In-House Research Program (IHRP) seeks to achieve these objectives by funding research projects of normally one- to two-year duration in the following categories:

- small, seeded collaborations between internal and/or external investigators that utilize their complementary expertise;
- bold but risky efforts that hold significant potential to extend the range and type of experiments; and
- initial seed support for new faculty and research staff, targeted to magnet laboratory enhancements.

The IHRP strongly encourages collaboration across host-institutional boundaries; between internal and external investigators in academia, national laboratories, and industry; and interaction between theory and experiment. Some projects are also supported to drive new or unique research, that is, to serve as seed money to develop initial data leading to external funding of a larger program. In accord with NSF policies, the NHMFL cannot fund clinical studies.

Eight IHRP solicitations have now been completed with a total of 296 pre-proposals being submitted for review. Of the 296 proposals, 147 were selected to advance to the second phase of review, and 59 were funded (20% of the total number of submitted proposals).

2003 Solicitation and Awards

The NHMFL IHRP has been highly successful as a mechanism for supporting outstanding projects in the various areas of research pursued at the laboratory. In 2001 two enhancements were made for the solicitation that significantly improved program management. These enhancements were utilized for a third year during 2003 and proved to be a great asset to the program overall.

The first dealt with the proposal review process. In the past the in-house component of the review of the proposals was carried out by a single committee comprised of scientists from all areas of research. In order to improve the quality of the review given each proposal, subcommittees were formed that reviewed only proposals in their area of expertise. The other major enhancement was the development and use of an online system for the submission, review, and management of the solicitation process. All proposals were submitted electronically; all reviewers (internal and external) had access to the IHRP Web site and performed their reviews online. Adopting the new technology saved money, saved time, and significantly enhanced program management and communications. The IHRP online management system will be expanded in the future to support the submission of the semi-annual reports as well.

Of the 18 pre-proposals received, the committee recommended that 13 pre-proposals be moved to the full proposal state. Of the 13 full proposals, 8 proposals were awarded. A breakdown of the review results is presented in the following tables.

Table 1. IHRP Awards for 2003.

Research Area	Pre-Proposals Submitted	Pre-Proposals Proceeding to Full Proposal	Projects Funded
Condensed Matter Science	9	7	5
Biological & Chemical Sciences	6	4	3
Magnet & Magnet Materials	3	2	0
Total	**18**	**13**	**8**

Table 2. IHRP Funded Projects for 2003.

Lead P.I.	NHMFL Institution	Project Title	Funding
Amlan Biswas	UF	Investigation of the Normal State of Electron-Doped Cuprates in High Magnetic Fields	[illegible]
Lloyd Engel	NHMFL	Microwave Spectroscopy of 2D Electron Systems in Tilted Field: Charge Density Waves in Higher Landau Levels	[illegible]
Stephen Hill	UF	Development of a Pulsed High-Field/High-Frequency EPR Spectrometer	[illegible]
Joanna Long	UF	Development of Techniques for Solid State NMR Structural Measurements at High Magnetic Fields	[illegible]
Arneil Reyes	FSU	NMR in Pulsed Magnetic Fields	[illegible]
Alexei Souslov	NHMFL	Development of User Available Ultrasonic Facilities at the NHMFL	[illegible]
Yasu Takano	UF	Bose-Einstein Condensation of Magnons in Quantum Magnets	[illegible]
Johan van Tol	NHMFL	Dynamic Nuclear Polarization at High Field	[illegible]

2004 Solicitation

The 2004 Solicitation Announcement will be released in March 2004. Awards will be announced by the end of the year.

5. EDUCATION PROGRAMS

2003 was a year for reassessing programs, goals, and objectives of the Center for Integrating Research and Learning (CIRL). Educators at the NHMFL have been working since 1994 to translate research done at the laboratory for students, teachers, and the general public. In 1998, the efforts of the education group was consolidated under the umbrella of the Center and, since then, there have been many changes that reflect the dynamic world of the laboratory and the changing landscape of education. In response to these changes, the Center chose to employ a number of strategies to reassess areas of focus and programs designed to address these areas. This report provides a brief description of progress in each of the seven areas of focus identified to address the Center's mission:

> The mission of CIRL is to build connections between the National High Magnetic Field Laboratory and the community of Tallahassee, the State of Florida, and the Nation, to expand scientific literacy, and to encourage interest in and the pursuit of scientific studies among students of all ages.

This report focuses on educational outreach conducted in 2003 and on new efforts and partnerships to expand Center programs.

K12 Programs

In calendar year 2003, Center educators conducted outreach for over 7,000 students, teachers, and general public. In addition to that number, about 2,800 people attended the NHMFL 9th Annual Open House. Outreach is conducted in classrooms as well as at the laboratory. Scientists, researchers, engineers, educators, administrators, machinists, graduate students, postdoctoral students, computer support staff, and others conduct tours of the laboratory. The Center coordinates and schedules all tours and outreach events for the laboratory.

New outreach activities were developed in 2003 to accommodate the growing number and great diversity of groups requesting outreach. In addition, extending the experience beyond one day requires additional curriculum development. All outreach materials are available on the Web site at *http://education.magnet.fsu.edu* under Curriculum Development. All existing outreach materials were redone to address specific reading literacy concerns of some school groups. Accompanying hands-on activities were also redone to bring more complex physics concepts to elementary and middle school students and teachers.

In spring 2003, 16 middle school students from a local charter school participated in a research experience with 10 mentor scientists and engineers at the NHMFL. Students worked in laboratories every Friday morning for 13 weeks, culminating in a public presentation of research.

Undergraduate Programs

The Center continues its efforts to expand the NHMFL Research Experiences for Undergraduates (REU) program by encouraging new mentors, providing educational and social support for participants, and by redesigning the REU Web site as a resource for students. All applications and most supporting documents are submitted online, making them available to all mentors at all three sites – Tallahassee, Gainesville, and Los Alamos. In 2003, an REU Network was proposed and designed to encourage former REU participants (1999-present) to report progress in their careers in science and to keep in touch with colleagues. The 2003 program is described in the Table 1.

Table 1. Research Experiences for Undergraduates, 2003.

Participant	Institution	Area of Research	Mentor
REUs at NHMFL-FSU in Tallahassee			
James Adler	Cornell University	Molecular Dynamic Simulations of Copper using Moldy	Ke Han
Christine Amwake	Florida State University	Fabricated Teflon Capacitors for NMR Probes	William Brey
Mercedes Castañeda	University of Puerto Rico	Electronic Paper Power Supply	James Brooks
John Challis	University of Kentucky	Statistical Analysis of a Glassy Two-Dimensional Semiconductor System	Dragana Popovic
Nathaniel Falconer	Florida A & M University	Fabricated Teflon Capacitors for NMR Probes	William Brey
Melinda Graham	Florida State University	Lead Isotope Dating of Galena Artifacts from Florida	Leroy Odom
Jacob Grimes	Southwest Texas State University	Designing and Testing a New Material Cantilever Material for Use in Cantilever Magnetometry	Eric Palm
Meryl McDowell	University of Oklahoma	Age-dating and Trace Element Analysis of Pallasite Meteorites	Leroy Odom
Evelyn Mervine	Dartmouth College	Chemical Analysis of Post-erosional Basalts from Maui and Hawaii	Leroy Odom
Timothy Noble	Boston College	Processing of MgB_2 and BSCCO 2212 Superconductors	Justin Schwartz
Manuel Ramos	University of Texas at El Paso	The Calorimetric Measurements of AC Losses in HTS Tape	Justin Schwartz
Lee Sears	Dartmouth College	Magnesium Diboride Wire	Justin Schwartz
Jonathon Shanks	Michigan State University	Fabrication and Analysis of Thin-Film Copper Multilayers	Ke Han
David Siegel	Cornell University	Designing and Testing a New Material Cantilever Material for Use in Cantilever Magnetometry	Eric Palm
Alexander Vitkalov	Cornell University	Quantized Conductance in Quantum Point Contacts	Dragana Popovic
REUs at NHMFL-UF in Gainesville			
David Elam Jr.	University of Florida	Magnetic Properties of Linear Metal Chains and Their Liquid Crystal Derivatives	Mark Meisel
REUs at NHMFL-Los Alamos			
Alison Hatt	University of Utah	Single Quantum Dot Imaging and Spectroscopy in High Magnetic Fields	Alex Lacerda
Shawna Hollen	Occidental College	Thermal Expansion and Magnetostriction of $Ce_{1-x}La_xRhIn_5$	Alex Lacerda
Cassandra Jackson	Florida A & M University	NHMFL User Management Manual	Alex Lacerda
William Keim	Cornell University	Resistivity and Quantum Hall Effect of ZnSe/ZnCdMnSe 2D Hall Bar An Ultrafast Prefire Detector for a 300 T Single Turn Magnet System	Alex Lacerda

Professional Development

The centerpiece of the Center's professional development programs is its Research Experience for Teachers (RET). Program features are developed each year in response to teacher population (grade level, areas of expertise, etc.) and are unique because all participants are placed at the NHMFL. The 2003 program is described in Table 2.

In addition to the RET program, the Center continues to maintain relationships with local and state school districts through which quality professional development opportunities are offered. In 2003, Center educators conducted a workshop on magnets and magnetism for The Endeavour Academy, the educational arm of the Technological Research and Development Authority. In addition, two 4-day summer institutes provided content-rich hands-on inquiry based activities and strategies for 40 elementary, middle school and high school teachers.

The NHMFL's Ambassador Program engages over 100 teachers in a network of science educators. The Center uses the program to disseminate information to schools in north Florida and South Georgia and provides mini-workshops and guest speakers at three meetings. This network serves students, teachers, and the general education community as well as the NHMFL's mission to translate research conducted at the laboratory.

Table 2. Research Experiences for Teachers, 2003.

Participant	Institution	Area of Research	Mentor
Kenneth Bowles	Apopka High School Altamonte Springs, FL	Superconductivity and Classroom Applications	Justin Schwartz MS&T
Logan Chalfant	Jefferson High School Monticello, FL	Magnetic Suspension and MagLev Train Technology	Yusuf Hascicek MS&T
Dani Dulin	Canopy Oaks Elementary Tallahassee, FL	Nuclear Magnetic Resonance: A Model	Arneil Reyes & Phil Kuhns Solid State NMR
Kristen Green Collier	Pre-service teacher Tallahassee, FL	Analyzing Mineral Content of Xenoliths	Vincent Salters & Leroy Odom Geochemistry
Susan Goracke	Ruediger Elementary School Tallahassee, FL	The Power of Weave: Analyzing Fibers of Textiles in the Microanalysis Lab	Robert Goddard MS&T
Jennifer Haid	Fairview Middle School Tallahassee, FL	Microscopy/Analysis of Metal Oxide Thin Films	Yan Xin MS&T
Mark Johnson	Lake Weir High School Ocala, FL	The Effect of Low Temperatures and High Magnetic Fields on Resistance in the Alloy, $CeCoIn_5$	Eric Palm Instrumentation & Operations
Robert Krouch	Winston Park Elementary School Margate, FL	Liquid Crystal Phase Changes	Michael Davidson Optical Microscopy
Pamela Mawson	West Port High School Ocala, FL	Nuclear Magnetic Resonance: A Model	Arneil Reyes & Phil Kuhns Solid State NMR
JoAnne McBrearty	Hawks Rise Elementary School Tallahassee, FL	Microscopy/Analysis of Metal Oxide Thin Films	Yan Xin MS&T
Brian McClain	Amos P. Godby High School Tallahassee, FL	Superconductivity and Classroom Applications	Justin Schwartz MS&T
Jessica Peddie	Pre-service Hosford, FL	The Power of Weave: Analyzing Fibers of Textiles in the Microanalysis Lab	Robert Goddard MS&T
Vana Richards	Kenneth J. Carberry Intermediate School Emmet, Idaho	Magnetic Suspension and MagLev Train Technology	Yusuf Hascicek MS&T
Farrell Rogers	Marshall Middle School Lakeland, FL	Liquid Crystal Phase Changes	Michael Davidson Optical Microscopy
Carol Smith	Odyssey Charter School	The Effect of Low Temperatures and High Magnetic Fields on Resistance in the Alloy, $CeCoIn_5$	Eric Palm
Kimberlain Zenon	Braden River Middle School Bradenton, FL	Analyzing Mineral Content of Xenoliths	Vincent Salters and Leroy Odom Geochemistry

Public Programs

The Center facilitated the NHMFL's 2003 Annual Open House, attracting over 2,800 people to demonstrations and interactive exhibits organized by scientists, researchers, graduate students, administrative staff, educators, and community partners. Open House activities are a way to open the facility to the community as well as to people who travel long distances to experience the excitement of real world science.

More than 1500 people excluding school groups toured the NHMFL facility guided by educators, researchers, scientists, students, machinists, technicians, support personnel and administrators. The commitment of NHMFL faculty and staff continues to be a linchpin of Center touring activities.

Science Night at Borders was initiated to conduct outreach activities to a wide range of participants at a nontraditional site. The success of this program initiated in 2003 is evident by the large number of people attending, and by Borders' commitment to providing advertising, space, and support.

The Center provides outreach and support for the Frenchtown After-School Program for underserved students. Working in conjunction with two community centers that serve student populations from local low-income housing projects, Center educators host students at the laboratory and go to the centers to conduct science activities.

Science instruction and activities at Boys and Girls Clubs are supported by Center activities four times each academic semester and during the summer. Students in grades K-12 participate in programs at locations throughout the community.

Curriculum Development

In 2003, the Center created three series of materials:

- Project Superconductivity is an ongoing venture being developed with the IEEE, Applied Superconductivity Conference, Inc., the University of Houston, the University of Wisconsin, American Superconductor, and the NHMFL at Florida State University. An interactive traveling museum exhibit has been designed and will be premiered in 2004. In addition, a smaller exhibit was created for classroom and workshop use and will be used as the basis for workshops at the Applied Superconductivity Conference in October 2004.
- Project Recertification was developed in summer 2003 in reaction to requests by Ambassador teachers. Designed for high school and middle school teachers, the package assists educators in receiving credits toward recertification by conducting classroom activities related to magnets and magnetism.
- New Pre/Post Visit and Outreach materials were designed in 2003 to provide richer experiences for students and teachers who participate in Center activities.

We continue to use other Center-created curriculum materials as the basis for teacher workshops: *MagLab: Alpha*; *Science, Magnets and You*; *Science, Optics and You*; and *Science, Tobacco and You*.

Partnerships

Developing and maintaining partnerships is a priority for the Center: partnerships within the Florida State University community, within the community surrounding the laboratory, and in particular within the educational community. We have an ongoing relationship with a number of programs and continue to look for ways to increase the number of programs with which we interact. In 2003, we made an effort to develop new partnerships such as the Alabama Wiregrass Math and Science Consortium, Newspapers in Education, and the University of West Florida's Quick Science program. The Center has also become an educational resource for the Center for Advanced Power Systems, the Center for Economic Forecasting and Analysis, scientists and researchers at the NHMFL, and for other groups at the university seeking assistance with curriculum development.

Educational Research

In 2003, evaluation of the Research Experiences for Teachers program continued, with first year results yielding impressive data regarding the effects that the program has on students of participating educators. The study will continue through summers 2004 and 2005 and is presently focused on surveying students' attitudes toward science as an indicator of success in science classes and predictor of choosing high-level science classes in high school.

In 2003, an REU Network was created on the newly designed Web site to track students' career paths after participating in the NHMFL REU program. While students are difficult to keep up with, the REU Network is a start toward locating participants from as far back as 1999 when the Center began administering the program.

A research study of the effects of the *Science, Tobacco & You* program was conducted in 2003 and provided longitudinal data on students who used the program 1998-2002. Results were used to write two articles: Dixon, P., Spiegel, S. A., & LaFrazza-Hickey, G. (2003). "Workshop Design and Development: A Model of 1-day Workshops that Work." Manuscript submitted for publication to *Journal of Science Teacher Education* and Flynn, L. R., Milton, S., Curva, F. Spiegel, S., & Dixon, P. (2003). "Outcomes of Exposure to a Science Curriculum." Manuscript accepted for publication to *Psychological Reports: Perceptual and Motor Skills.*

Center educators presented at the National Science Teachers Association national conference and contributed to the ADMIRE conference (part of the RET Network). In fall 2003, superconductivity materials were introduced at the Florida Association of Science Teachers conference in preparation for the 2004 National Science Teachers Association conference.

In addition to the programs and activities described above, the Center continues its ongoing commitment to programs that have been part of the NHMFL educational outreach since 1995. We are continually looking for new ways to strengthen the influence of informal science education and to translate the research conducted at the NHMFL for students, teachers, and the general public.

6. COLLABORATIONS

In accordance with one of the laboratory's mission objectives "to engage in the development of future magnet technology," NHMFL researchers and staff work aggressively to engage the private sector, other federal agencies and institutions, and international organization to advance a wide variety of magnet-related technologies and projects. These important external collaborations are an excellent means of fulfilling this laboratory's mission to advance magnet related technologies and promote United States economic competitiveness while enhancing user facilities. The NHMFL collaborations continue to grow and expand in both breath and scope as reflected by the summaries below.

Private Sector Activities

American Superconductor Corporation (AMSC), Westborough, MA. The NHMFL has been collaborating with AMSC in the characterization of HTS conductors. These characterizations include the effects of mechanical stress and strain (both tensile and compressive) on the current-carrying capabilities of YBCO and BSCCO conductors, investigations of the stability margin and quench propagation behavior of YBCO coated conductors, and the magneto-mechanical behavior of YBCO conductors using magneto-optical imaging.

Big Horn Valve (BHV), Sheridan, WY. The NHMFL and Big Horn Valve are working together on an NSF STTR-funded project to develop a magnetically actuated fluid handling valve that could have wide applications in the fluid processing industry. The potential outcome from this project is a valve that is completely sealed so that there will be no leakage into the environment. In addition, the NHMFL is working with BHV and NASA on developing a cryogenic value; this effort is funded by an SBIR grant.

BWX Technologies, Inc. (BWXT), Lynchburg, VA. The Center for Advanced Power Systems (CAPS), through the Office of Naval Research, is collaborating with BWXT to establish a superconducting magnetic energy storage (SMES) demonstration project. This project will be based on a 100 MJ SMES magnet developed by BWXT with the Department of Energy and DARPA funding. CAPS will be the host site for the SMES demonstration, will provide installation of the system, and will conduct an extensive research program with the device.

Cryogenic Materials Inc. (CMI), Boulder, CO. Materials scientists at CMI and the NHMFL have collaborated to study the mechanical properties of high strength steel weldments at cryogenic temperatures. The NHMFL has conducted low temperature tensile, fracture toughness, and Charpy impact tests of the base metals (Inconel 718 and 304 Stainless Steel), their weldments, and the heat-affected zones. The results of the tests are used for the selection of materials and fabrication processes in cryogenic machinery applications.

ExxonMobil Corporation, Irving, TX. The National High-Field FT-ICR Facility at the NHMFL has an ongoing collaboration with this oil company to analyze the mass resolution of a variety of different crude oils. Dr. Alan Marshall has achieved a world record in mass spectroscopy and mass accuracy with more than 20,000 chemically distinct components and 55 elemental compositions at a single nominal mass of South American crude oil. Collaborators are developing the potential of various ionization methods (electrospray, field desorption, field ionization, electron ionization, and chemical ionization) combined with FT-ICR mass analysis.

Florida Lasers Systems, Inc., Stewart, FL. Florida Lasers Systems in collaboration with the NHMFL is developing an optical mass gauging system (OMGS) for investigations of solid hydrogen particle mass in liquid helium. Solid hydrogen particles are under consideration by NASA as fuels for future space missions. The OMGS is being developed as a prototype for determining fuel quantity under reduced gravity conditions. The NHMFL is providing the cryogenic test facility and instrument calibration.

H.C. Starck/CSM Industries Inc., Cleveland, OH. The collaboration with H.C. Starck is concentrated on producing high strength MP35N sheets as reinforcement for high field pulsed magnets. Different fabrication routes have been assessed in order to achieve the properties that are reproducible.

High Energy Metals, Inc., Port Townsend, WA. The NHMFL is collaborating with High Energy Metals to develop explosive bonding between high strength aluminum alloys and high strength Cu alloys for fabrication of coils for repetitively pulsed magnets.

Hyper Tech Research Inc, Troy, OH. The NHMFL is collaborating with Hyper Tech Research Inc. to coat single RE-Oxide buffer layers and YBCO on Ni/Ni-alloy tape substrates and fine wires using NHMFL proprietary sol-gel process. The fine wire activity is also supported by an SBIR. The development of a long-length HTS power transmission cable, using the sol-gel, all non-vacuum coated conductors, is a mutual venture to illustrate the cost effectiveness and problem solving capacity of HTS materials. The development of second generation YBCO tape will reshape the cost of HTS materials while offering significant HTS coil design and fabrication advantages.

I^4 Learning, Tallahassee, FL. I^4 Learning, a subsidiary of TSI, Inc., is a health and science curriculum development partner with the Center for Integrating Research & Learning (CIRL) at the NHMFL. CIRL faculty members are working on a new joint project that builds upon the many successes of *Science, Tobacco & You*. The curriculum package under development will be marketed nationwide.

Interface Welding, Inc., Carson, CA. The NHMFL in conjunction with Interface Welding has developed and is continuing to develop novel welding procedures between thick sections of aluminum alloys and high strength, high conductivity copper alloys. The welding technology will be used as part of the Repetitively Pulsed Magnet project for neutron scattering.

Minnesota Mining and Manufacturing Company (3M), Saint Paul, MN. The NHMFL Repetitively Pulsed Magnet program in collaboration with 3M is attempting to produce a high strength composite conductor having higher fatigue endurance than aluminum alloys with low neutron cross-sections. 3M has produced the samples, which have arrived in Tallahassee for testing. The properties of the composite are also being assessed at the NHMFL.

Nikon USA, Melville, NY. The NHMFL maintains close ties with Nikon on the development of an educational and technical support microscopy Web site, including the latest innovations in digital imaging technology. As part of the collaboration, the NHMFL is field-testing new Nikon equipment and developing new methods of fluorescence microscopy.

Olympus American, Melville, NY. The NHMFL is developing an education/technical Web site centered on Olympus products and will be collaborating with the firm on the development of a new tissue culture facility at the NHMFL in Tallahassee. This activity will involve biologists at the NHMFL and will feature Total Internal Reflection Fluorescence microscopy.

Oxford Superconductor Technologies (OST), Carteret, NJ. The NHMFL and OST successfully developed an HTS insert coil that generated 3 T in the 19 T large bore resistive magnet, generating 22 T in total. This insert coil, which required approximately 1.5 kilometer of HTS conductor, is an important development on the path toward a 1 GHz NMR magnet system. OST is providing all powder-in-tube BSCCO 2212 conductor for the program. After OST fabricates the unreacted conductor, the NHMFL insulates it using an internally developed sol-gel approach and winds the double pancake coils. Approximately half of the coils are stacked at the NHMFL and electrically joined. Building upon this success, the NHMFL and OST are now collaborating on a 5 T insert coil using react-and-wind coils. In this system, OST provides reacted conductors and the NHMFL co-winds the conductor with insulated stainless steel into double pancakes and layer-wound coils. Testing of this coil is planned for early 2003.

Spalding Worldwide Sports, Chicopee, MA. The NHMFL is collaborating with Spalding to develop a test apparatus to conduct dynamic impact experiments on elastomeric materials used in golf ball construction. The test apparatus has been characterized and qualified with respect to the limits and accuracies that can be obtained. Data that is generated with the instrument can now be confidently used in computer models for design.

TSI, Inc., Atlanta, GA, Washington, D.C., Tallahassee, FL. TSI is a leader in development of innovative interactive programs for education and training. TSI specializes in the implementation of programs, systems, and strategies to improve efficiency and productivity for a wide variety of applications in business, industry, and education. TSI is a key partner to the NHMFL Center for Integrating Research and Learning in the *Science, Tobacco & You* curriculum program. In the past year alone, TSI has expanded marketing of *Science, Tobacco & You* to 11 additional states for a total of 20 states. Trainings by NHMFL and TSI personnel continue nationwide.

Inter-Agency & Inter-Institutional Activities

Air Force Research Laboratory (AFRL), OH. The NHMFL is collaborating with AFRL to deposit highly textured, high Jc YBCO layers by Pulsed Laser Ablation (PLD) on the Ni/Ni-alloy tape substrates with sol-gel buffer layer/layers. This is to provide high quality, sol-gel inexpensive buffer layered substrates to the working vacuum deposition technology, as well as to double check the suitability of the NHMFL sol-gel buffered Ni/Ni-alloy substrates.

Brookhaven National Laboratory (BNL), Upton, NY. The NHMFL is collaborating with BNL in achieving a high degree of texture in thick, sol-gel coated YBCO conductors by a proprietary processing method developed at Brookhaven. By achieving the biaxial texture in the thick YBCO layer of the second generation HTS conductors, the much awaited use of HTS in practical industrial applications will not only be possible, but also in high demand.

Center for Advanced Power Systems (CAPS), Florida State University. CAPS was established by Florida State University as a direct result of NHMFL efforts to develop research relationships focused on the uses of superconductivity to power systems of interest to the **Office of Naval Research**. CAPS is investigating power systems interactions, controls, and applications of high temperature superconductors in power systems. The major feature of CAPS' new facility will be its high bay test area, which will give it the capability to test power apparatus up to the 5 MW level. When the apparatus is being tested and coupled with a Real Time Digital Simulator (RTDS), CAPS will have a unique "hardware in the loop" dynamic test capability not presently available elsewhere at this power level. In addition, CAPS will have a large magnet on site when the 100 MJ Superconducting Magnetic Energy Storage (SMES) system is delivered by BWXT in mid-2003. CAPS has taken the leadership role in organizing the Electric Ship Research and Development Consortium, comprising representatives from **Florida State University, Mississippi State University**, the **University of South Carolina**, and the **University of Texas at Austin.**

Department of Energy-High Energy Physics Program (DOE-HEP). The NHMFL participates in pre-standards measurement research related to testing advanced superconductor materials. This year, NHMFL representatives attended a Low Temperature Superconductor Workshop held at the Applied Superconductivity Conference and helped to plan a Round Robin Test Program. The program will evaluate ITER standardized superconductor test methods as applied to tests of high current density superconductors.

Lawrence Berkeley National Laboratory, Berkeley, CA. The laboratory continues to support LBNL's high field, dipole development program through operation of a specially designed facility that allows simultaneous application of high field, high current, and high transverse load to large test conductors. The facility is based on our superconducting split-pair solenoid, produced by Oxford Instruments, Inc., that is located in the Large Magnet Component Test Laboratory at the NHMFL. At present, the facility is capable of applying up to 13 T, 19.5 kA, and 250 kN to a test conductor fitting into the 30 x 70 mm^2 radial-access port of the Oxford magnet. A variety of large Rutherford-style cables based on multifilamentary Nb_3Sn/copper composite wires have been tested and have provided insight to the performance of an experimental model dipole magnet tested at LBNL. Future test plans include cables fabricated with high temperature superconductor wires based on Ag-matrix Bi-2212.

Los Alamos National Laboratory, Los Alamos, NM. The object of the Los Alamos Neutron Science Experiment (LANSCE) high frequency split-pair pulsed magnet, funded by the Department of Energy and the NHMFL, is to supply the LANSCE with the highest field repeating pulsed magnet for neutron scattering experiments in the world. The present target is 30 T for 10 million cycles. The design of the magnet system is well underway with testing of the first prototype scheduled to begin shortly. These high frequency magnets will be pulsed at 1 Hz in the LANSCE facility, providing a unique high magnetic field and neutron beam scattering capability.

Los Alamos National Laboratory, Los Alamos, NM. Researchers from the University of Florida and Los Alamos have obtained grant support to develop and build a millimeter-wave EPR spectrometer for the Pulsed Field Facility at Los Alamos.

M.D. Anderson Cancer Center, Houston, Texas. This collaboration involves the study of transcription factors involved in cell differentiation and post-translational modifications of cascade proteins involved in apoptosis of cancer cells. FT-ICR mass spectrometry is being used to identify these proteins and any post-translational processing of them. It is anticipated that these factors could be potential therapeutic targets in treatment of glioblastoma multiforme.

National Superconducting Cyclotron Laboratory (NSCL), Michigan State University, East Lansing, MI. The NHMFL has designed and is building a 4 T superconducting sweeper magnet for installation and use in nuclear physics experiments at the NSCL. The magnet is referred to as a sweeper because it "sweeps" charged particles out of a multi-particle beam and into a mass spectrometer built by the NSCL. It is required to bend beams of high rigidity 40° on a 1 meter radius. The magnet consists of 2 "D"-shaped coils with a split of 140 mm. The conductor is epoxy-impregnated niobium titanium operating at 4.5 K. Although 4 T is not a tremendously high field, attaining 4 T in a gap of 140 mm with a "D"-shaped magnet leads to high stresses and requires substantial analytical work in the design process to ensure reliable operation. The coils have been successfully bucket tested and construction of the nitrogen shield and vacuum jacket is underway.

Oak Ridge National Laboratory, Oak Ridge, TN. A collaboration was initiated between the NHMFL and the Electron Microscopy Group, Solid State Division in Oak Ridge National Laboratory. The purpose of the partnership is the development of a program to characterize and fabricate bulk materials with nanostructures.

Ohio State University, Columbus, OH. The NHMFL is collaborating with Ohio State University to characterize the magnetic field dependence of the critical current density of "jelly-rolled" Nb_3Al conductors at 4.2 K and up to 26 T. Ohio State, IGC, and NRIM have been developing the conductors by various processing approaches like Ohmic heating and quenching. The aim of this collaboration is to evaluate the capacity of each conductor as possible candidate conductor for high field NMR applications due to the high B_{c2} of Nb_3Al.

University of California, Riverside (UCR), Department of Physics. With funding from LANL-DOE, Professor Ward P. Beyerman (UCR) and John Sarrao (LANL) are investigating lattice spin dynamics in transition metals at extreme conditions at the Pulsed Field Facility.

University of California, San Diego, Department of Physics. The NHMFL at LANL, with funding from LANL-DOE, will be starting a collaboration with Professor Brian M. Maple focusing on filled skutterudite compounds in high pulsed magnetic fields.

International Activities

A.A. Bochvar Institute, Moscow, Russia. Scientists at the NHMFL's Pulsed Field Facility and the material development program at Tallahassee have maintained a long-standing relationship with the Bochvar Institute. As a result, high quality Cu-Nb micro-composite wires with outstanding characteristics (strength, conductivity, and resistive ratio) were developed and are now available for the construction of high field coils. The materials were further characterized in Tallahassee for pulsed magnets. Another activity concerns the development of stainless-steel-clad cooper conductors in long lengths with small and large cross sections. Both types of conductors are of great importance to the 100 T development project (outsert and inner coils) and other high field user magnet systems with long decay times.

Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany. The NHMFL is collaborating with the DESY laboratory on cryogenic problems relating to the future of the TESLA electron accelerator. DESY is developing the TESLA Test Facility for He II cooling of RF cavities. The NHMFL is providing components to study the flow characteristics of two-phase He II for the TTF test facility.

Free Electron Laser Facility, Nieuwegein, The Netherlands. The National High-Field FT-ICR Facility at the NHMFL is collaborating with the Dutch facility. A 4.7 T FT-ICR instrument has been built at the University of Florida by Dr. John Eyler and installed in Nieuwegein. The Free Electron Laser Facility is the world leader in producing intense radiation conveniently tunable in the infrared spectral range that spans typical chemical bond vibrational frequencies. This FT-ICR instrument will provide a unique capability for the determination of the infrared absorption spectra of mass-selected ions.

Göteborg University, Sweden. The collaboration involves the determination of the glycosylation of proteins isolated from the cerebrospinal fluid of normal vs. Alzheimer's patients. Preliminary data from the FT-ICR analysis indicates that the glycosylation of specific proteins may vary according to the disease state. It is anticipated that this relatively "non-invasive approach" can be used as an early diagnostic technique and give insight into the progression and treatment of disease. NHMFL and Swedish collaborators were awarded a Swedish Foundation for International Cooperation in Research and Higher Education grant to conduct this research. These funds have also permitted the exchange of students and researchers between the facilities.

Grenoble High Magnetic Field Laboratory, Grenoble, France. Since the start of the NHMFL, the cooperation between the two high field laboratories has been very successful and productive. Accomplishments include the 20 T, 50 mm bore magnets at the NHMFL and the joint development of the 20 T, 20 cm bore magnet at the NHMFL along with a similar magnet in Grenoble. Discussions have started to repeat this cost-saving approach for the design of split-coil magnets for the two laboratories.

Hahn-Meitner Institute, Berlin, Germany. The institute is applying to the German government for a new neutron spectrometer for scattering experiments in continuous high magnetic fields up to 40 T. The NHMFL has agreed to participate in the proposal writing process and to supply help and advice concerning the layout of the 40 MW power supply and cooling infrastructure. In case of funding, the NHMFL will provide the magnetic field systems, a horizontal Florida-Bitter magnet, and a vertical split-coil magnet, both optimized for large opening angles and high magnetic fields.

High Field Magnet Laboratory, University of Nijmegen, The Netherlands. A 33 T Florida-Bitter magnet and some spare parts were delivered within budget to Nijmegen this summer per a contract signed in 2000. The Nijmegen lab is building two duplicate magnets themselves. The new magnets should form the basis for the new user facility starting in 2003. We are discussing collaborations on other future magnet systems, such as 30 T magnets suitable for condensed matter NMR, hybrid inserts, and split pairs.

Institute of Low Temperature Physics, University of Sao Paulo, Brazil. The NHMFL Pulsed Field Facility has an ongoing collaboration with a group at the University of Sao Paulo to investigate colossal magnetoresistance materials at very high magnetic fields.

Institute of Materials Research, Charles University, Prague, Czech Republic. Researchers at Charles University and the Pulsed Field Facility at Los Alamos are collaborating on the investigation of correlated metals at the facility's sophisticated low temperature and very high pressure instrumentation.

Institute of Solid State and Materials Research Dresden (IFW Dresden)/Research Centre Rossendorf (FZ Rossendorf), Germany. The NHMFL has an Agreement of Cooperation with IFW Dresden and FZ Rossendorf for the design and construction of pulse magnets for the non-destructive generation of the highest magnetic fields possible. Among other contributions, the German partner will develop and provide high-strength micro- and macro-composite conductors, their characterization, and offers the use of their facilities. The NHMFL delivered several 15 mm bore, 60 T, ZM pulse magnets for physics research to the Institute in Dresden Germany. The magnets have expanded the user magnet capability at the facility.

The Research Centre and the Institute have obtained funding for a 50 MJ capacitor bank, building, and necessary infrastructure. NHMFL and FZ Rossendorf/IFW Dresden have initiated discussions on how to expand the successful cooperation to include design and construction of pulsed coils up to 100 T.

Korean Institute of Machinery and Materials (KIMM), Changwan, South Korea. The NHMFL and KIMM are collaborating on the development of Bi-2223-based HTS insert coils. KIMM has provided the conductor for the winding of a double pancake coil, which was successfully tested in the 19 T, large bore resistive magnet.

Laboratoire de Physique de l'Ecole Normale Superieure, Paris, France. Researchers from the University of Florida are working with the French laboratory to extend the frequency coverage of its high frequency spectrometer from 200 GHz to 550 GHz and to develop time resolution capabilities for pulsed EPR capabilities. The French facility has great expertise in microwave signal processing, which is being used at the University of Florida.

Laboratoire National des Champs Magnétiques Pulsés, Toulouse, France. Extending the successful cooperation with the pulsed high field laboratory of Toulouse, we have submitted in cooperation with IFW Dresden a three-partner proposal to the respective funding agencies for the development of new conductors and reinforcement materials. It will include the set-up of a test bank in Toulouse and the development of Cu-SS and CuNb conductors. The test coils will be designed and wound in Tallahassee.

McMaster University, Hamilton, Ontario, Canada. This collaboration effort is related to a study of deformation mechanisms of high strength Cu-Ag conductors that have very high internal energies. The study confirmed that the deformation introduced more residual stresses and interfacial areas that resulted in higher internal energies than annealed samples. We measured these energies and attempted to relate the variation of the internal energies to the performance of the high strength conductors in the magnets.

Ministry of Science and Technology of Korea, Seoul, Korea. This multi-international cooperation project between researchers at Seoul National University and the NHMFL provides for the exchange of several graduate students. The Korean graduate students have used the NHMFL DC High Field Facility to pursue research that has been presented at a major conference and has been submitted for publication.

Nicolas Kurti Magnet Laboratory, Clarendon Laboratory, Oxford University, England. The magnet group of Clarendon Laboratory and the NHMFL have agreed to explore the application of CuSS wire as a cost-effective means for the generation of the highest pulsed fields possible. As a first step, the magnet group has offered one spool of high-quality conductor for design and testing of pulsed coils to be evaluated by the NHMFL.

QMC Instruments Ltd. and Cardiff University, United Kingdom. This collaboration at the University of Florida involves the development of a quasioptical setup in order to couple the higher frequency sources (200+ GHz) to the low-temperature/high-field environment.

Tsukuba Magnet Laboratory (TML), Tsukuba, Japan. The Japanese TML purchased a 30 T resistive magnet from the NHMFL in 1996 that was delivered in 1997. We have since delivered a spare set of coils under separate contract (with the last coil being delivered this year) and will continue to provide coils as needed in the future. Preliminary discussions have begun regarding a new insert for their 40 T class hybrid magnet.

Université de Reims, France. The collaboration between the NHMFL and the Université de Reims is related to the characterization of nano-structure materials. The materials include Cu-Nb used for pulsed magnets and Fe-Pt multi-layers that have unique magnetic properties.

7. Conferences and Workshops

43rd Sanibel Symposium

February 22 - March 1, 2003
St. Augustine, Florida

The 43rd annual Sanibel Symposium arranged by the faculty and staff of the University of Florida Institute for Theory and Computation in Molecular and Materials Sciences was held February 22 through March 1, 2003 at the Ponce de Leon Conference Center close to the North Gate of the city of St. Augustine, Florida. This year's meeting gathered close to 300 scientists from about 20 different nations.

The topics covered by the fifteen plenary and seven poster sessions included, in addition to Advances in Electronic Structure and Dynamics Theory, the following:

- Density Functional Theory and Applications
- Advanced Materials
- Molecular Electronics
- Coherent Control
- Computer Simulations of Bio-Nano Systems
- Energy Transduction
- Membrane Proteins
- Carbohydrate Modeling


Professor John A. Pople (Nobel laureate in Chemistry, 1998) shared discussions with Peter Gill of Nottingham University and others at the 43rd Sanibel Symposium.

The University of Florida, the IBM Corporation, the Office of Naval Research, and the Department of Energy sponsored the meeting. A one-day short-course on "Force Fields and Molecular Dynamics" with hands on computer applications, sponsored by the CACHe Group of Fujitsu, was part of the program and included the participation of graduate and undergraduate students from several U.S. colleges and universities. Conference organizers included NHMFL-affiliated UF faculty, Rodney Bartlett, Hai-Ping Cheng, Henk Monkhorst, John Sabin, and Samuel Trickey.

4th North American FT-ICR Conference

April 3-6, 2003
Greater San Francisco, California

The 4th North American FT-ICR Conference was held April 3-6 at the Marconi Conference Center in Marshall, California. A total of 84 people attended, which filled the on-site housing available to the conference registrants. The invited talks, poster session, and plenary session by Helmut Schwarz from the Technical University-Berlin were all well attended and stimulated many scientific discussions during the breaks.

The FT-ICR Conference talks ranged from theory to applications, but it is becoming apparent that applications, especially biological applications, are starting to dominate this biennial conference. This year, corporate sponsors gave an interesting 10-minute presentation on their latest instrumentation. Thermo-Finnigan MAT also gave a talk on their new quadrupole ion trap FT-ICR, which promises to be a "user friendly" high-resolution instrument. The ongoing interactions between the industry and the FT-ICR MS Facility continue to be strong, and we are pleased to note that most of the commercial vendors of FT-ICR MS have incorporated ion optics, which was pioneered at facilities in Tallahassee.

Special thanks go to the sponsors of this year's conference: Bruker-Daltonics, IonSpec Inc., Thermo-Finnigan MAT, and Oxford Instruments. The conference budget was provided solely from the vendor contributions and registration fees, and supported registration, room, and board for the 24 invited speakers and 14 student awardees. Since students are the future, the organizers felt that it was important to provide such awards to students in an effort to encourage them and to give them the opportunity to attend the conference.

The NHMFL conference organizing committee comprised Alan G. Marshall, Christopher L. Hendrickson, Mark R. Emmett of Florida State University, and John R. Eyler of the University of Florida.

VI Latin American Workshop on Magnetism, Magnetic Materials and Their Applications (LAW3M)

April 7-11, 2003
Chihuahua, Mexico

The NHMFL assisted in organizing this meeting initiated in La Habana, Cuba in 1991, and followed by workshops in Guanajuato, Mexico (1993), Merida, Venezuela (1995), Sao Paulo, Brazil (1998), and San Carlos de Bariloche, Argentina (2001). The workshop supports scientific exchanges in the Americas and brings together researchers and institutions interested in recent developments in all branches of fundamental and applied magnetism.

A primary goal during the 2003 LAW3M, which was held at the Advanced Materials Research Center (CIMAV), was to promote exchanges among researchers, including students and postdocs, and to facilitate discussions of new concepts and developments in materials research and magnetic applications. Workshop proceedings will be published as a special issue of the Elsevier Science B.V. journal, *Journal of Alloys and Compounds*.

SPIE's First International Symposium on Fluctuations and Noise

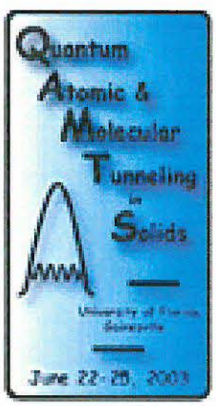
June 1-4, 2003
Sante Fe, New Mexico

The use of noise techniques to study materials has grown steadily over the last few decades, and the goal of this symposium was to bring together people from around the world working on the most exciting applications of noise to serious materials problems. These applications are largely but not exclusively to problems in glassy systems and disordered materials, for which probes that do not average over many dissimilar regions are particularly valuable. Another emerging theme is the use of shot noise to characterize conductance mechanisms in unconventional regimes.

The first meeting on Fluctuations and Noise (FaN) comprised six parallel conferences:

- FaN in Biological, Biophysical, and Biomedical Systems
- FaN in Photonics and Quantum Optics
- Noise as a Tool for Studying Materials
- Noise in Devices and Circuits
- Noise in Complex Systems and Stochastic Dynamics
- Noise and Information and Nano-electronics, Sensors, and Standards

The NHMFL was pleased to support the conference on Noise as a Tool for Studying Materials. Its success has led to a second Symposium on Fluctuations and Noise, to be held May 25-28, 2004, in Maspalomas, Spain. NHMFL condensed matter scientist Dragana Popovic is serving as the conference chair.



XIIth International Quantum Atomic and Molecular Tunneling in Solids Workshop (QAMTS)

June 22-25, 2003
Gainesville, Florida
Hotel Headquarters: Reitz Union Hotel and UF Hotel & Conference Center

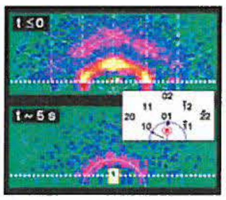
The XIIth QAMTS was held on the campus of the University of Florida in Gainesville. NHMFL Principal Investigator and UF Dean of the College of Liberal Arts and Sciences Neil Sullivan and Juergen Eckert of Los Alamos National Laboratory were the principal organizers. The topics for this important international meeting included Macroscopic Tunneling in Nanomagnets and Related Molecular Systems; Rotational Tunneling of Symmetrical Groups; Proton Tunneling in Hydrogen Bonds; Molecular Dynamics Simulations; Coupled Rotors; Tunneling in Life Sciences; and Tunneling in Glasses and Amorphous Systems.

Sponsors for XIIth QAMTS included the NHMFL, LANL, the Spallation Neutron Source, National Institute of Standards and Technology, and UF.

Neutron Scattering Workshops

September 23-26, 2003
Tallahassee, Florida

The inherent interface been high magnetic fields and neutron scattering research has forged natural collaborations between faculty at the NHMFL, the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory (ORNL), and other institutions. This fall, the NHMFL and FSU were pleased to host **two workshops** that enhanced these interactions and expanded interest in the growing field of neutron scattering. In addition to exchanging ideas on the science opportunities and needs, the workshops, which were attended by nearly 150 people, resulted in planning papers and preliminary proposals for the new magnets and instrumentation.



- **Joint Institute for Neutron Sciences (JINS) Workshop: Neutron Scattering for Chemistry and the Chemistry-Biology Interface, September 23-25, 2003**

- **Sample Environments for Neutron Scattering Experiments (SENSE) Workshop September 24-26, 2003**

33rd Southeastern Magnetic Resonance Conference

October 17-19, 2003
Site: Tallahassee, Florida

The 2003 SEMRC was an opportunity for 107 NMR and EMR scientists primarily from the southeast United States to share ideas and strengthen ties. Invited and contributed talks were presented in oral sessions on topics such as Magnetic Systems and Molecular Magnets, Magnetic Resonance of Materials, Imaging and Biological Applications, and Protein Structure and Dynamics. A special session was organized by James Prestegard of the University of Georgia to address the Prospects for Biomolecular NMR at Very High Magnetic Fields. In addition, a poster session gave students and scientists the opportunity to present their work. The conference banquet featured a lecture by Wallace S. Brey, Professor Emeritus of the University of Florida, titled “Some Tales about the Development of Magnetic Resonance.”

8. BUDGET & STAFFING

The National High Magnetic Field Laboratory (NHMFL) operates with funding provided by federal, institutional, and industry sources. In addition, the laboratory faculty and staff have been successful in securing individual research funding for specific areas of research from a variety of sources, including federal and private sectors. While the laboratory receives funding from numerous sources, the primary funding source for operation of the NHMFL remains the National Science Foundation (NSF) and funds provided through the participating institutions.

NSF CORE BUDGET

The National Science Board approved the NHMFL renewal award of the third five-year research grant in the amount of $117,500,000 at its meeting on October 19, 2000, plus subsequent amendments[1]. The renewal period is from January 1, 2001 through December 31, 2005. The following table provides a comparison of the current NSF award with the previous five-year award:

Table 1. NHMFL NSF Budget Comparison

Division/Program	1996 – 2000 5-Yr NSF Summary	% of BGT	2001 – 2005 5-Yr NSF Summary	% of BGT	% Change +/-
Director	$2,912,811	3.33%	$3,555,620	2.97%	22.07%
Unassigned Budget	0	0.00%	1,965,492	1.64%	
Facilities & Admin	5,698,737	6.51%	9,082,547	7.60%	59.38%
Instruments & Operations	18,366,654	20.99%	22,043,984	18.44%	20.02%
Instruments & Operations Electrical Power for DC Facility	7,918,471	9.05%	12,994,000	10.87%	64.10%
Magnet Science & Technology	22,122,487	25.28%	24,524,383	20.52%	10.86%
Science	7,343,739	8.39%	5,473,904	4.58%	-25.46%
LANL	20,838,959	23.82%	26,507,509	22.18%	27.20%
LANL - IHRP [2]			686,212	0.57%	
CIMAR - NMR - FSU	361,550	0.41%	3,298,918	2.76%	812.44%
CIMAR - EMR	248,902	0.28%	948,853	0.79%	281.22%
CIMAR - ICR [3]	175,650	0.20%	3,793,224	3.17%	2059.54%
CIMAR - NMR -UF - AMRIS	812,414	0.94%	1,599,354	1.35%	96.86%
UF - High B/T	699,626	0.80%	1,839,334	1.54%	162.90%
UF - IHRP [2]			1,207,855	1.02%	
Total NSF Cooperative Agreement	**$87,500,000**	**100.00%**	**$119,521,189**	**100.00%**	**36.60%**

1 Baseline budget $117,500,000
Amendments:
Eglin AFB 49,917
Electricity 1,470,000
RET Program 501,272
Amended Budget $119,521,189

2 IHRP (In-House Research Program) for LANL and UF is now being reported separately instead of including it in the Science Department's budget as has been done in the past.

3 ICR Facilities budget does not include the NSF Chemistry Division award in the amount of $5,808,433, which is for 1/1/2000 through 12/31/2004, although all the funding was received by 12/31/2003.

The following table presents the NSF funding for the five-year period.

Table 2. NHMFL - NSF Budget by Program

Division/Program	2001	2002	2003	2004	2005	Total Budget
Director	$407,208	$313,320	$115,223	$399,401	$339,292	$1,574,444
CIRL	225,379	198,611	142,872	284,315	133,589	984,766
Unassigned Budget [1]	(2,780,994)	(596,653)	2,071,302	925,808	1,569,991	1,189,454
Facilities & Admin	1,374,631	1,253,506	960,122	1,579,145	1,395,907	6,563,311
Instruments & Operations	2,771,403	3,888,227	2,326,974	3,038,667	3,238,900	15,264,171
Instruments & Operations - Electrical Power for DC Facility	1,900,000	1,600,000	3,020,000	3,074,000	3,400,000	12,994,000
Magnet Science & Technology	4,130,929	4,906,176	3,650,610	2,960,622	2,542,195	18,190,532
Science	880,889	1,037,627	813,047	1,150,608	713,726	4,595,897
LANL [2]	4,575,655	6,436,905	5,083,545	5,160,802	5,250,602	26,507,509
LANL IHRP [3]	397,107		209,802	79,303		686,212
CIMAR - NMR - FSU	338,597	595,990	501,271	496,046	538,918	2,470,822
CIMAR - EMR	81,473	95,650	135,388	194,294	141,852	648,657
CIMAR - ICR [4]	1,533,358	49,248	46,311	412,798	1,096,778	3,138,493
CIMAR - NMR - UF - AMRIS	303,110	312,202	320,288	328,590	335,162	1,599,352
UF - High B/T [2]	182,527	188,003	597,352	652,163	219,289	1,839,334
UF IHRP [3]	148,199	219,090	434,810	405,756		1,207,855
Overhead [5]	3,686,446	4,578,098	3,677,083	3,540,954	4,583,799	20,066,380
Total	**$20,155,917**	**$25,076,000**	**$24,106,000**	**$24,683,272**	**$25,500,000**	**$119,521,189**

1 Projected budget balance in Unassigned Budget will be used primarily to offset unanticipated electricity cost increases, as well other unanticipated costs.
2 LANL and UF funding is distributed through subcontracts. LANL also contributes funds to the Pulsed Magnet Program, amounting to $3.6 million in 2001, $3.8 million in 2002, and $3.6 million in 2003. UF contributes funds to the High B/T Magnet and the AMRIS Program; the High B/T contributions were $60 thousand in 2001, $131 thousand in 2002, and $195 thousand in 2003, and the AMRIS contribution is $895 thousand in 2003 (2001 and 2002 AMRIS contributions are not reported here).
3 LANL and UF IHRP (In-House Research Program) funding is distributed from the Science Program.
4 ICR Facilities budget does not include the NSF Chemistry Division award in the amount of $5,808,433, which is for 1/1/2000 through 12/31/2004, although all of the funding was received by 12/31/2003.
5 Overhead is shown as a separate line item, unlike previous Annual Reports that included overhead within the individual programs.

NHMFL Matching Commitment

The NSF grant includes a matching commitment by the State of Florida through Florida State University, which is $6,783,400 annually. In addition to this, the State of Florida also provides institutional funds to the laboratory above the NSF matching requirement. The NHMFL utilizes these additional state resources as cost sharing funds for other funding opportunities, as well as to help support some of the NSF core activities. Table 3 presents the State of Florida matching requirements and contribution provided through Florida State University.

Table 3. Fiscal Year 2003/2004 State of Florida Matching and Contribution

	State Matching	**State Contribution**	**Total State Funding**
State of Florida recurring funds cost sharing	$4,492,318	$2,343,663	$6,835,981
Indirect Cost (51%)	2,291,082	1,195,268	3,486,350
Total	**$6,783,400**	**$3,538,931**	**$10,322,331**

Program Budget Discussion

Calendar year 2003 is the third year of the current grant award from the National Science Foundation, in the amount of $24,106,000. This includes the National Science Board approved allocation of $24,000,000 plus supplemental funding in the amount of $106,000 for the RET (Research Experience for Teachers) Program. The NHMFL also receives an annual operating budget from the State of Florida through Florida State University. In fiscal year 2002/2003, the State budget was $6,730,012, and is $6,835,981 for fiscal year 2003/2004 (excluding overhead).

Table 4. NHMFL Program Budget by Source (budget allocation by program)

Program	NSF Budget Calendar Year 2003	State Matching Fiscal Year 2003/2004	State Contributed Fiscal Year 2003/2004	Total Budget
Director	$115,223	$1,653,390	$732,506	$2,501,119
CIRL	142,872	107,102	47,450	297,424
Unassigned Budget	2,071,302			2,071,302
Facilities & Admin	960,122	233,426	103,415	1,296,963
Instruments & Operations	2,326,974	453,299	200,826	2,981,099
Instruments & Operations - Electrical Power for DC Facility	3,020,000			3,020,000
M S & T	3,650,610	551,591	506,641	4,708,842
Science	813,047	542,667	240,420	1,596,134
LANL (Subcontract) [1]	5,083,545			5,083,545
LANL IHRP	209,802			209,802
CIMAR - Administration		2,079	923	3,000
CIMAR - NMR	501,271	424,680	279,297	1,205,248
CIMAR - EMR	135,388	232,143	102,847	470,378
CIMAR - ICR Facilities	46,311	232,520	103,013	381,844
CIMAR - Geochemistry		59,421	26,325	85,746
CIMAR - NMR - UF - AMRIS [2]	320,288			320,288
UF- High B/T [3]	597,352			597,352
UF IHRP	434,810			434,810
Overhead [4]	3,677,083	2,291,082	1,195,268	7,163,435
Total	**$24,106,000**	**$6,783,400**	**$3,538,931**	**$34,428,331**

[1] LANL's contribution to the Pulsed Magnet Program was $3.6 million in 2003.
[2] UF's contribution to AMRIS was $0.9 million in 2003.
[3] UF's contribution to the High B/T program was $0.2 million in 2003.
[4] The NSF Budget includes overhead, and the equivalent overhead is included in the state budget to reflect the total state support. FSU's federally negotiated overhead rate is 51%.

The following table summarizes the NHMFL budget position at the end of 2003. The budget balance represents major equipment purchases that were deferred in 2002 and 2003, and which are projected to be spent in 2004 and 2005.

Table 5. Cumulative NSF Budget and Expenses (1/1/2001 – 12/31/2003)

Expense Classification	Budget	Spent and Encumbered	Balance 12/31/2003
Salaries, Wages & Benefits	$15,982,765	$14,736,150	$1,246,615
Subcontracts	18,955,575	19,286,746	(331,171)
Capital Equipment	8,049,415	7,018,920	1,030,495
Other Direct Cost	14,408,534	12,478,985	1,929,549
Subtotal	**57,396,289**	**53,520,801**	**3,875,488**
Overhead	11,941,628	11,171,341	770,287
Total	**$69,337,917**	**$64,692,142**	**$4,645,775**
Program Income	$234,517		

PROGRAM BUDGETS

Director's Office

The Director's Office includes the Director, Deputy Director, Budget Administration, Government and Public Relations, and the Visiting Scientist Program. The Budget Administration Office is responsible for budget, accounting, and financial analyses functions for the laboratory. The development and maintenance of an internal budget management system provides greater cost accounting and control over the many different funding sources and projects supported by those funds. The Office of Government and Public Relations is responsible for NHMFL public relations and support, including monitoring of legislative issues, web application development and upgrades, media graphics, and publication support. The Visiting Scientist Program provides funding for scientists to conduct research utilizing the NHMFL facilities. Proposals requesting support through the Visiting Scientist Program are internally peer-reviewed, and awards are made based on input provided through the internal review process.

DIRECTOR'S OFFICE		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Director - Admin	$81,446	$1,011,159
Budget Administration	13,945	205,809
Visiting Scientist Prog.		265,945
Director's Research	19,832	94,543
Unallocated Budget	2,071,302	
Total	**$2,186,525**	**$1,577,456**
State Contribution		$698,865

Center for Integrating Research and Learning (CIRL)

CIRL supports programs in curriculum development, distance learning, and teacher education with the primary focus on enhancing science education at all levels and promoting public awareness.

CENTER FOR INTEGRATING RESEARCH AND LEARNING		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Education	$81,980	$107,102
REU Program	60,892	
Optical Microscopy		75,934
Total	**$142,872**	**$183,036**
State Contribution		$81,091

CIRL administers the Research Experience for Undergraduates (REU) program that has been extremely successful for eleven years; the Research Experience for Teachers (RET) program is also coordinated and run by the Center. In 2003, the NSF provided a supplemental allocation in the amount of $106,000, for the RET program. All mentorships for middle school students are organized by CIRL. CIRL is also the focal point for the organization of the NHMFL Annual Open House and other tour activities for K-12 groups and the public.

The Optical Microscopy Resource Center (OMRC) is another program operated as part of the NHMFL research and learning efforts. The OMRC has been hugely successful in its educational efforts and continues to receive world-wide recognition. In addition to establishing an in-house Magneto-Optical Imaging Facility, the OMRC has developed a state-of-the-art, live-cell imaging center that collaborates with outside users and is available to scientists who wish to study the dynamics of living organisms in magnetic fields. Distance learning efforts of the OMRC are highlighted by the international use of the educational Web sites in middle, high, undergraduate, and graduate curricula around the world. Eighty percent of the costs associated with the OMRC are offset with funding from other sources.

Facilities and Administration

Facilities and Administration includes general administrative functions for the lab including the ABA (Academic Business Administrators) Program. The ABA is responsible for accounts payable, accounts receivable, payroll, procurement, receiving, and other accounting activities. The Facilities staff is responsible for maintenance of the NHMFL building and facilities including magnet power supplies and cooling systems, helium systems, and the remainder of the facilities except grounds, janitorial, and some HVAC and plumbing preventative maintenance. The NHMFL Safety Program is housed within this group. The Facilities group also handles small interior renovations and modifications needed to support research activities. Funding for the facilities group is split between NSF and institutional funds. NSF funding is used for core-related activities while institutional funds are used for general facility maintenance and modifications required to support research and other activities related to the mission of the NHMFL.

FACILITIES AND ADMINISTRATION		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
ABA	$541,117	$65,936
Facilities	290,881	137,172
Safety	128,124	30,318
Total	**$960,122**	**$233,426**
State Contribution		$103,415

Instrumentation and Operations

This unit, headed by the Director of DC Field Operations, is responsible for the operation of the DC magnet systems at Tallahassee, as well as the Millikelvin facility.

INSTRUMENTATION AND OPERATIONS		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Administration	$217,605	$24,254
Computer Services	193,579	6,248
Cryogenics	344,064	
Electronics	197,189	
Magnet Operations	289,162	
Electrical Power – DC Facility	3,020,000	
Mechanical Instruments	256,238	
User Services	829,137	422,797
Total	**$5,346,974**	**$453,299**
State Contribution		$200,826

This unit also provides machine shop, electronics, cryogenic system support, and computer networking support. Most of the staff is dedicated to supporting user activities. This group focuses on keeping abreast of cutting edge instrumentation specialties and improving the performance of user instrumentation, and developing new approaches to measurement capabilities. The Instrumentation and Operations group also helps coordinate annual meetings of the NHMFL Users' Committee and interfaces with other activities within the user community.

Magnet Science and Technology

The Magnet Science and Technology (MS&T) group is responsible for the design, engineering, fabrication, and maintenance of a broad variety of powered-DC, pulsed, and advanced superconducting magnets, along with the development of the advanced materials, components, and subsystems critical for all high-performance magnet applications. MS&T has broad interactions with the private sector, with other national laboratories, and with the international community involved in high-field magnet research and development. Future advances in magnet technology are heavily dependent on advancements made in materials, especially: high-strength, high-conductivity conductors; high-strength, high-performance superconductors; high-temperature superconductors; and high-strength, high-modulus reinforcement materials that are critical to overcoming the enormous forces intrinsic to high-field magnet design.

MAGNET SCIENCE & TECHNOLOGY		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Administration	$451,887	$551,591
Resistive Magnets	1,237,342	
High Field Systems	46,673	
Materials Development	243,810	
Pulsed Magnets	380,029	
Cryogenics	152,542	
NMR Magnets	839,568	
Work for Others	173,162	
HTS Magnets	92,406	
Analysis	33,191	
Total	**$3,650,610**	**$551,591**
State Contribution		$506,641

Science Program

The NSF funding for the science and facilities development program are primarily distributed through the In-House Research Program (IHRP). A small amount of funding is utilized to cover the administration of the program, travel by reviewers, visitors, and speakers, and to provide assistance for the Director of the IHRP. The Director of the IHRP serves for a two-year term; the appointment rotates among the three institutions.

SCIENCE		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Administration	$49,779	$233,390
In-House Research Program	763,268	
Condensed Matter Theory		186,288
Condensed Matter Experimental		122,989
Total	**$813,047**	**$542,667**
State Contribution		$240,420

During the current period, the program is headed by Dr. John Eyler of the University of Florida. The Condensed Matter/Theory group in Tallahassee assists and provides administrative support with proposal solicitations and reviews. IHRP proposals must include an internal investigator from one of the three participating institutions as Principal Investigator but participation from external users as Co-Principal Investigators is strongly encouraged by the NSF and NHMFL. The proposed research work must utilize and advance facilities, and support is restricted to two years or less. Proposals that support young scientists and/or support bold new research areas that have the possibility of opening new frontiers are strongly encouraged.

Pulsed Field Facility - Los Alamos

PULSED FIELD FACILITY LOS ALAMOS		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Facilities & Admin	$2,537,893	
User Operations	1,904,453	
Pulsed Magnets	641,199	
IHRP	209,802	
Total	**$5,293,347**	
LANL Contribution		$3,600,000

The NHMFL Pulsed Field Facility is located at Los Alamos National Laboratory (LANL) and operated under a subcontract agreement between Florida State University and the Department of Energy. Funding for the NHMFL Pulsed Field Facilities and Administration includes the facility overhead charges. The Pulsed Field Facility provides technical and instrumentation support for the user community. The staff of the NHMFL Pulsed Field Facility, in cooperation with the user community, also devotes considerable attention to the development of new research capabilities and instrumentation responding to the unique requirements imposed by the rapidly changing magnetic fields and vibrations characteristic of these systems. The NHMFL Pulsed Field Facility staff works closely with members of the NHMFL Magnet Science and Technology group in Tallahassee to advance pulsed magnet technology and materials for these unique systems. Special staffing is also required to maintain the 4.0 MJ capacitor bank and the 1.4 GVA generator used to power the magnets available at the facility.

Center for Interdisciplinary Magnetic Resonance

CENTER FOR INTERDISCIPLINARY MAGNETIC RESONANCE		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
Administration		$2,079
NMR Program	$501,271	424,680
ICR Program	46,311	232,520
EMR Program	135,388	232,143
Geochemistry		59,421
AMRIS (UF)	320,288	
Total	**$1,003,258**	**$950,843**
State Contribution		$512,405
UF Contribution		$195,100

CIMAR represents all areas of magnetic resonance techniques and has made significant advances in building a user program that involves interdisciplinary activities with Physics, Geochemistry, Chemistry, Biology, and engineering. The program focuses on nuclear magnetic resonance (NMR), electron magnetic resonance (EMR), ion cyclotron resonance mass spectroscopy (ICR-MS), and magnetic resonance imaging and spectroscopy. A portion of the NMR spectroscopy and imaging activities are pursued at the Advanced Magnetic Resonance Imaging and Spectroscopy Facility (AMRIS) located at the UF McKnight Brain Institute. The ICR-MS facilities are primarily supported by a separate Chemistry Division NSF Facilities grant award that is being rolled into the funding of the current NHMFL core grant beginning in FY2003. The facilities within CIMAR provide unique instrumentation and capabilities to support a wide variety of research areas; they are open to all qualified users.

High B/T Facility

HIGH B/T FACILITY UNIVERSITY OF FLORIDA		
Program	**NSF Budget 2003**	**State Matching Budget 2003/2004**
High B/T User Support	$597,352	
IHRP	434,810	
Total	**$1,032,162**	**0**
UF Contribution		$895,156

The High B/T Facility is located at the University of Florida (UF) and is housed in the existing Microkelvin facility. A special bay has been retrofitted, using a specially designed $PrNi_5$ nuclear refrigerator and a separate 14/15.5 T magnet to conduct experiments at both high magnetic fields and low temperatures simultaneously, namely at a few hundred microkelvin.

This specialized facility is operated as an NHMFL user facility and is open to all qualified users who wish to explore new phenomena that require initial conditions of high spin polarization or high initial magnetization, and thus a high ratio of applied magnetic field to temperature. Recent examples include studies of the fractional quantum Hall effect, transport in polarized Fermi liquids, non-Fermi liquids, and superfluid helium three. The high cooling capacity of the facility enables users to maintain experiments below a fraction of a millikelvin for extended periods of time (beyond several weeks for nW heating rates), following a single demagnetization of the refrigerator. These long observation times are often needed to explore properties over a range of parameter space were the thermal equilibration times can be very long.

Specialized instrumentation is available for thermometry, pressure measurements and heat capacity studies, pulsed NMR techniques up to UHF frequencies, electrical conductivity, and transport studies. The facility is enclosed in a *tempest* quality, ultra-quiet environment.

Program Budget

The program budgets were prepared in accordance with the following criteria:

Budget Units: The NSF and Institutional budgets are allocated to the NHMFL programs. There are subcontracts for facilities and activities at Los Alamos National Laboratory, Los Alamos, New Mexico, as well as at the University of Florida in Gainesville. The overall operations of the NHMFL are governed by the Executive Committee, which is responsible for developing recommendations to the Director for allocation of budget dollars to programs.

Wage and Salary Rates: Where possible, actual salary rates have been used in the cost calculation. In some instances, the average salary rate may have been used for vacant and OPS positions.

Overhead Rates: The Florida State University's federally negotiated overhead rate is 51% for 2003. The institutional overhead rate used for costs at University of Florida is 45%; the rate for Los Alamos is 42%.

Overhead Base: At FSU and UF, overhead is applied to modified direct costs, which include payroll, payroll fringe benefits, materials and supplies, services, travel, and the first $25,000 of subcontracts. The following categories of expenditures are excluded from the overhead base:

- Permanent Equipment (equipment in excess of $1,000)
- Undergraduate, Graduate, and Ph.D. Programs (CIRL)
- Electric Power for magnet operations
- Subcontracts in excess of $25,000
- Tuition Waivers and Student Fees

UF also excludes charges for patient care, rental costs for off-site facilities, scholarships, and fellowships from the overhead base.

At LANL, full overhead is applied to all costs other than capital project costs. Capital projects designated as capital construction have a reduced overhead rate of 5%, and all other capital projects have a reduced overhead rate of 13%.

Fringe Benefits: Fringe benefits for Florida personnel are based on actual costs of fringe benefits for permanent employees (averaging 28%) and temporary employees (8% average). Fringe benefit costs for LANL employees are included in the average salary rates for each class.

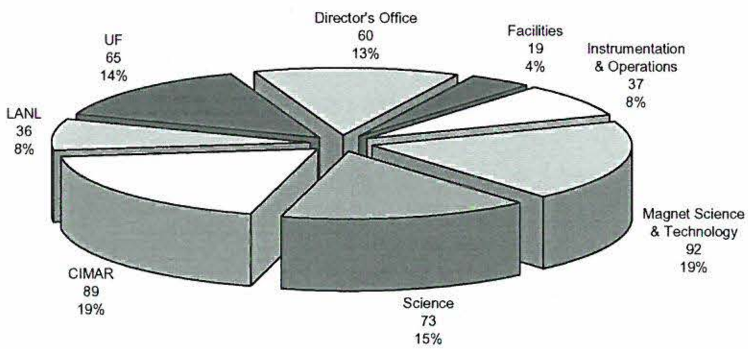
Administrative and Facility Maintenance Costs: Certain administrative and facility maintenance costs are accrued solely for the benefit and function of the NHMFL. These costs are included as direct costs in the budget estimates as allowed by the OMB regulations.

In-House Research Program Awards: The designated budget for the IHRP is inclusive of institution overhead. Since the actual overheads vary depending on the nature of the program and the institution involved, actual overheads are determined at the time of award within the total IHRP budget.

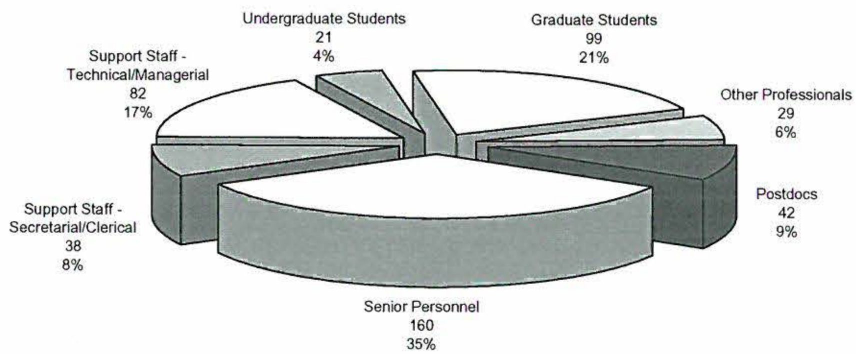
NHMFL STAFFING

The laboratory annually evaluates staffing levels and distribution relative to the priorities of the laboratory and user activities. After two years of stable staffing levels (413 in 2001, 415 in 2002), the laboratory experienced growth in 2003, to 471 faculty, staff, and affiliates. The following charts show the laboratory's personnel profile. The organization chart, as of December 2003, appears on the next page.

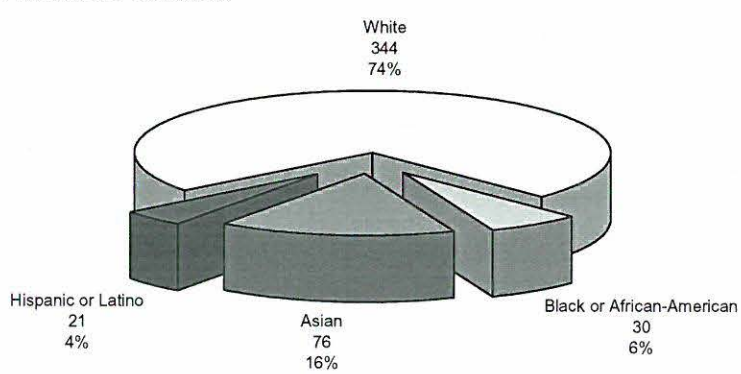
Personnel Distribution



Personnel by Classification

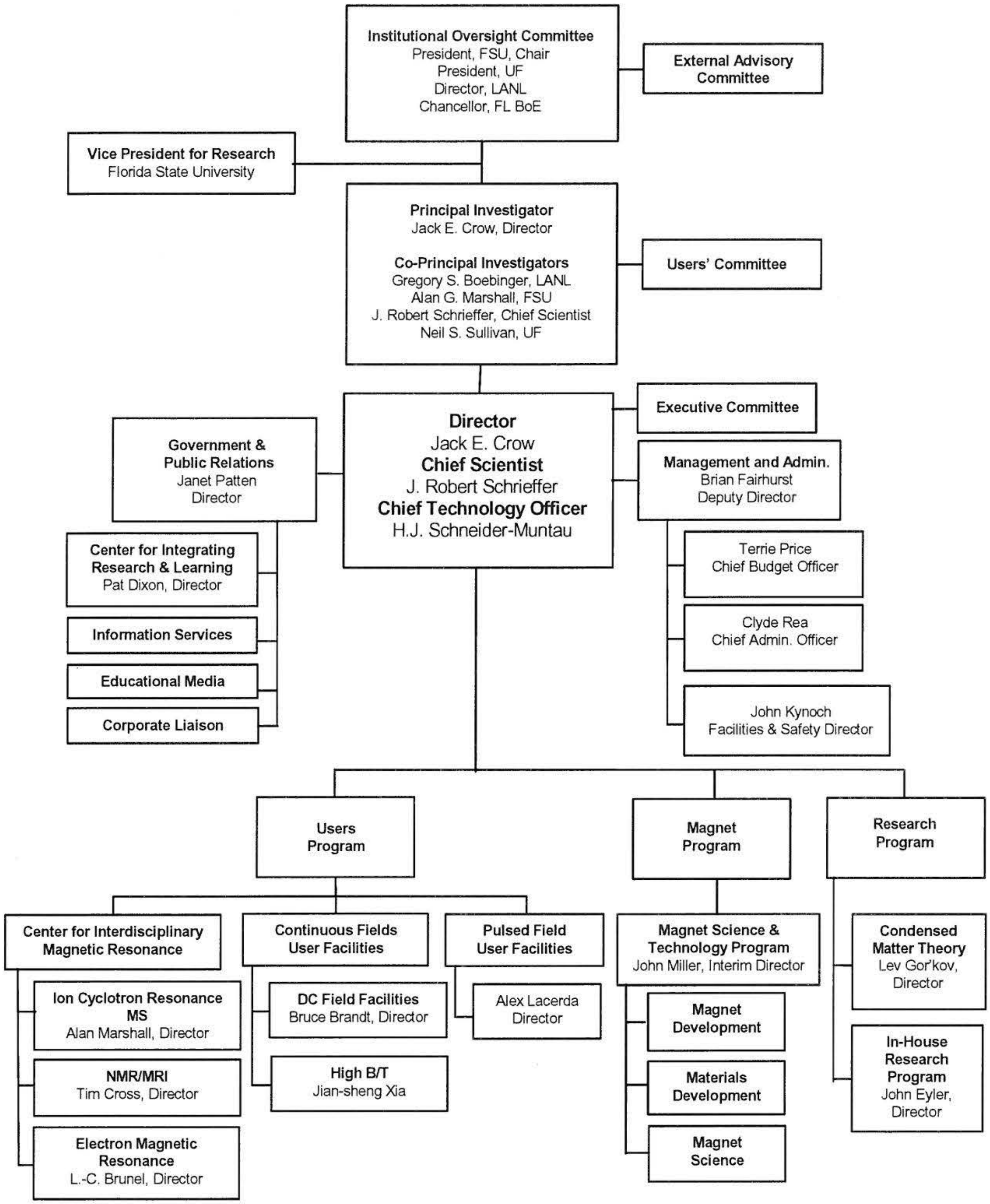


Personnel by Race Ethnic Status



Note: The gender distribution is 79% male; 21% female. The date of information is May 13, 2004.

National High Magnetic Field Laboratory



Appendix A: Users & Projects

USERS & PROJECTS: DC FIELD FACILITY

+ Postdoc   * Graduate Student   ~ Undergraduate Student

Users: DC Field	Institutions	Funding	Projects
Alamo, Rufina Brooks, James Douglas, Elliot P	FAMU-FSU College of Engineering FSU U. of Florida	National Science Foundation	Magnetic Field Processing of Polyolefins
Ardavan, Arzhang Bangura, Alimamy * Blundell, Stephen Coldea, Amalia + Harrison, Neil Singleton, John Tozer, Stan	U. of Oxford U. of Oxford U. of Oxford U. of Oxford NHMFL - LANL LANL NHMFL	EPSRC	Quantitative Studies of Fermi Surfaces and Groundstates in Organic Molecular Metals
Ardavan, Arzhang Bangura, Alimamy * Blundell, Stephen Coldea, Amalia + Harrison, Neil Klehe, Anne-Katrin Mielke, Charles Singleton, John Tozer, Stan	U. of Oxford U. of Oxford U. of Oxford U. of Oxford NHMFL - LANL U. of Oxford LANL LANL NHMFL	Department of Energy, ESPRC	High Field Studies of Interactions and Disorder in Correlated Electron Systems: Alloy Systems
Armstrong, Gordon Brandt, Bruce Jones, Glover	NHMFL NHMFL NHMFL	NHMFL	Rebuild of the Vibrating Sample Magnetometer(VSM) Probe
Aronson, Meigan Bennett, Marcus * Fisk, Zachary	U. of Michigan U. of Michigan FSU	National Science Foundation	Low Temperature Transport and Magnetization of CaB_6
Balicas, Luis Fisk, Zachary Maeno, Yoshiteru Nakatsuji, Satoru Neumeier, John	NHMFL FSU Kyoto U. U. of Kyoto Montana State U.	NHMFL In-House Research Program	Metamagnetism, Structural Instabilities and Orbital Physics in Single Layer Ruthenates
Basov, Dimitri Dordevic, Sasa + Wang, Yong-Jie	Univ. of California, San Diego UCSD NHMFL	Department of Energy	Infrared Spectroscopy of Heavy Fermions in High Magnetic Field
Bernal, Oscar Kuhns, Phil Moulton, William Reyes, Arneil Tozer, Stan	California State U., Los Angeles NHMFL FSU Physics NHMFL NHMFL	Department of Energy	URu_2Si_2 Under Extreme Conditions: High Field/High Pressure NMR
Bird, Mark Bole, Scott	NHMFL NHMFL	NHMFL	Testing Bitter Magnets and Hybrid Inserts
Biswas, Amlan Greene, Richard	U. of Florida U. of Maryland	National Science Foundation	The Normal-State Properties of the Electron-Doped Cuprate Superconductor $Pr_{2-x}Ce_xCuO_4$
Boebinger, Greg Harrison, Neil Jaime, Marcelo Jorge, Guillermo * Kim, Kee Hoon +	LANL NHMFL - LANL LANL LANL Seoul National U.	Department of Energy	Magnetotransport of $La_{2-x}Sr_xCuO_4$ Single Crystals in High Magnetic Fields: Search for Quantum Critical Point

Users: DC Field	Institutions	Funding	Projects
Brandt, Bruce Hannahs, Scott Pucci, John	NHMFL NHMFL NHMFL	NHMFL	Calibrating Bitter Magnets
Brey, William Suddarth, Steve	NHMFL NHMFL	NHMFL	Stabilization of Keck Magnet for NMR
Brooks, James Almeida, Manuel Anthony, John Choi, Eun Sang + Graf, David * Jobiliong, Eric * Kobayashi, Hayao Kobyashi, Akiko Konoike, Takako * Murata, Keizo Oshima, Yugo + Papavassiliou, George Tanaka, Hisashi Tokumoto, Madoka Tokumoto, Takahisa * Uji, Shinya Vasic, Relja * Yamada, Jun-ichi	FSU ITN, Sacavém U. of Kentucky NHMFL FSU FSU Inst. for Molecular Science The U. of Tokyo National Inst. for Materials Science Osaka City U. NHMFL National Hellenic Research Foundation National Inst. of Advanced Industrial Science and Technology (AIST) AIST FSU Physics/NHMFL National Inst. for Materials Science FSU Himeji Inst. of Technology	National Science Foundation, DARPA	Electronic, Magnetic, and Thermodynamic Properties of Molecular Solids
Canfield, Paul Bud'ko, Sergey L Finnemore, Douglas K Hannahs, Scott Wilke, Derek *	Iowa State U. Iowa State U. Iowa State U. NHMFL Iowa State U.	Department of Energy	High Magnetic Field Properties of Doped MgB_2 Filaments
Cao, Gang	U. of Kentucky	National Science Foundation	Possible Quantum Criticality in Calcium Ruthenates and Strontium Iridates
Chung, Ok Hee	NHMFL	NHMFL In-House Research Program	Pressure Effects on the Fermiology of Quasi-One-Dimensional Organic Superconductors (II)
Chung, Ok Hee	NHMFL	KOSEF	Pressure Effects on the Fermiology of Quasi-One-Dimensional Organic Superconductors
Clark, W. Gilbert Balicas, Luis Brown, Stuart E Greene, Richard Kuhns, Phil Menon, Reghu Montgomery, Lawrence Moulton, William Reyes, Arneil	U. of California, Los Angeles (UCLA) NHMFL UCLA U. of Maryland NHMFL Indian Inst. of Science Indiana U. FSU Physics NHMFL	National Science Foundation	NMR Investigation of Spin and Charge Dynamics in Conducting Polymers

Users: DC Field	Institutions	Funding	Projects
Clark, W. Gilbert Balicas, Luis Kuhns, Phil Menon, Reghu Montgomery, Lawrence Moulton, William Reyes, Arneil	U. of California, Los Angeles (UCLA) NHMFL NHMFL Indian Inst. of Science Indiana U. FSU Physics NHMFL	National Science Foundation	Single-Crystal NMR Investigation of the Unusual Phases of lambda-$(BETS)_2FeCl_4$
Clark, W. Gilbert Brown, Stuart E Greene, Richard Kuhns, Phil Menon, Reghu Moulton, William Reyes, Arneil	U. of California, Los Angeles (UCLA) UCLA U. of Maryland NHMFL Indian Inst. of Science FSU Physics NHMFL	National Science Foundation	High Field NMR Spin-Echo Investigation of the Local Magnetic Field Structure in the Electron-doped High TC Superconductor $Pr_{1.85}Ce_{0.15}CuO_{4-y}$ (PCCO)
Cornia, Andrea Pacchioni, Mirko * Zobbi, Laura *	U. of Modena and Reggio Emilia U. of Florence U. of Modena and Reggio Emilia	NHMFL	Mn12 Adsorbates on Gold: an Investigation by Surface Magneto-Optical Kerr Effect
Crow, Jack McCall, Scott + Zhou, Zhixian * Zvyagin, Sergei	NHMFL NHMFL NHMFL NHMFL	NHMFL	High-Field ESR on $GdBaCo_2O_{5.5}$
Crow, Jack Alexander, Scott + Cao, Gang McCall, Scott Zhang, Xiaohang * Zhou, Zhixian *	NHMFL NHMFL U. of Kentucky NHMFL NHMFL NHMFL	NHMFL	Measurement of the Fermi surface of $SrRuO_3$
Curro, Nicholas Smith, James L	LANL LANL	Department of Energy, LANL	NMR Investigations of Novel Phases of URh_2Si_2 in High Fields
Desrochers, Patrick Krzystek, Jurek Zvyagin, Sergei	U. of Central Arkansas NHMFL NHMFL	American Chemical Society	Characterization of the Valence Electron Spin Density in Nickel-Borohydride Complexes Using HFEPR
Du, Rui-Rui Pfeiffer, Loren Simmons, Jerry Yang, Changli ~ Yuan, Zhoquan * Zhang, Jian *	U. of Utah Lucent Technologies Sandia National Labs U. of Utah U. of Utah U. of Utah	DARPA-Quantum Computer	Quantum Transport Near Half-Filling in a Thick Quantum Hall System
Engel, Lloyd Chen, Yong * Lewis, Rupert + Pfeiffer, Loren Tsui, Daniel Wang, Zhihai * West, Ken	NHMFL/FSU NHMFL-Princeton NHMFL -Princeton Lucent Technologies Princeton U. NHMFL/Princeton Lucent Technologies	NHMFL In-House Research Program	Microwave Resonances in High B Wigner Crystal Regime of 2D Electron Systems
Epstein, Arthur J Nandyala, Raju +	Ohio State U. The Ohio State U.	Department of Energy	Anomalous Magnetoresistance in High-Temperature Organic-Based Magnetic Semiconductor $V(TCNE)_x$ Films

Users: DC Field	Institutions	Funding	Projects
Fisk, Zachary Balicas, Luis Nakatsuji, Satoru +	FSU NHMFL U. of Kyoto	National Science Foundation	New Field-Induced Magnetic Transitions and Its Impurity Effects in the Local f-Moment Phase of $YbInCu_4$
Fortune, Nathanael Carroll, Maia ~ Hannahs, Scott Tozer, Stan	Smith College Smith College NHMFL NHMFL	NHMFL	Field-Angle-Dependent Heat Capacity of Layered Structure Materials
Gan, Zhehong Brey, William Gorkov, Peter Kwak, Hyung +	FSU NHMFL NHMFL NHMFL	NHMFL In-House Research Program	High Field and High Resolution NMR Using Resistive Magnets
Garmestani, Hamid Bacaltchuk, Cristiane * Gault, Barbara ~ Hayek, Saleh * Yan, Shishen +	Florida A&M U. & NHMFL FSU FSU FAMU-FSU CoE & NHMFL FAMU-FSU CoE	U.S. Army	Texturing of Materials Using Magnetic Heat Treatment
Garmestani, Hamid Sheikh-Ali, Askar +	Florida A&M U. & NHMFL FAMU-FSU College of Engineering	National Science Foundation, NSF	The Effect of Grain Boundary Sliding on Boundary Mobility
Garmestani, Hamid Al-Haik, Marwan + Berret, Antoine ~ Dahmen, Klaus	Florida A&M U. & NHMFL Micromechanics Laboratory Laboratory of Micromechanics of Materials MARTECH	FAMU-FSU College of Engineering	Synthesis of Aligned Carbon Nanotubes via the Pyrolysis of Ferrocene-xylene in a Strong Magnetic Field
Gasparov, Lev	U. of North Florida	NHMFL, Research Corporation, UNF	Optical Studies of the Effects of High Magnetic Field on Charge Ordering in Magnetite
Ghosh, Kartik Mishra, Sanjay	Southwest Missouri State U. U. of Memphis	National Science Foundation	Electrical and Magnetic Properties of Magnetic-Polymer Nanocomposite Prepared by Ion Implantation
Goldberg, David Krzystek, Jurek Telser, Joshua Zvyagin, Sergei	Johns Hopkins U. NHMFL Roosevelt U. NHMFL	National Science Foundation	High-Field and Frequency EPR of Novel Metallo Porphyrinoid Complexes
Goodrich, Roy G Balicas, Luis Young, David +	Louisiana State U. NHMFL LSU	Department of Energy	dHvA Effect Measurements in the $ReMGa_6$ Heavy Fermion System
Han, Ke Cui, Baozhi + Garmestani, Hamid Schneider-Muntau, H.	NHMFL NHMFL Florida A&M U. & NHMFL NHMFL	U.S. Army	Synthesizing Textured $FePt/Fe_3Pt$ and FePd/alfa-Fe -Type Nanocomposite Magnets and fct-FePt and fct-FePd Single-Phase Magnets
Harrison, Neil Boebinger, Greg Jaime, Marcelo Kim, Kee Hoon +	NHMFL - LANL LANL LANL Seoul National U.	Department of Energy	Investigating the Field-Induced Phases in the Vicinity of the Field-Induced Quantum Critical Point of URu_2Si_2

Users: DC Field	Institutions	Funding	Projects
Hascicek, Yusuf Arda, Lutfi * Dur, Osman	NHMFL NHMFL NHMFL	Air Force	Field Dependence of Critical Current Density of MgB_2 Conductors Between 4.2 K and 30 K Using 20 T Superconducting Magnet
Hebard, Arthur F Du, Xu * Maslov, Dmitri Nesbitt, Jeremy *	U. of Florida U. of Florida U. of Florida U. of Florida	NHMFL In-House Research Program	Luttinger-Liquid Phase Induced in Graphite by Ultraquantum High Magnetic Fields
Hilke, Michael Armstrong-Brown, A. * Engel, Lloyd Pfeiffer, Loren Tsui, Daniel West, Ken	McGill U. McGill U. NHMFL/FSU Lucent Technologies Princeton U. Lucent Technologies	NSERC	Dynamical properties of a Luttinger Liquid at the Edge of a Two-Dimensional Electron Gas
Hill, Stephen Benjamin, Daniel ~ Browne, Andrew * Lawrence, Jon * Takahashi, Susumu *	U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida	National Science Foundation	Millimeter Wave Spectroscopy in High Magnetic Fields
Hill, Stephen Benjamin, Daniel ~ Browne, Andrew * Lawrence, Jon * Takahashi, Susumu *	U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida	National Science Foundation	Millimeter Wave Spectroscopy in High Magnetic Fields
Hong, Seung Field, Mike Parrell, Jeffrey Zhang, Youzhu	Oxford Instruments Inc., Superconducting Technology Oxford Instruments Inc., Superconducting Technology Oxford Instruments Oxford Instruments Inc., Superconducting Technology	NHMFL In-House Research Program, OST	Development of Superconducting Wire for High Field Usage
Hussey, Nigel Abdel-Jawad, Majed * Balicas, Luis	U. of Bristol U. of Bristol NHMFL	EPSRC, U.K.	Polar AMRO in High-Tc Cuprates
Jaime, Marcelo Balicas, Luis Batista, Cristian Fisk, Zachary Harrison, Neil Jorge, Guillermo * Kim, Kee Hoon + Nakatsuji, Satoru + Sarrao, John Stern, Raivo	LANL NHMFL LANL FSU NHMFL - LANL LANL Seoul National U. U. of Kyoto LANL NICPB	Department of Energy	Specific Heat and Magnetocaloric Effect Measurements of Highly Correlated Electron Systems at High Magnetic Fields
Kang, Woun Brandt, Bruce Jo, Younjung * Kang, Haeyong *	Ewha Womans U. NHMFL Ewha Womans U. Ewha Womans U.	KOSEF	Adaptation of Miniature Pressure Cell for the Various Rotation Probes in the NHMFL and Application to Measurements of Angular Magnetoresistance Under Pressure

Users: DC Field	Institutions	Funding	Projects
Kapitulnik, Aharon Steiner, Myles *	Stanford U. Stanford U.	National Science Foundation	Superconductor-Insulator Transition Studies of Indium Oxide Thin Films
Kataev, Vladislav Klingeler, Ruediger + Zvyagin, Sergei	IFW Dresden Aachen Technical High School NHMFL	U. of Cologne, Germany	High Field ESR Study of $La_{1-x}Sr_{1+}MnO_4$ Single Crystals
Kono, Junichiro Jho, Young-Dahl + Smalley, Richard Wei, Xing Zaric, Sasa *	Rice U. NHMFL Rice U. NHMFL Rice U.	The Robert A. Welch Foundation	Magneto-Optical Spectroscopy of Single-Walled Carbon Nanotubes
Kono, Junichiro Reitze, David Si, Qimiao Smalley, Richard Stanton, Christopher Wei, Xing Zaric, Sasa *	Rice U. U. of Florida Rice U. Rice U. U. of Florida NHMFL Rice U.	The Robert A. Welch Foundation	Magneto-Optical Spectroscopy of Single-Walled Carbon Nanotubes
Krzystek, Jurek Telser, Joshua Zvyagin, Sergei	NHMFL Roosevelt U. NHMFL	NHMFL	Two-Dimensional (Frequency-Field) ESR Spectroscopy of High-Spin Systems
Kwok, Wai-Kwong Erb, Andreas Karapetrov, Goran Klein, Thierry Marcenat, Christophe Moulton, William Paulius, Lisa Phillips, Norman Undreiu, Lucian *	Argonne National Laboratory U. of Karlsruhe Argonne National Labs CNRS Commissariat a l'Energie Atomique FSU Physics Western Michigan U. LBNL Western Michigan U.	Department of Energy	Entanglement of Vortex Matter at Extremely High Fields in $YBa_2Cu_3O_{7-d}$
Kynoch, John Chasteen, Charles Dalton, Bryon Fabre, Mark Gordon, Larry Morris, Wesley Piotrowski, Joel Ranner, Steven	NHMFL NHMFL NHMFL Classic Controls, Inc. NHMFL Electrical NHMFL NHMFL	NHMFL	Development, Testing, and Installation of the Distributed Control System
Landee, Chris Zvyagin, Sergei	Clark U. NHMFL	National Science Foundation	Magnetization Studies of Quantum Spin Ladders
Larbalestier, David Braccini, Valeria * Godeke, Arno Jewell, Matthew * Kim, Sang-Il * Senkowicz, Ben *	U. of Wisconsin U. of Wisconsin U. of Twente U. of Wisconsin-Madison U. of Wisconsin - Madison U. of Wisconsin - Madison	Department of Energy	Investigations on the Irreversibility and Upper Critical Field of Nb_3Sn Superconductors in Relation to Composition Gradients
Little, Reginald	FAMU	USDA	The Effects of Magnetic Field on Carbon Nanotube Formation
Long, Virginia Landee, Chris Wei, Xing	Colby College Clark U. NHMFL	Colby College Startup Funding	Magnetic Field-Dependent Electronic Structure of Haldane Compounds

Users: DC Field	Institutions	Funding	Projects
Ludtka, Gerard England, Roger Jaramillo, Roger + Kalu, Peter Kisner, Roger Sheikh-Ali, Askar + Waryoba, Daudi * Wilgen, John	Oak Ridge National Laboratory Cummins Engine Company, Inc. ORNL FAMU-FSU College of Engineering/NHMFL ORNL FAMU-FSU COE FAMU-FSU COE/NHMFL ORNL	Department of Energy	Enhanced Performance and Energy Savings Through Ultrahigh Magnetic Field Processing of Ferromagnetic Materials
Luongo, Cesar Bernstein, Allison ~ Brown, Christopher ~ Burris, Carl ~ Meyers, Kelly ~ Pouliot, Stacy ~	FAMU-FSU College of Engineering FAMU-FSU COE FAMU-FSU COE FAMU-FSU COE FAMU-FSU COE FAMU-FSU COE	FAMU-FSU College of Engineering	CERN Inclinometer Research
Maple, Brian Scanderbeg, Daniel * Taylor, Benjamin *	U. of California at San Diego UCSD UCSD	Department of Energy	Electrical Transport Properties of $Y_{1-x}Pr_xBa_2Cu_3O_{7-d}$ and $Sm_{2-x}Ce_xCuO_{4-y}$ Thin Films Under High Magnetic Field
Marken, Kenneth Meinesz, Maarten Miao, Hanping Schwartz, Justin Weijers, Hubertus +	Oxford Instruments, Superconducting Technology Oxford Instruments Oxford Instruments NHMFL & FAMU-FSU College of Engineering NHMFL	Self funded	BiSrCaCuO-2212 Conductors and Coils for High Magnetic Field Applications
McCombe, Bruce Acbas, Gheorghe * Kim, Gibum +	U. at Buffalo, The State U. of New York U. at Buffalo U. at Buffalo	DARPA/ONR	Magnetotransport Studies of Ferromagnetic InAs/Mn and GaSb/Mn Digital Alloys
Meisel, Mark Park, Ju-Hyun * Talham, Daniel	U. of Florida U. of Florida U. of Florida	National Science Foundation	Magnetic Saturation Studies of Thin Film Prussian Blue Analogs
Minervini, Joseph Senkowicz, Ben * Takayasu, Makoto	MIT Plasma Science & Fusion Center U. of Wisconsin - Madison Massachusetts Inst. of Technology	Department of Energy	Characterization of Nb_3Sn Superconducting Wires Under Strain
Molodov, Dmitri Sheikh-Ali, Askar	Aachen U. FAMU-FSU College of Engineering	German Research Society	Investigation of Texture Development in Ti and Zr Sheet During Annealing in a High Magnetic Field
Moulton, William Kuhns, Phil Reyes, Arneil	FSU Physics NHMFL NHMFL	NHMFL In-House Research Program	NMR Studies of Magnetic Phase Separation in Mixed Valent Ferromagnets

Users: DC Field	Institutions	Funding	Projects
Munger, Gareth Caraway, Lee Creighton, Francis Ishmael, Sasha Meinke, Rainer Ritter, Rogers Werp, Peter	Stereotaxis Inc. Advanced Magnet Lab Inc. Stereotaxis, Inc. Advanced Magnet Lab Inc. Advanced Magnet Lab Inc. Stereotaxis, Inc. Stereotaxis, Inc.	Stereotaxis Inc. and Advance Magnet Lab.	Magnetization Test
Murphy, Peter Bonninghausen, Lee Powell, Andy	NHMFL NHMFL NHMFL	NHMFL	Testing Bitter Magnets and Hybrid Inserts
Murphy, Sheena Chokomakoua, Jean-Claude * Santos, Michael	U. of Oklahoma U. of Oklahoma U. of Oklahoma	National Science Foundation	Quantum Hall Ferromagnetism in InSb Heterostructures
Murphy, Tim Jones, Glover Palm, Eric Sumption, Mike	NHMFL NHMFL NHMFL Ohio State U.	NHMFL	Install and Test Helium 3 Fridge
Musfeldt, Janice Cao, Jinbo * Choi, Jongwoo + Dalal, Naresh Kogerler, Paul Landee, Chris Mandrus, David Olejniczak, Iwona Pederson, Mark Revcolevschi, Alexandre Schlueter, John Turnbull, Mark Wang, Yong-Jie Wei, Xing Wesolowski, Roman * Whangbo, Mike Woodward, Jon + Zvyagin, Sergei	U. of Tennessee U. of Tennessee U. of Tennessee Florida St. U. Ames Lab Clark U. Oak Ridge National Laboratory Polish Academy of Sciences NRL Universite de Paris-Sud Argonne Labs Clark U. NHMFL NHMFL U. of Tennessee North Carolina State U. U. of Tennessee NHMFL	National Science Foundation	Infrared Investigations of Organic Superconductors in High Magnetic Fields
Musfeldt, Janice Choi, Jongwoo + Wei, Xing Woodward, Jon +	U. of Tennessee U. of Tennessee NHMFL U. of Tennessee	Department of Energy	Spectroscopic Investigations of Low-Dimensional Quantum Antiferromagnets

Users: DC Field	Institutions	Funding	Projects
Musfeldt, Janice	U. of Tennessee	Department of Energy	Spectroscopic Investigations of Layered Oxides: Probing Density Wave Transitions in Two-Dimensional Materials
Cao, Jinbo *	U. of Tennessee		
Choi, Jongwoo +	U. of Tennessee		
Dalal, Naresh	Florida St. U.		
Haraldsen, Jason *	U. of Tennessee		
Kogerler, Paul	Ames Lab		
Landee, Chris	Clark U.		
Luttrell, Robert *	U. of Tennessee		
Mandrus, David	Oak Ridge National Laboratory		
Olejniczak, Iwona	Polish Academy of Sciences		
Pederson, Mark	NRL		
Revcolevschi, Alexandre	Universite de Paris-Sud		
Schlueter, John	Argonne Labs		
Turnbull, Mark	Clark U.		
Wang, Yong-Jie	NHMFL		
Wei, Xing	NHMFL		
Wesolowski, Roman *	U. of Tennessee		
Whangbo, Mike	North Carolina State U.		
Woodward, Jon +	U. of Tennessee		
Zvyagin, Sergei	NHMFL		
Nagel, Urmas	National Inst. of Chemical Physics and Biophysics	1. Estonian Science Foundation; 2. NATO Science Program	Coupling of Optical Phonons to the Gapped Spin State in Quarter-Filled Spin Ladder Compound a'-NaV_2O_5
Hyvonen, Dan *	National Inst. of Chemical Physics and Biophysics		
Room, Toomas	Natl. Inst. of Chemical Physics and Biophysics		
Ong, N. Phuan	Princeton U.	National Science Foundation	Measure the Upper Critical Field of High Tc Superconductors Using High Field Nernst Effect
Ando, Y	CRIEPI, Tokyo		
Uchida, S	U. of Tokyo		
Wang, Yayu *	Princeton U.		
Park, Yung Woo	Seoul National U.	BK21 Program of Ministry of Education Korea	Magnetotransport in Synthetic Nanowire
Ahn, Se Jung *	Seoul National U.		
Campbell, Eleanor	Chalmers U., Physics Department, Sweden		
Kim, Bio *	Seoul National U.		
Kim, Jun Sung *	Seoul National U.		
Lee, Hyun Jung *	Seoul National U.		
Lee, Ju Yul *	Seoul National U.		
Lee, Seung Hyun *	Seoul National U.		
Roth, Siegmar	Max-Planck-Inst. in Stuttgart, Germany		
Reitze, David	U. of Florida	National Science Foundation	New Materials for Spintronics: Semiconducting Oxides ZnO and TiO_2
Jho, Young-Dahl +	NHMFL		
Kono, Junichiro	Rice U.		
Stanton, Christopher	U. of Florida		
Wang, Xiaoming *	U. of Florida		
Wei, Xing	NHMFL		
Rosenbaum, Ralph	Tel Aviv U.	Tel Aviv U.	Hall Voltage Measurements in High Magnetic Fields in Thin Bismuth Films
Galibert, Jean	Laboratoire National des Champs Magnetiques Pulses		
Rosenbaum, Ralph	Tel Aviv U.	Tel Aviv U.	Magnetoresistance Measurements in Bulk Quasicrystaline Samples
Lin, Shui-Tien	National Cheng Kung U.		
Salamon, Myron	U. of Illinois	Department of Energy	Anomalous Hall Effect of Single-Crystal Gadolinium
Baily, Scott *	U. of Illinois - Urbana-Champaign		

Users: DC Field	Institutions	Funding	Projects
Santos, Michael Doezema, Ryan Khodaparast, Giti + Meyer, Robert * Zhang, Xinhui +	U. of Oklahoma U. of Oklahoma Rice U. U. of Oklahoma U. of Oklahoma	National Science Foundation	Magneto-Optical Studies of Rashba Spin Splitting in InSb Quantum Wells
Santos, Michael Doezema, Ryan Kasturiarachchi, T. * Meyer, Robert * Zhang, Xinhui +	U. of Oklahoma U. of Oklahoma U. of Oklahoma U. of Oklahoma U. of Oklahoma	National Science Foundation	Interaction Between Landau-Level States with Opposite Spin
Sarachik, Myriam Anissimova, Svetlana * Kravchenko, Sergey Tsui, Yeekin +	City College of New York Northeastern U. Northeastern U. City College of the City U. of New York	National Science Foundation	Full Spin Polarization in 2d Electron Systems
Sarma, Bimal Ketterson, John Lowe, Ryan * Souslov, Alexei +	U. of Wisconsin-Milwaukee Northwestern U. U. of Wisconsin-Milwaukee NHMFL, FSU	National Science Foundation	Magnetometry and Ultrasonic Research in UPt_3 and URu_2Si_2
Sarma, Bimal Ketterson, John Souslov, Alexei Williamsen, Mark ~	U. of Wisconsin-Milwaukee Northwestern U. NHMFL, FSU U. of Wisconsin-Milwaukee	National Science Foundation, NHMFL	High Field Low Temperature Phase Diagram of URu_2Si_2 by Sound Velocity Measurements
Schwartz, Justin Maeda, Hiroshi Pamidi, Sastry Su, Jianhua Trillaud, Frederic Vereleby, Darren Weijers, Hubertus	NHMFL & FAMU-FSU College of Engineering Kitami Inst. of Technology Center for Advanced Power Systems NHMFL NHMFL American Superconductor Inc. NHMFL	Department of Energy, CEES Thieme, Oak Ridge National Laboratory	Stability in Thin Film Coated HTS Conductors
Schwartz, Justin Mbaruku, Abdallah * Weijers, Hubertus	NHMFL & FAMU-FSU College of Engineering NHMFL, CAPS NHMFL	Center for Advanced Power Systems	HTS in Field Mechanical Characterization
Schwartz, Justin Marken, Kenneth Thieme, Cees Trillaud, Frederic * Trociewitz, Ulf + Vereleby, Darren Weijers, Hubertus + Wiezoreck, Jan	NHMFL & FAMU-FSU College of Engineering Oxford Instruments, Superconducting Technology American Superconductor Corporation NHMFL NHMFL American Superconductor Inc NHMFL Trithor Gmbh.	U.S. Dept. of Air Force	HTS Conductors for High Field Insert Magnets

Users: DC Field	Institutions	Funding	Projects
Schwartz, Justin Maeda, Hiroshi Pamidi, Sastry Su, Jianhua * Weijers, Hubertus + Xu, Bin *	NHMFL & FAMU-FSU College of Engineering Kitami Inst. of Technology Center for Advanced Power Systems NHMFL NHMFL NHMFL	U.S. Navy, AFOSR	Enhancement of Texture and Critical Current Density in High Tc Superconductors Through Processing in High Magnetic Fields
Schwartz, Justin Hascicek, Yusuf Marken, Kenneth Mbaruku, Abdallah Pamidi, Sastry Su, Jianhua Trillaud, Frederic Trociewitz, Bianca Trociewitz, Ulf + Weijers, Hubertus	NHMFL & FAMU-FSU College of Engineering NHMFL Oxford Instruments, Superconducting Technology NHMFL, CAPS Center for Advanced Power Systems NHMFL NHMFL NHMFL NHMFL NHMFL	NHMFL	HTS Layer-Wound Coils for Insert Magnets
Schwartz, Justin Marken, Kenneth Mbaruku, Abdallah * Pamidi, Sastry Su, Jianhua * Trillaud, Frederic * Vereleby, Darren Weijers, Hubertus +	NHMFL & FAMU-FSU College of Engineering Oxford Instruments, Superconducting Technology NHMFL, CAPS Center for Advanced Power Systems NHMFL NHMFL American Superconductor Inc. NHMFL	National Science Foundation	HTS Demonstration Insert Coils
Shahar, Dan Engel, Lloyd Ganapathy, S. +	Weizmann Inst. of Science NHMFL/FSU Weizmann Inst. of Science	U.S.-Israel Binational Science Foundation	Microwave Conductivity Measurements at High Magnetic Fields on Disordered Superconducting Films
Shayegan, Mansour De Poortere, Etienne + Shkolnikov, Yakov * Tutuc, Emanuel * Vakili, Kamran *	Princeton U. Princeton U. Princeton U. Princeton U. Princeton U.	National Science Foundation	Magnetotransport of 2D Electrons in AlAs and GaAs
Shayegan, Mansour Shkolnikov, Yakov * Vakili, Kamran *	Princeton U. Princeton U. Princeton U.	National Science Foundation	High Field Measurement of Uniaxially Strained AlAs Quantum Wells
Stanton, Christopher Jho, Young-Dahl + Kono, Junichiro Reitze, David Wang, Xiaoming * Wei, Xing Zaric, Sasa	U. of Florida NHMFL Rice U. U. of Florida UF NHMFL Rice U.	National Science Foundation, NHMFL In-House Research Program	Ultrafast Optics of Excitons in High Magnetic Fields

Users: DC Field	Institutions	Funding	Projects
Stern, Raivo Krzystek, Jurek Kuhns, Phil Reyes, Arneil Zvyagin, Sergei	NICPB NHMFL NHMFL NHMFL NHMFL	Estonian Science Foundation (ESF)	Quantum Transitions in Frustrated Multidimensional Antiferromagnetic Dimer Systems with Spin Gap
Stewart, Greg Kim, Jung Soo +	U. of Florida U. of Florida	Department of Energy	High Field Measurements of Highly Correlated f-Electron Systems
Stormer, Horst Gervais, Guillaume + Pfeiffer, Loren Tsui, Daniel West, Ken	Columbia U. Columbia U. and NHMFL Lucent Technologies Princeton U. Lucent Technologies	Columbia U. and Princeton U.	Anisotropic and Paired State of Composite Fermions
Stormer, Horst Syed, Sheyum * Wang, Yong-Jie	Columbia U. Columbia U. NHMFL	Columbia U.	Cyclotron Resonance on AlGaAs/GaAs Heterostructures
Stormer, Horst Syed, Sheyum * Wang, Yong-Jie	Columbia U. Columbia U. NHMFL	Columbia U.	CR vs. Mobility in AlGaAs/GaAs
Storr, Kevin Papavassiliou, George	FAMU National Hellenic Research Foundation	FAMU	Transport and Magnetization Measurements of Tau Phase Organic Conductors
Takano, Yasu Andraka, Bohdan Kageyama, Hiroshi McDonald, Frank * Tsujii, Hiro +	U. of Florida U. of Florida Inst. for Solid State Physics, U. of Tokyo U. of Florida U. of Florida	Department of Energy, National Science Foundation	Specific Heat of $SrCu_2(BO_3)_2$ in High Magnetic Field
Takano, Yasu Andraka, Bohdan Cizmar, Erik + Meisel, Mark Park, Ju-Hyun + Rotundu, Costel * Tsujii, Hiro +	U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida	National Science Foundation	Specific Heat of a Two-Leg Spin-Ladder Antiferromagnet in High Magnetic Field
Takano, Yasu Andraka, Bohdan Aoki, Yuji Cizmar, Erik + Kaczorowski, Dariusz Kageyama, Hiroshi Katsumata, Koichi MacLaughlin, Douglas McDonald, Frank * Meisel, Mark Park, Ju-Hyun + Rotundu, Costel * Sugawara, Hitoshi Tanaka, Hidekazu Thomas, Jason ~ Troc, Robert Tsujii, Hiro +	U. of Florida U. of Florida Tokyo Metropolitan Univ. U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. Inst. for Solid State Physics, Univ. of Tokyo RIKEN Harima Inst. Univ. of California, Riverside U. of Florida U. of Florida U. of Florida U. of Florida Tokyo Metropolitan Univ. Tokyo Inst. of Technology U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. U. of Florida	National Science Foundation	Specific Heat and Magnetization of NDMAP in High Magnetic Field

Users: DC Field	Institutions	Funding	Projects
Takano, Yasu Ajiro, Yoshitami Andraka, Bohdan Aoki, Yuji Cizmar, Erik + Kaczorowski, Dariusz Kageyama, Hiroshi Katsumata, Koichi MacLaughlin, Douglas McDonald, Frank * Meisel, Mark Park, Ju-Hyun + Rotundu, Costel * Sugawara, Hitoshi Tanaka, Hidekazu Thomas, Jason ~ Troc, Robert Tsujii, Hiro +	U. of Florida Kyushu U. U. of Florida Tokyo Metropolitan Univ. U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. Inst. for Solid State Physics, U. of Tokyo RIKEN Harima Inst. U. of California, Riverside U. of Florida U. of Florida U. of Florida U. of Florida Tokyo Metropolitan Univ. Tokyo Inst. of Technology U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. U. of Florida	National Science Foundation	Specific Heat of a S=1/2 One-Dimensional Antiferromagnet in High Magnetic Field
Takano, Yasu Andraka, Bohdan Aoki, Yuji Cizmar, Erik + Kaczorowski, Dariusz Kageyama, Hiroshi Katsumata, Koichi MacLaughlin, Douglas McDonald, Frank * Meisel, Mark Park, Ju-Hyun + Rotundu, Costel * Sugawara, Hitoshi Tanaka, Hidekazu Thomas, Jason ~ Troc, Robert Tsujii, Hiro +	U. of Florida U. of Florida Tokyo Metropolitan Univ. U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. Inst. for Solid State Physics, U. of Tokyo RIKEN Harima Inst. U. of California, Riverside U. of Florida U. of Florida U. of Florida U. of Florida Tokyo Metropolitan U. Tokyo Inst. of Technology U. of Florida Inst. of Low Temp. and Structure Research, Polish Academy of Sci. U. of Florida	Department of Energy	Anisotropy in the High Field Specific Heat of $PrOs_4Sb_{12}$
Telser, Joshua Baran, Peter + Krzystek, Jurek Raptis, Raphael Zvyagin, Sergei	Roosevelt U. U. of Puerto Rico NHMFL U. of Puerto Rico NHMFL	Roosevelt U.	High-Field and Frequency EMR of High-Spin Transition Metal Complexes
Tessema, Guebre Skove, Malcolm	Clemson U. Clemson U.	None	CDW's Under Very High Magnetic Fields: Investigation of a Aharonov -Bohm Effect in CDW Systems, and Fermiology Under Uniaxial Stress

Users: DC Field	Institutions	Funding	Projects
Thieme, Cees Schwartz, Justin	American Superconductor Corporation NHMFL & FAMU-FSU College of Engineering	National Inst.s of Health, USAF	High Field Properties of YBCO Coated Conductors
Tozer, Stan Agosta, Charles Goodrich, Roy G Hall, Donavan Kuhns, Phil Martin, Catalin * Murphy, Tim Palm, Eric Radovan, Henri + Reyes, Arneil Sarrao, John	NHMFL Clark U. Louisiana State U. NHMFL NHMFL Clark U. NHMFL NHMFL NHMFL NHMFL LANL	Department of Energy	Exploring the Interaction Between Magnetism and Superconductivity in Heavy Fermions
Tsui, Daniel Fang, Frank Lai, Keji * Pan, Wei Xie, Ya-Hong	Princeton U. IBM Princeton U. Sandia National Laboratories UCLA	ONR	Fractional Quantum Hall Effect in $Si/Si_{1-x}Ge_x$
Tsui, Daniel Chen, Yong * Engel, Lloyd Lewis, Rupert + Wang, Zhihai *	Princeton U. NHMFL-Princeton NHMFL/FSU NHMFL -Princeton NHMFL/Princeton	NHMFL In-House Research Program	Finite Frequency Transport of 2D Electron systems in Higher Landau Levels
Uji, Shinya Brooks, James Enomoto, Kengo + Kobayashi, Hayao Konoike, Takako + Yamada, Jun-ichi Yasuzuka, Syuma +	National Inst. for Materials Science FSU NIMS Inst. for Molecular Science NIMS Himeji Inst. of Technology NIMS	In-House Research Projects, NIMS, JAPAN	Quest for New Quantum States in Low Dimensional Organic Materials
Viehland, Dwight Krzystek, Jurek Reyes, Arneil Ruette, Benjamin * Zvezdin, Anatolii Zvyagin, Sergei	Virginia Tech NHMFL NHMFL Virginia Tech Russian Academy of Sciences NHMFL	U.S. Navy	Investigations of Field-Induced Phase Transitions by ESR and NMR Along the c-Axis: "Incommensurate to Homogeneous Antiferromagnetic States" in Magnetic Ferroelectrics $BiFe0_3$
Walsh, Robert Han, Ke Miller, John Trociewitz, Ulf	NHMFL NHMFL NHMFL NHMFL	National Science Foundation	Critical Current vs. Strain and Field
Wang, Ben Liang, Zhiyong (Richard) Zhang, Chuck	FAMU-FSU College of Engineering FAMU-FSU College of Engineering FAMU-FSU College of Engineering	National Science Foundation, U.S. Army, U.S. Air Force	Investigation and Development of Multifunctional Carbon Nanotube-Reinforced Composites Using Magnetically Aligned Carbon Nanotube Networks and Resin Infiltration Approaches
Wang, Yong-Jie Wei, Xing	NHMFL NHMFL	National Science Foundation	Magneto-Optical Study of Electronic Structure for Dilute GaAsN Alloys

Users: DC Field	Institutions	Funding	Projects
Wang, Yong-Jie San Martin, Angel Smirnov, Dmitry Wang, Xiaoming +	NHMFL NHMFL NHMFL UF	NHMFL	FTIR Instrument Development
Welp, Ulrich Karapetrov, Goran Kwok, Wai-Kwong Marcenat, Christophe Paulius, Lisa Rydh, Andreas +	Argonne National Laboratory ANL ANL Commissariat a l'Energie Atomique Western Michigan U. ANL	Department of Energy	Specific Heat Measurements of the Upper Critical Field Anisotropy in MgB_2
Woo, Jong-Chun Ahn, Sung Min * Jeong, In-Taek *	Seoul National U. Seoul National U. Seoul National U.	None	Zeeman Spectroscopy in In(Ga)As/AlGaAs Quantum Structures(Dots, Well, Wire)
Zheng, Guo-qing Kuhns, Phil Reyes, Arneil Sakai, Akihiro *	Osaka U. NHMFL NHMFL Osaka U.	Ministry of Education, Calture, Sports, Science and technology (MEXT), Japan	High-Field NMR Study of the Pseudogap Phase in High-Tc Copper-Oxides
Zvyagin, Sergei Krzystek, Jurek Stern, Raivo	NHMFL NHMFL NICPB	NHMFL	High-field ESR Study of Highly-Frustrated Quasi-Two-Dimensional Spin Systems
Zvyagin, Sergei Krzystek, Jurek Revcolevschi, Alexandre	NHMFL NHMFL Universite de Paris-Sud	NHMFL	Using High-Field Electron Spin Resonance to Probe Structural Evolution in the Spin-Peierls Compound $CuGeO_3$
Zvyagin, Sergei Krzystek, Jurek Landee, Chris Revcolevschi, Alexandre Turnbull, Mark	NHMFL NHMFL Clark U. Universite de Paris-Sud Clark U.	NHMFL	High Field ESR Spectroscopy of Quantum Spin Ladders

Number of DC Field Projects: 128

USERS & PROJECTS: PULSED FIELD FACILITY AT LOS ALAMOS

+ Postdoc * Graduate Student ~ Undergraduate Student

Users: Pulsed Field	Institutions	Funding	Projects
Amitsuka, H. Harrison, N. Jaime, M. Kim, K-H. Mydosh, J.A.	Hokaido U., Japan Amsterdam, Netherlands	NSF	Pulsed Magnetic Field Investigation on Heavy Electron Systems
Amitsuka, H. Kim, K.H.	Hokaido U. NHMFL-LANL	DoE and other	Hall Effect Studies of URu_2Si_2
Ando, Y. Komiya, S. Ono, S. Betts, J. Boebinger, G. Kim, K.H.	CRIEPI, Japan NHMFL-LANL	DOE	Transport of High Tc Cuprates in Pulsed Fields
Andronikov, D. Kochereshko, V.P. Karczewski, G. Negre, N. Crooker, S.	A.F.Ioffe Physico-Technical Institut, Russia Institute of Physics Polish Academy NHMFL-LANL	NSF	Excitons and Trions in Heavily Doped QW Structures at High Magnetic Fields
Balakirev, F. Boebinger, G. Ono, S. Ando, Y.	NHMFL-LANL CRIEPI, Japan	NSF and DoE	Hall Effect and Resistivity in Underdoped Cuprate
Barker, D.	Ratheon Corp.	Other	Experimental Test of Nonreciprocal Magnetic Photonic Crystals in the GHz Region
Betts, J.	NHMFL-LANL	DoE	Thermometer and Addenda Calibration of Silver Heat Capacity Stage
Bianchi, A. Movshovich, R. Haas, M. Cava, R. McCall, S. Alexander, C.S. Cao, G. Crow, J. Jaime, M. Lacerda, A.	LANL Princeton U. NHMFL-TLH NHMFL-LANL	NSF	Thermodynamic Investigation of the Metamagnetic Transition in $Sr_3Ru_2O_7$
Bianchi, A. Movshovich, R. Mandrus, D.	MST-10/LANL Oak Ridge Nat. Lab.	NSF	Specific Heat in the "Purple Bronze" $Li_{0.9}Mo_6O_{17}$
Bianchi, A. Movshovich, R. Sarrao, J. Harrison, N. Lacerda, A.	MST-10/LANL NHMFL-LANL	NSF	Magnetization Measurements in $CeCoIn_5$ for Fields in the [110] Direction
Boebinger, G. Harrison, N.	NHMFL-LANL	DOE	Magnetization of Cuprates in High Magnetic Fields

Users: Pulsed Field	Institutions	Funding	Projects
Brooks, J. Graf, D.	FSU	NSF	Exploration of the Newly Discovered Field Induced CDW-to-SDW Transition in $Perylene_2Au(mnt)_2$ Above 40 T
Canfield, P.	Ames Laboratory	DoE	Low Temperature Studies of New Materials
Capan, C. Bianchi, A. Moreno, N.O. Pagliuso, P.G. Sarrao, J. Hundley, M.F. Thompson, J.D. Oeschler, N. Gegenwart, P. Steglich, F.	MST-10/LANL Max-Planck-Institute, Dresden	NSF and DoE	Thermal Conductivity in $CeCoIn_5$
Cheong, S.W. Kim, K.H.	Rutgers U. NHMFL-LANL	DoE and Other	Dielectric Constant Measurements
Civale, L. Serquis, A. + Coulter, Y.	MST-STC-LANL	NSF and DoE	Critical Currents in MgB_2 Wires
Correa, V. Jaime, M. Lacerda, A. Tung, L.-C.	NHMFL-LANL U.C. Riverside	NSF and DoE	Magnetotransport Measurements in $Ce_{0.5}La_{0.5}RhIn_5$
Correa, V. Jaime, M. Sarrao, J. Tung, L-C. Hollen, S.	NHMFL-LANL U.C. Riverside Occidental College	NSF and DoE	Thermal Expansion and Magnetostriction in $Ce_{1-x}La_xRhIn_5$
Correa, V. Tung, L-C. Schmiedeshoff, G. Canfield, P. Bud'ko, S.	NHMFL-LANL U.C. Riverside Occidental College AMES Lab.	NSF	Thermal Expansion and Magnetostriction in $Ce_{1-x}La_xRhIn_5$ and $YbNi_2B_2C$ Heavy Fermions
Correa, V. Lacerda, A. Sarrao, J.	NHMFL-LANL	NSF	Thermal Expansion in $LaRhIn_5$
Correa, V. Lacerda, A. Tung, R.	NHMFL-LANL U.C. Riverside	NSF	Thermal Expansion in 115-Ce Compounds
Correa, V. Tung, R. Lacerda, A. Sarrao, J.	NHMFL-LANL	NSF	Specific Heat in 115 Compounds
Crawford, M. Fisher, R.A. Lashley, J.	DuPont U.C. Berkeley NHMFL-LANL	Other	Specific Heat of Spin Ice
Crone, B. Smith, D. Crooker, S. Barrick, T.	MST-11/LANL MST-11/LANL NHMFL-LANL NHMFL-LANL	NSF and DoE	Looking for Polarized Electrons in Polymers

Users: Pulsed Field	Institutions	Funding	Projects
Crooker, S. Barrick, T. Kono, J. Reitze, D. Stanton, C. Jho, Y.D.	NHMFL-LANL Rice U. U. of Florida NHMFL-TLH	NSF and DoE	High Field Polarized Voigt Absorption Spectroscopy
Crooker, S. Barrick, T. Petruska, M. Hollingsworth, J. Klimov, V.	NHMFL-LANL	DoE	Spin-Polarized Line Narrowing in Semiconductor Nanocrystals
Crooker, S. Barrick, T. Klimov, V. Hollingsworth, J. Petruska, M. Efros, A.	NHMFL-LANL LANL Chemistry Division NRL	NSF	Acoustic Phonons in Semiconductor Nanocrystals
Crooker, S. Smith, D. Kos, S. Lilly, M.	NHMFL-LANL LANL Theoretical Div. Sandia Nat. Lab.	NSF	Lateral Spin Drag in GaAs
Drymiotis, F. Betts, J. Migliori, A. Fisk, Z. Lashley, J.	NHMFL-LANL	NSF	Induction of Ferromagnetic Ground State in TmAuSn with Application of High Magnetic Fields
Drymiotis, F. Betts, J. Migliori, A. Fisk, Z. Lashley, J. Mueller, F.M.	NHMFL-LANL	DoE	Field Dependence of the Ce Alpha-Gamma Transition and Transport in High Magnetic Fields of Selected Laves Alloys
Drymiotis, F. Lashley, J.	NHMFL-LANL	DOE	AC Susceptibility of Cubic Laves
Drymiotis, F. Lashley, J. Fisk, Z. Gor'kov, L.	NHMFL-LANL LANL/FSU NHMFL/FSU	DOE	Magnetic Field Dependence of the Structural
Dunsinger, S. Curro, N.J. Cheong, S-W. Kim, K.H.	LANL Rutgers U. NHMFL-LANL	DoE	Transport Study of $(Bi,Y)Ru_2O_7$ Pyrochlore Materials
Ebihara, T.	Shizuoka U., Japan	NSF	The dHvA Measurements in Pulse Magnetic Field of $CeIn_3$
Fisher, I. Sebastian, S.	Stanford U.	NSF	High Field Magnetization of $Sr_2Cu(BO_3)_2$
Fisk, Z. Migliori, A. Balakirev, F. Betts, J. Kim, D. + Kim, K. + Drymiotis, F. +	FSU NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL	NSF and DoE	Magnetoresistance of beta-Ti_5Sn_6
Goodrich, R. Young, D. Harrison, N.	LSU NHMFL-LANL	DoE	dHvA in $Ce_xLa_{1-x}PdGa_6$ Alloys

Users: Pulsed Field	Institutions	Funding	Projects
Guertin, R.	Tuffs U.	NSF	Pulsed Field Studies of Cobaltites and Ruthenates
Ho, P-C. Maple, M.B. Frederick, N.	UCSD	Other	Magnetoresistance of $PrOs_{1-x}Ru_{(x)4}Sb_{12}$
Hu, J. Lacerda, A. Betts, J. Boebinger, G. Migliori, A.	U. of Chicago NHMFL-LANL	NSF	High Field Magnetoresistance of Ag_2Te
Hu, J. Betts, J.	U. of Chicago NHMFL-LANL	DoE	Longitutional Magnetoresistance of AgSe
Hu, J. Betts, J.	U. of Chicago MST-LANL	NSF	Linear Magnetoresistance in $AgSe_2$
Jones, E. Zhang, Y. Crooker, S.	Sandia Nat. Lab. Nat. Renewable Energy Lab. NHMFL-LANL	NSF	Magnetoluminescence of Isoelectronic Impurities in III-V Semiconductors
Keller, D. Yakovlev, D. Astakhov, G. Keller, D. Crooker, S.	U. of Dortmund U. of Wuerzburg NHMFL-LANL	NSF	Spin Polarized Spectroscopy of Magnetic 2D Electron Gases
Kenzelman, M. Stern, R. Jorge, G.	NIST Nat. Inst. of Phys. Tallin, Estonia NHMFL-LANL	NSF	Specific Heat in $RbFe(MoO_4)_2$
Kenzelman, M. Jaime, M.	NIST NHMFL/LANL	NSF	Magnetization vs. Field in $RbFe(MoO_4)_2$
Kenzelman, M. Jaime, M.	NIST NHMFL-LANL	DoE	Specific Heat of $RbFe(MoO_4)_2$ in Dilution
Kim, D. Migliori, A. Betts, J. Kim, K-H. Jia, Q. Lee, J.	NHMFL-LANL	NSF and DoE	3 Omega Thermal Conductivity Measurement of High TC Oxides
Kim, D. Migliori, A. Kim, K-H. Jia, Q. Sohn, J-Y.	NHMFL-LANL	DoE	3 Omega Thermal Conductivity Measurements
Kim, H. Klimov, V. Kim, K.-H.	LANL NHMFL-LANL	NSF	Specific Heat Study of Co Nano-Particle System
Kim, H. Kim, K.-H. Klimov, V.	LANL	NSF	Specific Heat Investigation of Co Nanoparticle
Kim, K.H. Boebinger, G. Komia, S. Ando, Y.	NHMFL-LANL CRIEPI, Japan	NSF	Search for Quantum Critical Point in $La_{2-x}Sr_xCuO_4$
Kimura, T. Ramirez, A. Lashley, J. Lawes, G.	MST-10 LANL	DOE	Magnetocapacitance and Magnetoelectric Effect

Users: Pulsed Field	Institutions	Funding	Projects
Kirk, M. Depperman, E. Zaleski, C.	U. of New Mexico	NSF	High Field Magnetization and AC Susceptibility
Landee, C. Singleton, J.	Clark U. NHMFL-LANL	NSF	Magnetization of Organic Spin Ladders
Lashley, J. Drymiotis, F. Thurmon, R. ~	NHMFL-LANL NHMFL-LANL College of the Ozarks	NSF	Elastic Constants of Single Crystal Iron in Magnetic Field
Lashley, J. Mielke, C. Singleton, J. Migliori, A. Drymiotis, F. Fisk, Z. Smith, J.L.	NHMFL-LANL	DOE	Interaction of First-Order Isostructural Phase Change with High Magnetic Fields
Lashley, J. Kimura, T.	NHMFL-LANL	DOE	Capacitance in the 14 T PPMS
Lashley, J. Mielke, C.	NHMFL-LANL	NSF	First Order Transition in Pulsed Field in $Ce_{.8}La_{.1}Th_{.1}$
Lee, A.Y. Lin, Y. Jia, Q.	LANL	NSF	Optical Properties of nc-Si
Lee, S.Y. Jia, Q. Crooker, S.	LANL NHMFL-LANL	NSF	Optical Properties of ZnO Thin Films
Leisure, R. Atteberry, J.E. Hightower, N. Migliori, A. Kim, D. Kim, K.-H. Betts, J.B. Boebinger, G.	Colorado State U. NHMFL-LANL	DoE	RUS Studies of H Motion in C-15 Materials
Leisure, R. Betts, J. Migliori, A. Ledbetter, H.	Colorado State U. NHMFL-LANL	NSF and DoE	Elastic Constants of TeO_2 from 300 K-4 K
Leisure, R. Betts, J. Migliori, A. Ledbetter, H.	Colorado State U. NHMFL-LANL	NSF	Elastic Constants of Single Crystal Diamond
Leisure, R.G. Hightower, J. Migliori, A. Kim, K. Kim, K. Betts, J.B. Boebinger, G.S.	C.S.U. C.S.U. NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL	NSF and DoE	Hydrogen Motion in Rare Earths
Leisure, R.G. Atteberry, J. (nee Hightower) Migliori, A. Kim, D. Kim, K. Betts, J.B. Boebinger, G.S.	C.S.U. C.S.U. NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL MST-DO/LANL	NSF and DoE	RUS Studies of H Motion in C-15 Materials

Users: Pulsed Field	Institutions	Funding	Projects
Lin, Y. Lee, S.Y. Jia, Q. Crooker, S.	MST-STC/LANL NHMFL-LANL	NSF and DoE	Optical Property of ZnO Thin Film
McDonald, R. Harrison, N. Mielke, C. Singleton, J. Hill, S.	NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL and U. of Florida	NSF	Cryogenic and Pulsed Field Testing of Dielectric GHz Conductivity Apparatus
McDonald, R. Harrison, N. Singleton, J. Musfeldt, J. He, J. Choi, J. Jin, R.	NHMFL-LANL NHMFL-LANL NHMFL-LANL U. of Tennessee Oak Ridge Nat. Lab	NSF	Magnetoresistance on Li Doped Purple Bronze
McDonald, R. Harrison, N. Mielke, C. Singleton, J.	NHMFL-LANL	DOE	First Pulsed Field Tests of Flow Cryostat
McDonald, R.	NHMFL-LANL	DOE	Photonic Bandgap Resonator Perturbation Tests
McDonald, R. Crooker, S. Migliori, A. Balatsky, A.V. Samarth, N. Ku, K-C.	NHMFL-LANL LANL Theoretical Div. Penn. State U.	DOE	Spin-Noise Experiments in 2D Electron Systems
Mielke, C. Goddard, P. McDonald, R. Migliori, A. Singleton, J.	NHMFL-LANL	DoE	Conductivity Measurements of Alpha-Plutonium in High Magnetic Fields
Mielke, C.H. McDonald, R. Singleton, J. Ryan, J.F.	NHMFL-LANL Clarendon Lab. Oxford U.	NSF and DoE	Upper Critical Fields in High Tc Superconductors
Migliori, A. Lashley, J.C. Kim, K. Kim, D. Betts, J.B. Boebinger, G.S. Balakirev, F.	NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL NHMFL-LANL MST-DO/LANL NHMFL-LANL	NSF	Specific Heat and Transport in Pu
Migliori, A. Lashley, J. Betts, J.	NHMFL-LANL	DOE	Plutonium Heat Capacity Measurements at Helium Three Temperatures
Morosan, E.	Iowa State U.	Other	Torque Magnetometry Measurements on $MYIn_5$, Where M and Y are Various Transition-Metal Elements
Morosan, E. Goddard, P. McDonald, R. Singleton, J.	Iowa State U. NHMFL-LANL	DoE	$CeRh_xCo_{x-1}In_5$ Transport

Users: Pulsed Field	Institutions	Funding	Projects
Morosan, E. Goddard, P. McDonald, R. Singleton, J.	Iowa State U. NHMFL-LANL	DoE	$CeRh_xCo_{x-1}In_5$ Magnetization
Movshovich, R. Capan, C. Bianchi, A.	MST-10/LANL	NSF and DoE	Resistivity of $CeIrIn_5$
Movshovich, R. Capan, C. Ronning, P.	MST-10/LANL	DOE	Resistivity Measurements Near Quantum Critical
Nakotte, H. El-Khatib, S. Correa, V. Migliori, A.	New Mexico State U. NHMFL-LANL	NSF	Thermal Expansion and Magnetostriction
Nakotte, H. El-Khatib, S.	Physics Department MSC3D	NSF	Resonant Ultrasonic Studies in Uranium
Narduzzo, A. Ardavan, A. Day, P. McDonald, R. Singleton, J.	U. of Oxford NHMFL-LANL	Other	GHz Studies of Low Dimensional Organic
Ono, S. Komiya, S. Ando, Y. Kim, K.H. Boebinger, G.S.	NHMFL-LANL CRIEPI, Japan NHMFL-LANL	DOE	Hall Effect Studies of High Tc Cupates
Petuskey, B. George, T. Mansell, J.	ASU LANL Qynergy Corp.	NSF	Hall Effect in Boron Compounds
Planes, A. Lashley, J. Harrison, N. Goddard, P.	LANL Theoretical Div. NHMFL-LANL	NSF	Magnetoelasticity in Pulsed Field
Rickel, D. Crooker, S. Samath, N.	NHMFL-LANL UCSB	NSF and DoE	Measurement of Paramagnetism in CdMnSe
Rickel, D. Samath, N.	NHMFL-LANL UCSB	NSF and DoE	Paramagnetism of an Epilayler of CdMnSe
Rickel, D.	NHMFL-LANL	NSF and DoE	Pulsed Ultrasound System Test
Schmiedeshoff, G. Dulguerova, D. Smith, J. Cooley, J. Canfield, P.	Occidental College Occidental College LANL LANL Ames/Iowa State	NSF	Magnetoresistance of Actinide and Rare-Earth Superconducting Compounds
Schmiedeshoff, G. Cooley, J. Correa, V.	Occidental College LANL	NSF	Thermal Expansion and Magnetostriction of Be-Cu
Serquis, A. Civale, L.	LANL	DoE	Superconducting Upper Critical Field in MgB_2
Sohn, J.Y.	NHMFL-LANL	NSF	THz Complex Conductivity on YBCO
Sohn, J.Y.	NHMFL-LANL	NSF	THz Optical Conductivity on YBCO
Sohn, J.Y. Kim, K-H. Crooker, S.	NHMFL-LANL	NSF	Magnetic Field Induced Metal Insulator Transition

Users: Pulsed Field	Institutions	Funding	Projects
Sohn, J.Y.	NHMFL-LANL	NSF	Metal Insulator Transition in Semiconductors
Stern, R. Uchinokura, K.	NICPB, Estonia U. of Tokyo	NSF	Magnetization Measurements in 2D Spin Dimer System $BaCuSi_2O_6$
Stern, R. Jaime, M.	Nat. Inst. of Phys. Tallin, Estonia NHMFL-LANL	NSF	Magnetization of 2D Spin Systems BaCuSiO
Stewart, G. Kim,J. Sarrao, J. Moreno, N. Harrison, N.	UF LANL NHMFL-LANL	DoE	M vs. H to 60 T vs. Temperature in Highly Correlated Systems
Tozer, S.W. Agosta, C.C. Martin, C. Mielke, C.H.	FSU Clark U. Clark U. NHMFL-LANL	NSF	High Pressure Studies of Highly Correlated Electron Systems
Tsukada, I. Ando, Y. Boebinger, G. Balakirev, F.	CRIEPI NHMFL-LANL	NSF	Hall Effect in LaSrCuO
Tung, L-C.	NHMFL-LANL	DOE	Heat Capacity of Quantum Paraelectric Material
Wolf, B. Mayerstrasse, R. Lang, M. Wagner, M.	U. of Frankfurt	NSF	Magnetization Measurements on Low Dimensional Spin Systems
Wolf, B.	U. of Frankfurt, Germany	NSF	High Field Magnetization of a New Heisenberg Spin Chain
Wosnitza, J. Hagel, J. Goll, G. Takabatake, T. Kozlova, N.	 Hiroshima U.	NSF	Magnetotransport in CeBiPt
Yakovlev, D. Ossau, W. Astakhov, G.	U. of Dortmund U. of Wuerzburg	NSF	Spin-Polarized II-VI Electron Gases in High Magnetic Fields
Yeh, N-C. Zapf, V. Beyer, A.	Caltech	NSF	Cantilever Magnetization Measurements

Number of Pulsed Field Facility Projects: 108

USERS & PROJECTS: HIGH B/T FACILITY AT THE UNIVERSITY OF FLORIDA

Users: High B/T	Institutions	Funding	Projects
Lee, Y. Halperin, W.P. Mulders, N. Gervais, C. Choi, H.C. Gray, A.J. Vicente, C. Xia, J.S.	UF/NHMFL Northwestern U. Northwestern U. Northwestern U. & NHMFL UF UF UF/NHMFL UF/NHMFL	IHRP and NSF	Effect on Dirty Superfluid ^{3}He in High Magnetic Fields and Ultra-Low Temperatures
Pan, W. Stormer, H.L. Tsui, D.C. Gabor, A.C. Pfeiffer, L.N. Baldwin, K.W. West, K.W. Vicente, C. Xia, J.S. Adams, E.D. Sullivan, N.S.	Princeton U. & NHMFL Columbia U. & Bell Labs Princeton U. Princeton U. Bell Labs Bell Labs Bell Labs UF/NHMFL UF/NHMFL UF/NHMFL UF/NHMFL	NSF and others	Fractional Quantum Hall Effect at Ultra-Low Temperatures

Number of High B/T Projects: 2

USERS & PROJECTS: NMR SPECTROSCOPY AND IMAGING FACILITIES

Users: NMR, MRI/S	Institutions	Funding	Projects
Adhyaru, B. Bowers, C.	UF UF	NIH	SPINOE and Polarization Measurements in Hyperpolarized Liquid Xe-129
Al-Nagger, I. Edison, A.S. Zachariah, C. Topp, H. Yarmola, E. Bubb, M.R.	UF UF UF UF UF UF	VA	Biophysical Studies of MARCKS: Implications for Neuroplasticity
Amwake, C.E. Brey, W.W. Falconer, N.D. Gor'kov, P.	FAMU-FSU College of Engineering & NHMFL FSU/NHMFL FAMU-FSU College of Engineering, Sciences and Technology FSU/NHMFL	NHMFL	Fabricated Teflon Capacitors for NMR Probes
Angerhofer, A. Garcia-Rubio, I. Schweiger, A.	UF ETH Zürich ETH Zürich	NIH	Advanced EPR Studies of Model Systems for Biological Mn-Enzymes – ENDOR-Induced EPR
Angerhofer, A. Garcia-Rubio, I. Schweiger, A.	UF ETH Zürich ETH Zürich	NIH	Advanced EPR Studies of Model Systems for Biological Mn-Enzymes – The PEANUT Experiment
Barbar, E. Mokokha, M. Montelione, G. Huang, J. Edison, A.S.	Ohio U. Ohio U. Rutgers U. Rutgers U. UF	NHMFL/NSF	Structural Biology of Microtubule Transport
Beck, B. Fitzsimmons, J. Goldberg, R.J.	UF UF UF	NIH	Simulating Image Inhomogeneities on Large Samples at High Magnetic Fields
Beck, B. Fitzsimmons, J. Jenkins, K.	UF UF UF	NIH	Wave Behavior in Phantoms at 11.1 T Tesla
Bencze, K.Z. Stemmler, T.L. Mobashery, S.	Wayne State U. Wayne State U. Wayne State U.	NSF	Structure of the Peptidoglycan NAG-NAM Repeat
Benveniste, H. Zhang, L. Grant, S. Blackband, S. Siram, A. Hof, P.R. Volkow, N.D. Grandy, D.	Brookhaven Natl. Lab Brookhaven Natl. Lab UF UF State U. of New York at Stony Brook Mount Sinai School of Medicine Brookhaven Natl. Lab Oregon Health & Science U.	NIH	MR Microimaging Studies of Mouse Brains For Generation of a Web Based Atlas and a Study of the Effects of ETOH
Bertini, I. Pierattelli, R. Fu, R.	U. of Florence, Italy U. of Florence, Italy FSU/NHMFL		Solid-State NMR of Paramagnetic Metalloproteins

Users: NMR, MRI/S	Institutions	Funding	Projects
Bhattacharya, N. Logan, T.M. Yi, M. Zhou, H.X.	FSU FSU/NHMFL FSU/NHMFL FSU	FSU	Effective Concentrations in Biochemical Reactions
Brey, W.W. Suddarth, S. Lin, Y.	FSU/NHMFL FSU/NHMFL UCLA	NHMFL	Sensitivity of Hahn Echo Phase to Field Fluctuations
Brey, W.W. Withers, R. Edison, A.	FSU/NHMFL Bruker Biospin UF	NIH	Progress Toward a 1 mm Superconductive NMR Probe
Cain, M.A. Brey, W.W. Cruden, A. Shetty, K.	FSU College of Engineering/NHMFL FSU/NHMFL FSU College of Engineering/NHMFL FSU/NHMFL	NHMFL	Accurate Models of NMR Coils at High Frequency
Chekmenev, E. Cross, T.A.	FSU/NHMFL FSU/NHMFL	NSF	Development of Solid State NMR Sample Cell with Improved Heat Dissipation Parameters
Cross, T.A. Chapman, M. Chiu, W. Jap, Bing Loll, P.J. Marshall, A. Nakamoto, R.K. Opella, S.J. Sanders, C. Söennichsen, F. Stauffacher, C. Taylor, K. Wiener, M.	FSU/NHMFL FSU Baylor, College of Medicine Lawrence Berkeley Natl. Lab Drexel School of Medicine FSU U. of Virginia U. of California, San Diego Vanderbilt U. Case Western Reserve Purdue U. FSU U. of West Virginia	NIH	Membrane Protein Structural Genomics: M Tuberculosis
D'Espinose de Lacaillerie, J.B. Fonollosa, P. Gan, Z.	ESPCI - UMR CNRS Laboratoire de Physique Quantique ESPCI FSU/NHMFL	ESPI	High-Field MAS NMR of Molybdenum Based Models for Oxidic Precursors and Sulfided Hydrotreatment Catalysts
Edison, A.S. Zachariah, C. Dossey, A. De bono, M. Evan, P.D.	UF/NHMFL UF/NHMFL UF/NHMFL Cambridge, UK Cambridge, UK	NSF	Structure/Function Relations of Neuropeptides
Eisenmesser, E.Z.E. Kern, D. K. Lebeikovsky, W. Bosco, D.A. Skalicky, J. Millet, O. Korzhner, D.M. Kay, L.E.	Brandeis U. Brandeis U. Brandeis U. Brandeis U. FSU/NHMFL U. of Toronto U. of Toronto U. of Toronto	NSF	Insights into Enzyme Dynamics During Catalysis of CypA

Users: NMR, MRI/S	Institutions	Funding	Projects
Fonollosa, P. D'Espinose, J. Gan, Z.	ESPCI - UMR CNRS Laboratoire de Physique Quantique ESPCI-UMR CNRS Laboratoire de Physique Quantique FSU/NHMFL	ESPI	Characterization of Aluminum and Calcium in Hydrated Cementitious Materials
Frimel, T.N. Walter, G.A. Cahill, K.S. Gaidosh, G.S. Torres, R. Haurd, J. Byrne, B.J. Vanderborne, K.	UF UF UF UF UF UF UF UF	NIH	Noninvasive Monitoring of Stem Cell Delivery and Muscle Regeneration
Fu, R. Hu, J. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NSF	Lee-Goldburg Frequency Modulated Cross Polarization in Solid-State CPMAS NMR
Fu, R. Ma, Z. Zheng, J.P. Au, G. Plichta, E.J. Ye, C.	FSU/NHMFL FSU/NHMFL FAMU-FSU College of Engineering U.S. Army Communications-Electronics Command U.S. Army Communications-Electronics Command Chinese Academy of Sciences	U. S. Army Communications-Electronics Command	High Resolution ^{7}Li Solid State NMR Study of $Li_xV_2O_5$ Cathode Electrodes for Li-Rechargeable Batteries
Fu, R. Cross, T.A.	FSU/NHMFL FSU/NHMFL	NSF	Measurement of ^{15}N-^{1}H Bond Lengths by Rotational-Echo Double-Resonance NMR Spectroscopy
Gan, Z. Zumbulyads, N.	FSU/NHMFL Eastman Kodak	Eastman Kodak	Characterization of the Alpha-, Beta-, and Delta-Forms of tris (8-hydroxyquinolinato) Aluminum by High Field ^{27}Al MQMAS NMR Spectroscopy
Gan, Z. Alam, T. Vold, P. Hoatson, G.	FSU/NHMFL Sandia Natl. Labs College of William & Mary College of William & Mary	IHRP	A New Representation for MQMAS
Gan, Z. Kwak, H.	FSU/NHMFL FSU/NHMFL	NHMFL	Multiplex Phase Cycling for Enhancing MQMAS Sensitivity
Gan, Z. Kwak, H.	FSU/NHMFL FSU/NHMFL	NHMFL	MQMAS with Soft-Pulse Added Mixing
Gannett, P.M. Hummel, M.A. Aguilor, J.S. Tracy, T.S.	West Virginia U. U. of Minnesota West Liberty State College U. of Minnesota	NSF	T1 Relaxation Time Based Evaluation of Proton to Heme Distances of Fluribiprofen and Dapsone Within the Active Site of CYP2C9

Users: NMR, MRI/S	Institutions	Funding	Projects
Gao, F.P. Cross, T.A.	FSU/NHMFL FSU/NHMFL	NIH	Determination of a Cu^{2+} Binding Site in the Proton Channel of M2 Protein from Influenza A by ^{19}F NMR
Gao, F.P. Cross, T.A. Vijayvergiya, V. Busath, D.D.	FSU/NHMFL FSU/NHMFL Brigham Young U. Brigham Young U.	NIH	M2 Influenza A Viral Protein Single Channel Conductance Studies in Planar Lipid Bilayers
Gao, F.P. Fu, R. Ulrich, A.S. Cross, T.A.	FSU/NHMFL FSU/NHMFL Forschungzentrum Karlsruhe/Germany FSU/NHMFL	IHRP	^{19}F MAS NMR of Membrane Proteins
Gao, F.P. Cross, T.A. Korepanova, A. Qin, H. Hua, Y.	FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU FSU/NHMFL	NIH	Structural Genomics of Mycobaterium tuberculosis
Gor'Kov, P. Brey, W.W. Li, C. Saha, S. Chekmenev, E. Cross, T.A. Hu, J. Fu, R. Mo, Y.	FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL	IHRP	Large Sample Probes for Solid State NMR of Membrane Proteins
Gower, L.B. Long, J.R.	UF UF	NIH	Examination of Calcium Phosphates Formed During *In Situ* Mineralization
Grant, S.C. Shaw, C.A. Wilson, J.M. Petrik, Ms. Blackband, S.	UF U. of British Columbia U. of British Columbia U. of British Columbia UF	NIH	MR Microscopy of an Exogenous ALS-PDC Mouse Model: High-Resolution T2*- and Diffusion-Weighted Imaging at 17.6 T
Grant, S.C. Constantinidis, I. Simpson, N.E. Blackband, S.	UF UF UF UF		MR Microscopy in Alginate Beads as a Tool for Developing Artificial Organs
Grant, S.C. Constantinidis, I. Simpson, N.E. Blackband, S.	UF UF UF UF	NIH	MR Microscopy of the Human Pancreatic Islet
Gunaydin-Sen, O. Fu, R. Dalah, N.	FSU/NHMFL FSU/NHMFL FSU	NHMFL	High Resolution ^1H Magic Angle Spinning (MAS) NMR of Antiferroelectric Phase Transition in a Single Crystal of WSPAmmonium Dihydrogen Arsenate

Users: NMR, MRI/S	Institutions	Funding	Projects
Haskell-Luevano, C. Holder, J.R. Wilczynski, A. Richards, N. Wang, X.S. Thirumoorthy, R. Edison, A.S.	UF/NHMFL UF/NHMFL UF/NHMFL UF/NHMFL UF/NHMFL UF/NHMFL UF/NHMFL	NIH	Structure/Activity Studies of Melanocortin Receptor Ligands
He, G. Liu, Y. Levine, S. James, A. Chen, Y.	UF UF U. of Pittsburgh UF UF	NIH	Noise Reduction for Diffusion Tensor Imaging in Aged Human Subjects
Hopkins, A. Cross, T.A.	FSU/NHMFL FSU/NHMFL	NIH	Comparison of Ground-State Bacteriorhodopsin Structures Within the Protein Data Bank
Houpt, T.A. Smith, J.C. Cason, A. DenBleyker, M. Hood, A.	FSU FSU FSU FSU FSU	NIH	Behavioral and Neural Effects of High Strength Magnetic Fields
Hu, J. Gan, Z. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Development of ^{17}O NMR as a Tool to Characterize Ion Channels
Hu, J. Cross, T.A. Zhang, L. Nishimura, K.	FSU/NHMFL FSU/NHMFL FSU Yokohama Natl. U.	NIH	Histidine Protonation in the Transmembrane Segment of the M2 Proton Channel from Influenza A Virus
Hwang, S.J. Kwak, H.	California Institute of Technology FSU/NHMFL	IHRP	11B NMR Study of B-Zeolite BEA* at 830 MHz
Kim, H. Fu, R. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NSF	Cross Polarization Schemes for Peptide Samples Oriented in Hydrated Phospholipid Bilayers
Kwak, H. Gan, Z.	FSU/NHMFL FSU/NHMFL	IHRP	Double-Quantum Filtered STMAS
Labeikovsky, W. Kern, D. Eisenmesser, E. Bosco, D.A. Skalicky, J.	Brandeis U. Brandeis U. Brandeis U. Brandeis U. FSU/NHMFL	NSF	Dynamics of the Prolyl Isomerase Pin1 during Catalysis
Lee, J. Logan, T.M. Blaber, M. Kim, J. Brych, S.	FSU FSU/NHMFL FSU FSU FSU	NSF	Structure and Dynamics of Mutants of Fibroblast Growth Factor
Lethbridge, B. Edison, A.S. Rumjanek, V. Sims, J. Tate, M. Triplett, E.	U. of Adelaide UF/NHMFL U. of Federal Rural do Rio de Janerio U. of California U. of Adelaide U. of Adelaide	NHMFL	Covalent Structure of Trifolitoxin

Users: NMR, MRI/S	Institutions	Funding	Projects
Li, C.L. Cross, T.A. Fu, R. Gan, Z. Mo, Y.	NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL	NSF	Evaluation of Heteronuclear Decoupling Sequence Applied to Static Oriented Solid
Li, C.L. Cross, T.A. Mo, Y. Hu, J. Gao, F. Gor'kov, P. Fu, R. Chekmenev, E. Brey, W.W.	FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Radio Frequency Heating of Membrane Protein Sample
Li, Y. Edison, A.S. Rocca, J Zachariah, C. Webb, A. Zhang, X. Logan, T.L.	UF/NHMFL UF/NHMFL UF UF U. of Illinois U. of Illinois FSU/NHMFL	IHRP	Development of Solenoidal Microcoils for Protein NMR
Lin, Yung-Ya	UCLA		Chaos Control in NMR
Liu, M. Vandenborne, K. Walter, G. Pathare, N.C. Zimmerman, U. Forster, R.E.	UF UF UF UF U. of Pennsylvania U. of Pennsylvania	NIH	A Quantitative Study of Bioenergetics in Carbonic Anhydrase III Knockout Mice by *in vivo* ^{31}P Magnetic Resonance Spectroscopy
Liu, M. Vandenborne, K. Bose, P. Thompson, F. Walter, G.	UF UF UF UF UF	NIH	The Effects of Training on the Skeletal Muscle Following Spinal Cord Contusion Injury Using Magnetic Resonance Imaging
Luck, L.A.	Clarkson U.	NSF	^{19}F NMR Spectroscopy for Structure and Dynamics of Proteins
Marin, V. Logan, T.M.	FSU/NHMFL FSU/NHMFL	FSU	Domain-Domain Interactions in the Activation of Diphtheria Toxin Repressor DtxR Using Paramagnetic Relaxation Enhancement
Mehta, M.A. Long, J.R.	Oberlin College UF	NSF	SSNMR Structural Studies of Condensed Peptides in Heterogeneous Environments
Milling, C.T. Peck, T.L. Hillenbrand, D.F.	Magnetic Resonance Microsensors Corp. Magnetic Resonance Microsensors Corp. Resonance Research, Inc.	NIH	High Resolution NMR in the Very-Narrow Bore 830 MHz Solids Magnet
Mo, Y. Cross, T.A. Li, C. Hu, J. Gao, F.P.	FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Optimizing Lipid Composition for Membrane Protein Samples

Users: NMR, MRI/S	Institutions	Funding	Projects
Mo, Y. Fu, R. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	^{87}Rb NMR Spectroscopy of KcsA Channel
Monk, T. Davies, L. Gearen, P. Schmalfuss, I. Bowers, D.	UF UF UF UF UF	UF	The Influence of Tourniquet Time on Cerebral Embolic Events in Elderly Patients Undergoing Total Knee Arthroplasty
Moore, J.D. Cross, T.A. Korepanova, A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Purification and Characterization of Mycobacterium Tuberculosis Integral Membrane Proteins
Mowery, D. Alamo, R.G.	FAMU-FSU College of Engineering/NHMFL FAMU-FSU College of Engineering/NHMFL	NSF	Structural Studies of Ethylene 1-Octene and Ethylene-Norbornene Random Copolymers by NMR and WAXS
Nandagopal, M. Kwak, H.T. Utz, M. Gan, Z.	U. of Connecticut FSU/NHMFL U. of Connecticut FSU/NHMFL	NSF	NMR Studies of Alq3 at NHMFL
Nguyen, H. Cross, T.A. Gao, F.P.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Semisynthesis of the Influenza Virus M2 Proton Channel Protein Using a Modified Mycobacterium Xenopi GyrA Intein Expression System
Pacak, C. Byrne, B. Cloutier, D. Zolotukhin, I. Campbell, K. Walter, G.	UF UF UF UF U. of Iowa UF	NIH	rAAV-Mediated Gene Therapy to Treat Limb Girdle Muscular Dystrophy Type 2D (LGMD-2D).
Padgett, K. Blackband, S.J. Grant, S.	UF UF UF	NIH	Investigation of Improved T1 Contrast at High Field Strengths
Padgett, K.R. Blackband, S.J. Eyler, F.D. Behnke, M. Crandall, K.M. Mareci, T.J. Black, T.A. Schmalfuss, I. Garvan, C.S.	UF UF UF UF UF UF UF UF UF	NIH	DTI Measurements in the Brains of Prenatally Cocaine Exposed Children
Padgett, K.R. Van Eldik, L. Wainright, M.S. Craft, J.M. Griffin, W.S.T. Marks, A. Pineda, J.	UF Northwestern U. Medical School Childrens Memorial Hospital, Chicago Northwestern U. U. of Arkansas U. of Toronto UF	NIH	Cerebral Ischemia Volume Studies Performed on *Ex Vivo* Mouse Brains at 11 Tesla

Users: NMR, MRI/S	Institutions	Funding	Projects
Page, R. Korepanova, A. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Expression and Purification of the Integral Membrane Protein Rv2433c from Mycobacterium tuberculosis for NMR Spectroscopy
Page, R. Gao, F.P. Cross, T.A.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Structural Characterization of the M2 Proton Channel from Influenza A Virus by Solution NMR Spectroscopy
Price, C. Monk, T. Schmalfuss, I.	UF UF UF	UF	Neuroanatomical and Neurocognitive Predictors of Post-Operative Dysfunction Among Non-Demented Subjects Over 65 Years of Age Following Major Non-Cardio...
Ragan, T.J. Harris, T.K.	U. of Miami, School of Medicine U. of Miami, School of Medicine	NSF	NMR Studies of the Role of the Pleckstrin Homology (PH) Domain in Regulation of the Serine-Threonine Protein Kinase PKB2/Akt2
Schilling, M. Cooper, W.T.	FSU FSU	NSF	Effects of Chemical Treatments on the Quality and Quantitative Reliability of ^{13}C NMR Spectroscopy of Mineral Soils
Schroeder, K.T. Greenbaum, N.L. Skalicky, J.	FSU/NHMFL FSU/NHMFL FSU/NHMFL	NIH	Structural Role of Protons of Pseudouridine in RNA Duplexes as Measured by NMR Experiments in Supercooled Water
Shepard, T. Blackband, S.J. Roper, S. Chen, H.X. Wirth, E.	UF UF UF UF U. of Chicago	NIH	NMR Microscopy of Isolated Perfused Human Brain Slices
Shepherd, T.M. Blackband, S.J. Wirth, E. King, M. Thelwall, P. Ozarslan, E. Mareci, T.J. Stanisz, G.J.	UF UF U. of Chicago UF UF UF UF U. of Toronto	NIH	NMR Microscopy of Isolated Perfused Rat Brain Slices
Simpson, N.E. Constantinidis, I. Han, Z. Stacpoole, P.	UF UF UF UF	NIH	Media-Influenced Secretory and ^{13}C Isotopomer Behavior of Insulinoma Cells
Simpson, N.E. Constantinidis, I.	UF UF	NIH	A Study of Model Beta Cells in Diabetes Treatment

Users: NMR, MRI/S	Institutions	Funding	Projects
Skalicky, J. Davulcu, O. Meryer, N.L. Ellington, W.R. Chapman, M.S.	FSU/NHMFL FSU/NHMFL FSU/NHMFL FSU FSU	IHRP	Functional Dynamics of Arginine Kinase
Srinivasan, P. Gan, Z. Quine, J. Kwak, H.T. Vold, R.	FSU FSU/NHMFL FSU/NHMFL FSU/NHMFL College of William & Mary	NHMFL	Multiple-Site Exchange in Solid State NMR of Quadrupolar Nuclei
Tang, P.	U. of Pittsburgh	NIH	Transmembrane Domains of Neuronal Cys-Loop Receptors
Thelwall, P. Blackband, S.J. Shephard, T. Stanisz, G.	UF UF UF U. of Toronto	NIH	NMR Studies of Red Blood Cell Ghosts
Thirumoorthy, R. Walkenhorst, W.F. Edison, A.S.	UF Loyola U. UF	NHMFL	Structural and Thermodynamic Studies of an Engineered Fragment of Ovomucoid
Tian, C. Sanders, C.	Vanderbilt U. Vanderbilt U.	NIH	Alignment and ^{15}N Spectroscopy of DAGK
VanderHart, D.L. Alamo, R.G.	NIST, Polymer Division FAMU-FSU College of Engineering/NHMFL	NIST	Proton NMR Study of Room Temperature Aging in Isotactic Poly(propylene) and Ethylen 1-Octene Copolymers
Walton, W.J. Logan, T.M. Rocca, J. Edison, A.S.	FSU FSU/NHMFL UF UF	FSU	Structural Studies of Recombinant Thy1 Glycoprotein
Wu, G. Wong, A. Gan, Z.	Queen's U. Queen's U. FSU/NHMFL	IHRP	Solid-state ^{39}K NMR spectroscopy at 19.6 T
Zheng, J.P.	FAMU		Study of Li-Rechargeable Batteries by STRAFI

Number of NMR Spectroscopy and Imaging Projects: 93

USERS & PROJECTS: FOURIER TRANSFORM ICR MASS SPECTROMETRY FACILITY

Users: ICR	Institutions	Funding	Projects
Abbatiello, S. Richards, N.	UF	NSF	ESI of Asparagine Synthase
Allmaier, G.	Vienna U. of Technology	NSF	Small Molecule MALDI FT-ICR MS
Bakhtiar, R.	Merck Research Labs	NSF	Complimentary ECD of Scorpion Venom
Becker, C.	Surromed Pharmaceuticals	NSF	Accurate Mass of Complex Mixtures
Bell, A. Boismenu, D. Mamer, O.	McGill U, Montreal, Que.	NSF	ESI of Complex ER Digest
Beu, S.	Beu Consulting, Inc.	NSF	FT-ICR Instrument Design
Briscoe, C.	MDS Pharma	NSF	ESI of Pharmaceutical Contaminates
Burton, R. Johnson, R. Shen, J.	Abbott Pharmaceutical	NSF	ECD of Phosphoproteins
Cardasis, H.	UF	NSF	ESI of a Combinatorial Library
Chin, H.-T.	Fred Hutchinson Cancer Institute	NSF	FT-ICR MS of Protein X-Linking
Colman, A.	EPRI	NSF	Analysis of Complex Mixtures
Conrad, C.	M.D. Anderson Cancer Center	NSF	Cytokines Associated with Gliablastoma Brain Tumors
Cooper, B. Riegner, C. Stenson, A.	FSU	NSF	ESI of Humic Substances
Cox, H.	Cal-Tech	NSF	Ion Molecule Rxns with Phosphate Groups
Creek, J.	Chevron/Texaco	NSF	ESI of Complex Mixtures
Cross, T.	FSU	NSF	Peptide Sequence Analysis
Dahlal, N.	FSU	NSF	ESI of FE Complexes
Davidson, M. Griffin, J.	NHMFL	NSF	Cell Culture at High Magnetic Field
Davidsson, P. Paulsson, L.	U. of Göteborg, Sweden	NSF	Identification of Glycosylated Peptides From 2D gels
DeGrange, J. Nichols, L.	Savanna River Site	NSF	Construction of Micro-ESI Emitters
DeSouza, L. Hudgins, R. Siu, M.	York U., Canada	NSF	ESI of PCM11 Cancer Protein
Eyler, J. Zientek, K.	UF	NSF	Instrumentation Development
Freitas, M.	Ohio State U.	NSF	H/D Exchange of Peptide/Protein
Freund, F.	NASA-Ames	NSF	ESI of Complex Mixtures
Gaffney, B.	FSU	NSF	ESI of Labeled Proteins

Users: ICR	Institutions	Funding	Projects
Gaskill, S.	UMIST, U.K.	NSF	Localization of Phosphorylation of Protein Kinase C
Goli, O. Hendricks, H.	FSU	NSF	Peptide Lab, Verification of Peptide Structure
Gon, L.		NSF	
Grannas, A.	Ohio State U.	NSF	Black Carbon Analysis
Greenbaum, N.	FSU	NSF	FT-ICR of RNA
Gustafsson, E.	U. of Göteborg, Sweden	NSF	LC Micro-ESI FT-ICR
Hakansson, K. Kyong, H.	U. of Michigan	NSF	HDX of Melittin and Pars Protein with ECD
Hammami, A.	Oilphase DBR, Canada	NSF	High Resolution Analysis of Complex Mixtures
Hare, J.	FSU	NSF	Magnetic Assisted Transformation, Gliablastoma and Microglia
Hatcher, P. Kim, S.	Ohio State U.	NSF	ESI of Humics
Johansson, T. Krengal, U.	Chalmers U. of Technology, Sweden	NSF	HDX of Transhydrogenase Protein
Kainov, G. Lisal, J. Tuma, R.	U. of Helsinki, Finland	NSF	HDX of Protein Complexes
Kelleher, N. Patrie, S.	U. of Illinois	NSF	Construction of High Performance ESI 9.4 T FT-ICR
Keller, T. Olenych, S.	FSU	NSF	Biomarker for Smitin
Kempf, V. Liu, Y.	Duke U.	NSF	ESI of Melanins
Khitrov, G.	U. of California, Santa Barbara	NSF	ESI of CdSe Nanocrystals
Kim, D.-L. So, H.-Y. Yim, Y.H.	Korean Basic Science Institute	NSF	FT-ICR Instrumentation Construction
Kolli, K. Orlando, R. Xie, M.	U. of Georgia	NSF	ECD of o-Glycoproteins
Kujawinski, E.	Barnard College	NSF	Photochemistry of Humic Acids
Land, M. Manning, T.	Valdosta U.	NSF	ESI of Complex Mixtures
Langridge-Smith, P.	U. of Edinburgh, Scotland	NSF	Metal Complexes
Lanham, J.	U. of Alabama, Birmingham	NSF	H/D Exchange of HIV Capsid Protein
LeClaire, L. Vanderlinde, O.	FSU	NSF	ESI of Worm Spermatocytes
Levin, V. Parikh, N.	M.D. Anderson Cancer Center	NSF	ESI of Endogenous SRC Protein from Cancer Cells
Li, H. Xu, F.	FSU	NSF	Verification of Protein RNA Complex
Lifshitz, C.	Hebrew U., Jerusalem	NSF	Gas Phase HDX
Lin, S.-K. Nakamoto, R.	U. of Virginia	NSF	HDX of F1-ATPase
Linden, B.	Linden CMS	NSF	FD-FT-ICR MS Development

Users: ICR	Institutions	Funding	Projects
Lion, N.	LEPA, Switzerland	NSF	HDX on Microchip FT-ICR MS
Liu, T.J.	M.D. Anderson Cancer Center	NSF	PTM Studies of P53 Protein
Logan, T.	FSU	NSF	Di-Sulfide Bonding and Verification of Peptide Sequence
Macara, I.	U. of Virginia	NSF	MS/MS of Phosphorylated Peptides
Margalos, B.		NSF	
Marin, V.	FSU	NSF	HDX of FKBP Protein
Markley, J.	U. of Wisconsin	NSF	ESI of Glycoprotein
Marzluff, W. Thapar, R.	U. of North Carolina	NSF	ESI of Phosphorylated RNA Binding Proteins
Mehndiratta, P.	FSU	NSF	Glycosylation of Thy1 Protein
Milligan, L.	FSU	NSF	ESI of Photolized Ligands
Mischak, H.	Medizinische Hochschule, Germany	NSF	Localization of Phosphorylation of Protein Kinase C
Moffet, F.	Syngenta Pharm, U.K.	NSF	FT-ICR MS of Large Membrane Proteins
Moore, D.	FELIX, Netherlands	NSF	MIDAS
Mullins, O.	Schlumberger-Dol	NSF	High Resolution Analysis of Complex Mixtures
Novak, J.	U. of Alabama, Birmingham	NSF	ESI of Glycosylated Antibody Peptides
Nilsson, C.	U. of Göteborg, Sweden	NSF	MS/MS of Glycosylated Peptides
O'Conner, P.	Boston U. Medical School	NSF	MIDAS
Oliva, J.M.	U. of Bristol, U.K.	NSF	Principals of FT-ICR MS
Omichinski, J.G.	U. of Georgia	NSF	ESI of Phosphoproteins
Oswald, C.	Chalmers U. of Technology, Sweden	NSF	HDX of Isotopically Depleted Transhydrogenase Protein
Peterson, D.	U. of California, Berkley	NSF	Construction of Monolith Micro-ESI Emitters
Pinto, D.	NRC, Institute of Marine Sciences, Canada	NSF	ESI of Toxins
Powell, D.	UF	NSF	High Sensitivity FT-ICR MS
Prevelidge, P.	U. of Alabama, Birmingham	NSF	H/D Exchange of HIV Capsid Protein
Qian, K.	Exxon/Mobil Inc.	NSF	ESI of Crude Oil
Roberts, T.	FSU	NSF	Biomarker for P48 from Sperm
Sang, A.	FSU	NSF	Enzyme Characterization by ESI & H/D Exchange
Schaifer, M.	U. of Cologne, Germany	NSF	Dissociation of Gas Phase Non-Covalent Complexes
Scott, R.	U. of Georgia	NSF	Photo-Induced DNA X-Linking
Seavy, M.	FSU	NSF	MALDI of Proteins
Sihlbom, C.	U. of Göteborg, Sweden	NSF	Identification of CSF Glycosylated Peptides from 2D Gels
Smithu, S.	FSU	NSF	ESI of DTXR

Users: ICR	Institutions	Funding	Projects
Svek, F.	U. of California, Berkley	NSF	CEC on a Chip
Tolocka, M.	U. of Delaware	NSF	Accurate Mass of Oligomers
Trundle, F. Vine, W.	Oxford Instruments, U.K FSU	NSF NSF	Construction of an ICR Magnet MALDI of Glycosylated Proteins
Volmer, D.	NRC, Institute of Marine Sciences, Canada	NSF	ESI of Toxins
Walton, W.	FSU	NSF	MALDI of Glycosylated Proteins
Zhang, L.	Ohio State U.	NSF	ECD of Histones

Number of ICR Projects: 84

USERS AND PROJECTS: ELECTRON MAGNETIC RESONANCE FACILITIES

Users: EMR	Institutions	Funding	Projects
Angerhofer, A. Walker. L. Van Tol, J.	NHMFL, U. of Florida U. of Florida NHMFL	NHMFL	High Field ENDOR of Chlorophyl and Pheophytin Anions
Angerhofer, A. Ozarowski, A. Richards, N. Schweiger, A. Van Tol, J.	UF NHMFL UF ETH, Zurich, Switzerland NHMFL	NHMFL	High Field EPR on Oxalate Decarboxylase and Model Systems
Arata, T. Sugata, K. Song, L. Fajer, P.	Osaka U., Japan FSU-Biology FSU-NHMFL	NSF, MDA	Conformational Changes in Kinesin – DEER Studies
Arcon, D. Lappas, A. Zorko, A.	Inst. Jozef Stefan, Slovenia IESL – FORTH Inst. Jozef Stefan, Slovenia	SLO-US CLG	High-Field ESR Study of One and Two-Dimensional Cu-Based Spin-Gap Systems
Ardavan, A. Austwick, M. Morley, G. Briggs, G.A.D. Van Tol, J. Brunel, L.C.	U. of Oxford, UK U. of Oxford, UK U. of Oxford, UK U. of Oxford, UK NHMFL NHMFL	UK Department of Trade and Industry, NHMFL	EMR of Endohedral Fullerenes and Derivatives
Brooks, J. Oshima, Y. Jobiliong, E. Kobayashi, H. Kobayashi, A. Tanaka, H.	NHMFL NHMFL FSU Inst. for Molecular Science, Japan U. of Tokyo, Japan Natl. Inst. of Advanced Science and Technology, Japan	NHMFL	X-Band EMR Measurements of the Two Dimensional Organic Conductor λ-$(BETS)_2Fe_{0.6}Ga_{0.4}Cl_4$
Brown, L. Rouviere, C. Song, L. Fajer, P.	UNSW, Sydney, Australia FSU-Biology FSU–Biology FSU-NHMFL	AHA, NSF	Interactions Between Troponin Subunits
Brunel, L.C. Van Tol, J. Bortolus, M.	NHMFL NHMFL NHMFL	NHMFL	Multifrequency EPR/ENDOR Investigation of Phosphor-Doped Silicon
Budil, D. Van Tol, J. Brunel, L.C.	Northeastern U. NHMFL NHMFL	NSF	Development of High-Field EPR Instrumentation for Aqueous Biological Samples
Budil, D. Van Tol, J.	Northeastern U. NHMFL	NSF	High Field Electron Magnetic Resonance Spin-Label Studies of Protein Dynamics in Ordered Systems
Cremo, C. Liang, H. Song, L. Fajer, P.	U. Nevada, Reno FSU-Biology FSU–Biology FSU-NHMFL	AHA, NSF	Activation of Smooth Muscle Myosin

Users: EMR	Institutions	Funding	Projects
Dalal, N. Ramsey, C. Cotton, F.A. North, M.	FSU FSU Texas A&M U. FSU	NSF	EPR Investigation of a Trinuclear Cobalt Cluster: $Co_3(depa)_3Cl_3$
Dalal, N. Stowe, A. Van Tol, J.	FSU FSU NHMFL	FSU, NHMFL	Exchange Coupled Transition Ion Clusters Studied by HF EPR
Dalal, N. Nellutla, S. Stowe, A.	FSU FSU NHMFL/FSU	FSU	EPR of High Spin Fe3+ Clusters
Dalal, N.S. Ramsey, C.	FSU FSU	FSU, NHMFL	Direct Measurement of Relaxation Times in Hydrated Cr(V)-peroxo Complexes Using Pulsed EPR
Eichel, R Dinse, K.P. Hoffmann, M. Kungl, H. Lupascu, D. Mestric, H. Roedel, J.	Darmstadt Technical U., Germany Darmstadt Technical U., Germany U. of Karlruhe, Germany U. of Karlruhe, Germany Darmstadt Technical U., Germany Darmstadt Technical U., Germany Darmstadt Technical U., Germany	NHMFL	High-Field EPR of Copper- and Iron Doped Ferroelectric Ceramics
Goldberg, D.P. Telser, J. Krzystek, J.	Johns Hopkins U. Roosevelt U. NHMFL	NIH/NSF	EPR Investigation of Corrolazines
Henning, P. Van Tol, J.	Foster-Miller, Inc. NHMFL	Foster Miller, Inc.	Detection of Ferrous Molecules in Tissue
Hoffman, B.M. Telser, J. Smoukov, S. Bernat, B.A. Armstrong, R.N. Krzystek, J. Brunel, L.C.	Northwestern U. Roosevelt U. Northwestern U. Vanderbilt U. Vanderbilt U. NHMFL NHMFL	NSF	High Frequency and Field EPR Spectroscopy of a Mononuclear Manganese(II) Enzyme, FosA, Involved in Bacterial Drug Resistance
Hoffman, B.M. Telser, J. Nocek, J. Krzystek, J.	Northwestern U. Roosevelt U. Northwestern U. NHMFL	NIH	High-Frequency and -Field EPR (HFEPR) Spectroscopy of a Manganoglobin: Mn(III) Substituted Hemoglobin
Kispert, L. Konovalova, T. Gao, J. Lawrence, J.	U. Alabama U. Alabama U. Alabama U. Alabama	DOE	HF EPR (95-287 GHz) and 9 GHz ESEEM/ENDOR Measurements of Carotenoid Radical Cations in Bacterial Reaction Center and within MCM-41 Molecular Sieves
Kispert, L. Konovalova, T. Van Tol, J.	U. Alabama U. Alabama NHMFL	DOE	Multifrequency EPR Studies of MCM-41 Molecular Sieves with Incorporated Metal Ions and Metalloproteins

Users: EMR	Institutions	Funding	Projects
Klonkowski, A. M. Lis, S. Szyczewski, A. Krzystek, J.	Gdansk U., Poland A. Mickiewicz U., Poland A. Mickiewicz U., Poland NHMFL	NHMFL	The "Antenna Effect" in Lanthanide Cryptates as Investigated by Multifrequency EPR
Kono, J. Brunel, L.C. Si, Q. Smalley, R. Van Tol, J. Zaric, S.	Rice U. NHMFL Rice U. Rice U. NHMFL Rice U.	The Robert A. Welch Foundation	Electron Spin Resonance in Single-Walled Carbon Nanotubes
Krzystek, J. Telser, J.	NHMFL Roosevelt U.	NHMFL	High Frequency and Field EPR Spectroscopy of Mn(III) Complexes in Frozen Solutions
Krzystek, J. Hung, C.H.	Changhua U., Taiwan Changhua U., Taiwan	NHMFL	Properties of N-Confused Porphyrins Metallated with Mn(III) and Fe(II)
Larion, M. Fajer, P.	FSU-Chemistry FSU-NHMFL	AHA, NSF	Librational Motion of Labels at W-Band
Lenahan, P. Brunel, LC. Van Tol, J.	Pennsylvania State U. NHMFL NHMFL	NSF	High Field Spin Dependent Recombination Study for Quantum Computation
Logan, T. Kisen, I. Fajer, P.	FSU-Chemistry FSU-MOB FSU-Biology/NHMFL	MDA	Metal Homeostasis in AntR and DNA-Protein Interactions
Logan, T. Fajer, P. Sen, K.I. Krzystek, J.	FSU FSU FSU NHMFL	NIH/NHMFL/PEG	Metal Binding in the Diphteria Toxin Resistance (DTxR) Protein
Malnasi-Czismadia, A. Bagshaw, C. Song, L. Fajer, P.	Lorant U., Budapest Leicester U., UK FSU-Biology FSU-NHMFL	NSF, MDA, Wellcome Trust, European Community	Myosin Cleft Closure as a Mechanism of Force Generation
Maniero, A.L. Van Tol, J. Brunel, L.C. Bortolus, M.	U. of Padova NHMFL NHMFL U. of Padova	NHMFL, CNR Italy	High-Field Transient EPR of Bisadducts of Fullerene C60
Maniero, A. Brustolon, M. Zoleo, A. Brunel, L.C.	U. Padova, Italy U. Padova, Italy U. Padova, Italy NHMFL	NHMFL, CNR, Italy	High Field EMR Studies of C60 Derivative Anions
Meisel, M. Feher, A. Orendac, M. Park, Ju-Hyun	UF P.J. Safarik U., Slovakia P.J. Safarik U., Slovakia UF	NSF	Single Ion Bound States
Misra, S. Brunel, L.C. Van Tol, J.	Concordia U. Montreal NHMFL NHMFL	NHMFL	Variable Frequency Study of Powder and Single Crystals Containing Transition Metal Ions
Nojiri, H.	Okayama U. Japan	Okayama	High Frequency ESR Research on Single Molecular Magnets

Users: EMR	Institutions	Funding	Projects
Ozarowski. A. Jezierska, J. Vassilyeva, O. Brunel, L.C.	NHMFL Wroclaw U., Poland Taras Shevchenko U. Ukraine NHMFL	NHMFL	Studies on the Exchange Interactions and Zero-Field Splitting in Dimeric and Tetrameric Copper(II) Complexes of Diethanolamine
Redding, K. Gu, F. Van Tol, J.	U. of Alabama U. of Alabama NHMFL	DOE	The Cofactor Branches of Photosystem I
Reyerse, E. Van Tol, J. Brunel, L.C.	Nijmegen NHMFL NHMFL	NHMFL	Study of Specific and Non-Specific Protein-Metal Binding by HF-EPR
Sevilla, M. Van Tol, J.	Oakland U. NHMFL	NIH	EMR of DNA Sugar Phosphate Radicals
Sienkiewicz, A. Bohle, D.S. Forro, L. Krzystek, J.	Polish Academy of Sciences McGill U., Montreal, Canada Ecole Polytech., Lausanne, Switzerland NHMFL	Swiss Natl. Science Foundation	High-Field ESR Study of Iron Centers in Malarial Pigments
Smirnov, A. van Tol, J.	North Carolina State U. NHMFL	NSF	Nanostructure of Fiberoptic Materials by Advanced EPR Techniques
Smirnov, A. Van Tol, J.	North Carolina State U. NHMFL	NSF	HF EPR of Spin Labels of lipid membranes in nanopore structures
Smirnova, T. Van Tol, J.	North Carolina State U. NHMFL	NIH	New Gd3+-Containing Spin-Labels for Multifrequency EPR Protein and Membrane Studies
Stavreva, T Fajer, P.	FSU-Biophysics FSU-NHMFL	AHA, NSF	Molecular Motion by Saturation Recovery and 2D-ELDOR
Stern, R. Zvyagin, S.A. Krzystek J.	Estonian Acad. Sci. NHMFL NHMFL	NHMFL	ESR Studies of the Spin-Gap Dimer System $BaCuSi_2O_6$ – Search for New Quantum Transitions
Telser, J. Krzystek, J. Brunel, L.C.	Roosevelt U. NHMFL NHMFL	NHMFL	High-Frequency and -Field EPR Spectroscopy of Tris(2,4-pentane-dionato) manganese(III): Investigation of Solid-State vs. Solution Jahn-Teller Effects
Telser, J. Baran, P. Raptis, R. Brunel, L.C. Krzystek, J.	Roosevelt U. U. of Puerto Rico U. of Puerto Rico NHMFL NHMFL	Roosevelt U.	High-Field EMR of Biologically Relevant First and Second Row Transition Metal Complexes
Van Tol, J. Angerhofer, A. Brunel, L.C.	NHMFL UF NHMFL	NSF	The Lowest Excited Triplet State in Porphyrins Studied by High Field Transient EMR

Users: EMR	Institutions	Funding	Projects
Van Tol, J. Berger, A. Prieto, P. Campillo, G.	NHMFL IBM U. del Valle, Columbia U. del Valle, Columbia	NHMFL	Substrate Dependence of Characteristics of Thin Films of $La_{1-x}Ca_xMnO_3$ on Different Substrates Measured by High-Field EPR
Ziegler, C. Krzystek, J.	Akron U. NHMFL	NSF	N-Confused Porphyrins Containing Mn(III): Influence of Unusual Ring Structure on Spectroscopic Properties
Zoleo, A. Maniero, A. Sala, F.D. Brustolon, M. Lippe, G. Pinato, L.	U. of Padova, Italy U. of Padova, Italy U. of Padova, Italy U. of Padova, Italy U. of Udine, Italy U. of Padova, Italy	NHMFL, CNR, Italy	HF-EMR Studies of Mn-Nucleotides and Mn-F1ATPase Complexes
Zorko, A. Arcon, D. Mihailovic, D. Van Tol, J.	Inst. Josef Stefan, Slovenia Inst. Josef Stefan, Slovenia Inst. Josef Stefan, Slovenia NHMFL	SLO-US CLG	High-Field ESR Study of Li-Doped MoS_2 Nanotubes
Zvanut, M. Konovalov, V. Van Tol, J.	U. of Alabama U. of Alabama NHMFL	U.S. Office of Naval Research	240 GHz EPR Studies of Intrinsic Defects in As-Grown ^4H SiC
Zvyagin, S. Landee, C.P. Turnbull, M.M. Galeriu, C. Brunel, L.C. Van Tol, J	NHMFL Clark U. Clark U. Clark U. NHMFL NHMFL	NHMFL/NSF	High-Frequency ESR in the $(5AIP)_2CuBr_4{\cdot}H_2O$ Spin Ladder

Number of EMR Projects: 55

USERS AND PROJECTS: GEOCHEMISTRY FACILITIES

Users: Geochemistry	Institutions	Funding	Projects
Chanton, J.	FSU		Carbon Isotopic Composition of Dissolved Organic Carbon in Coastal Wetlands
Gu, B.	South Florida Water Management District	South Florida Water Management District	Carbon Isotopic Composition of DOC, POC, Soils and Plants in the Everglades
Hickey, R.	Florida International U.	NSF	Isotopic Investigation of Island-Arc Basalts
Landing, W.M.	FSU		Trace Elements in Atmospheric Dust
Landing, W.M.	FSU	NSF	Fe by Isotope Dilution ICP-MS
Marcantonio, F.	Louisiana State U.	Louisiana State U.	Sr-Isotopes in Salt-Marshes
Odom, A.L. Salters, V. Landing, W.M.	NHMFL/FSU NHMFL FSU	EPA	Constraining the Sources and Cycling of Mercury Through Use of Natural Variations in Mercury Isotopic Composition
Salters, V.	NHMFL		Interfacing CE with ICP-MS
Salters, V. Dick, H.	NHMFL Woods Hole Oceanographic Institute	NSF	Determining the Mineralogy of the Source of Mid-Ocean Ridge Basalts Through Nd-Isotopes in Abyssal Peridotites
Salters, V. Dick, H.	NHMFL Woods Hole Oceanographic Institute	NSF	The Isotopic Compositions of Basalts Along the Southwest Indian Ridge
Salters, V. Blichert-Toft, J. Patchett, P.J.	NHMFL ENS-Lyon U. of Arizona	NSF	The Composition of Bulk Earth Inferred from Primitive Chondrites
Salters, V. Longhi, J.	NHMFL Lamont-Doherty Earth Observatory, Columbia U.	NSF	Trace Element Partitioning and Phase Equilibria at P,T and X Relevant to Mid-Ocean Ridge Basalt Genesis
Salters, V.	NHMFL	NSF	Constraints on the Origin of Mantle Endmembers Through Hf-Isotope Analyses on Ocean Island Basalts
Salters, V. Landing, W. Cooper, W.	NHMFL FSU FSU/NHMFL	FSU/PEG	The Speciation of REE with Humic and Fulvic Acid
Sen, G.	Florida International U.	NSF	Isotopic Investigations of Hawaiian Xenoliths
Wang, Y.	NHMFL/FSU	NSF	Tracing the Source of Phosphorus Using Oxygen Isotopic Ratios

Users: Geochemistry	Institutions	Funding	Projects
Wang, Y.	NHMFL/FSU	NSF	Isotopic Evidence for Late Cenozoic Ecosystem and Climate Changes in Southwest China
Wang, Y.	NHMFL/FSU		Coastal Wetland Formation and Its Significance to Carbon Sequestration

Number of Geochemistry Projects: 18

APPENDIX B: SEMINARS AT THE NHMFL IN TALLAHASSEE

1/6/2003
A. Godeke
Applied Superconductivity Center, University of Wisconsin, Madison
The Critical Surface of Nb_3Sn Conductors: Can We Extend Our Understanding Beyond Empirical Relations?

1/9/2003
Prof. Ross McKenzie
University of Queensland, Australia
Superconductivity Mediated by Charge Fluctuations in Layered Molecular Crystals

1/10/2003
Dr. Igor Herbut
Simon Fraser University
Theory of Fluctuating D-Wave Superconductors: QED3 and Beyond

1/13/2003
Jingping Chen
NHMFL-FSU, Magnet Science & Technology
Nb_3Sn Strands and Strengthening Mechanisms

1/14/2003
Dr. Alexei Souslov
University of Wisconsin, Milwaukee
H-T Phase Diagram of the Metamagnetic Transition in URu_2Si_2

1/16/2003
Dr. Luis Balicas
NHMFL-FSU, Instrumentation & Operations
Interplay Between Superconductivity and Magnetism in Low Dimensional Strongly Correlated Electron Systems

1/17/2003
Dr. Stuart Wolf
Defense Advanced Research Projects Agency (DARPA)
A New Spin on Electronics - Spintronics

1/24/2003
Prof. A. J. Leggett
University of Illinois, Urbana Champaign
Cuprate Superconductivity without a "Model"

1/27/2003
Dr. Greg Boebinger
NHMFL-LANL
The Abnormal Normal State of the High-Tc Superconductors...or Undressing Electrons with Nearly a Million Gauss

1/28/2003
Dr. Dmitri Smirnov
Laboratoire National des Champs Magnetiques Pulses
Intersubband Magnetophonon Resonance in Quantum Cascade Lasers

1/30/2003
Dr. Sergei Zvyagin
NHMFL-FSU, Instrumentation & Operations
Quantum Phenomena and Spin Dynamics in Low-Dimensional Spin Systems: High-Field Sub-Millimeter Wave ESR Spectroscopy

1/31/2003
Dr. Alexei Abriskosov
Argonne National Laboratory
Theory of High-Tc Superconducting Layered Cuprates

1/31/2003
Mr. Marcelino Bernardo
Exxon Research and Engineering, Corp.
Design and Application of a Versatile Pulsed Electron-Nuclear Magnetic Resonance Spectrometer

2/7/2003
Prof. Ivan Schuller
University of California, San Diego
Nanostructures and the Proximity Effect

2/11/2003
Dr. Tae Hee Kim
Massachusetts Institute of Technology
Spin Polarized Tunneling Study in Transition Metal Ferromagnet

2/13/2003
Dr. Andrea Bianchi
Los Alamos National Laboratory
Pauli Limiting as the Origin of a Field Induced First-Order Superconducting Phase Transition in the Heavy Fermion $CeCoIn_5$

2/14/2003
Prof. Clare Yu
University of California, Irvine
Probing the Glass Transition

2/21/2003
Prof. Ravindra Bhatt
Princeton University
Ferromagnetism in Highly Disordered, Low Carrier Density Electron Systems

2/28/2003
Prof. Premala Chandra
NEC Research Institute
From Roman Vases to Novel Memories and Beyond: Thoughts on the Glass Transition

3/3/2003
Dr. Jong H. Baik
University of Central Florida
Analysis of Loss Mechanisms in G-M Type Pulse Tube Refrigerator

3/7/2003
Dr. Saikat V. Saha
University of Alabama at Huntsville
Computational Electromagnetics and Its Application to Plasmas and the Human Body

3/11/2003
Eduard Chekmenev
University of Louisville
^{13}Ca ^{15}N Glycyl Chemical Shielding and Theoretical Aspects of ^{17}O Electric Field Gradient in the Solid State

3/14/2003
Prof. Subir Sachdev
Yale University
Order and Quantum Phase Transitions in the Cuprate Superconductors

3/21/2003
Prof. Theodore G. Castner
University of Massachusetts, Lowell
I. Microwave Properties of Barely Metallic Si:As. II. A Simple Theoretical Approach for the Metal-Insulator Transition in Doped Semiconductors

3/21/2003
Dr. Toshitaka Idehara
Fukui University
Development and Applications of Submillimeter Wave Gyrotron FU Series

3/21/2003
Dr. Greg Khitrov
University of California, Berkeley
Analyzing Materials by Mass Spectrometry: Probing Clusters to Nanomaterials

3/28/2003
Dr. Bill Moulton & Mike Hoch
NHMFL-FSU, Condensed Matter Science Program; Solid State NMR
Magnetic Phase Separation and Spin Dynamics in $La_{1-x}Sr_xCoO_3$ for $x=0.1$ to 0.5

4/1/2003
Dr. Luca Bottura
CERN
CERN LHC Superconducting Magnets: Overview and Status Report

4/2/2003
Dr. Yuntian Theodore Zhu
Los Alamos National Laboratory
Nanostructured Materials by Severe Plastic Deformation

4/4/2003
Dr. Jeff Gee
Scripps Institute of Oceanography
Variation of Geo-magnetism Over Time

4/4/2003
Prof. Robert Joynt
University of Wisconsin, Madison
Quantum Computing Using Spins in Silicon

4/14/2003
George Martins
NHMFL-FSU, Electron Magnet Resonance Program
Computational Physics: Research Proposals in Strongly Correlated Systems and Modeling of EPR Measurements in Proteins

4/18/2003
Prof. Norman O. Birge
Michigan State University
Electron Dephasing and Energy Exchange in Mesoscopic Metal Wires

4/21/2003
Dr. Ryan Julian
California Institute of Technology
Tales of Molecular Recognition in Non-Covalent Complexes

4/25/2003
Prof. Leonid Glazman
University of Minnesota
Transport in a Luttinger Liquid

4/28/2003
Dr. Sunghwan Kim
Ohio State University
Structure and Reactivity of Dissolved Organic Matter as Determined by Ultra-High Resolution Electrospray Ionization Mass Spectrometry

5/15/2003
Dr. Marcel Ausloos
University of Liege, Belgium
Do So-Called Imperfect CMR Samples Tell Us Something at All of Interest?

5/30/2003
Jun Kono
Rice University
Cyclotron Resonance and Ultrafast Optics in InMnAs Dilute Magnetic Semiconductors

6/3/2003
Prof. Sandro Sorella
Trieste, Italy
Phase Diagram of the J1-J2 Frustrated Heisenberg Model Using Variational Techniques

6/9/2003
Dr. Michael Tomsic
Hypertech Research Inc.
Latest Progress with Making MgB_2 Wires

6/16/2003
Philippe Vanderbemden
University of Liege, Belgium
Magnetic Properties of Bulk High Temperature Superconductors for Rotating Machine Applications

6/20/2003
Dr. Guo-Qing Zheng
Osaka University
Spin Correlation and Superconductivity in Electron-Doped Cuprate and Cobaltate Superconductors

6/27/2003
Dr. Roman Movshovich
Los Alamos National Laboratory
Pauli Limiting, First Order Superconducting Phase Transition and Fulde-Ferrell-Larkin-Ovchinnikov Superconducting State in $CeCoIn_5$

6/30/2003
Frederic Trillaud
NHMFL-FSU, Magnet Science & Technology
Normal Zone Initiation and Propagation in YbaCuO Coated Conductors

7/14/2003
Dr. David O'hara
Parralax Research Inc.
Applications of X-Ray Optics at Parallax Research Inc.: A Local Small Business Success Story

7/30/2003
Dr. Rafael Bruschweiler
Clark University
Protein Dynamics Studied by NMR Spectroscopy

8/19/2003
Dr. Klaus Schmidt-Rohr
Iowa State University
Investigations of Natural Organic Matter and of Polymer Materials by Advanced Solid-State NMR

8/22/2003
Dr. Fanyu Meng
University of Illinois at Urbana-Champaign
Direct Analysis of Intact Proteins from Microorganisms Using Top Down Mass Spectrometry

9/12/2003
Henri Radovan
NHMFL-FSU, Instrumentation & Operations
Superconductivity Magnetically Enhanced by Spin Domains: The FFLO State

9/19/2003
Dr. Mei Zhu
Washington University
Determination of Protein-Ligand Interactions Using H/D Exchange, LC/MS and LC/MS/MS

9/19/2003
Prof. Sang Wook Cheong
Rutgers University
Preformed, Nanoscale Ferromagnetism in Manganites

9/24/2003
Prof. Mei Hong
Iowa State University
Solid State NMR Investigations of the Conformation & Dynamics

9/26/2003
Prof. Andrew Berkley
University of Maryland
Quantum Computation with Superconducting Devices

9/29/2003
Dr. Yoshifumi Tanimoto
Institute for Molecular Science
Magnet Control of Chemical and Physical Processes

10/3/2003
Prof. Mike Lilly
Sandia National Laboratory
"Metallic" Behavior of Dilute 2D Electron Systems

10/6/2003
Baozhi Cui
NHMFL-FSU, Magnet Science & Technology
Nanostructure and Magnetic Properties of Exchange-Coupled $Nd_2Fe_{14}B/a$-Fe-Type Nanocomposite Magnets

10/10/2003
Dr. Akakii Melikidze
NHMFL-FSU, Condensed Matter Science Program
Parity Effects in Spin Decoherence

10/13/2003
Prof. Alex Smirnov
North Carolina State University
Nanopore-Confined Lipids: A New Type of Substrate-Supported Bilayers

10/14/2003
Prof. Tomasz Dietl
Polish Academy of Sciences
Manipulation with Spin Ordering in Ferromagnetic Semiconductors

10/17/2003
Prof. Rui Du
University of Utah
Microwave-Induced Zero-Resistance States in Two-Dimensional Electron Systems - Findings and Issues

10/24/2003
Dr. Meigan Aronson
University of Michigan
Magnetic Correlations Near Quantum Critical Points

10/27/2003
Prof. Michael Loewnhaupt
Institut fuer Festkoerperphysik - Dresden, Germany
New Magnetic Phenomena in High Fields Studied by Neutron Scattering and Lab Methods

10/31/2003
Prof. Arnold Dahm
Case Western Reserve University
Quantum Computing with Bits Made of Electrons on a Helium Surface

11/6/2003
Dr. Richard Knochenmuss
Novartis (Basel, Switzerland)
Ionization Mechanisms in UV-MALDI

11/7/2003
Prof. Richard Scalettar
University of California, Davis
Dynamical Mean Field Theory of the Cerium Volume Collapse Transition

11/12/2003
Dr. Brian Connell
California Institute of Technology
(I) The Total Synthesis of (+)-Roxaticin. (II) A Triple Bond Wittig Reaction: Conversion of Acid Chlorides and Nitriles to Alkynes

11/20/2003
Dr. Jan van Bentum
University of Nijmegen
Options for High Resolution NMR in Bitter and Hybrid Magnets

11/20/2003
Dr. Armen Zakarian
University of California, Irvine
Progress Toward the Total Synthesis of Ouabain and Guanacastepene A and the Total Synthesis of Hemibrevetoxin B

11/24/2003
Dr. Sunil Saxena
University of Pittsburgh
Spectroscopic Ruler and Protein Dynamics

12/2/2003
Dr. Jed Hubbs
Harvard University
Targets and Methods in Polyketide Synthesis

12/23/2003
Dr. Swastik Kar
Indian Institute of Science, Bangalore & Universitaet Karlsruhe, Germany
Spectral analysis of Resistance Fluctuations in doped Silicon near the Mott-Anderson Transition

APPENDIX C: KEY PERSONNEL & COMMITTEES, as of 12/31/03

National High Magnetic Field Laboratory
Florida State University
1800 E. Paul Dirac Dr.
Tallahassee, FL 32310
http://www.magnet.fsu.edu
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Fax: 850-644-9462

NHMFL KEY PERSONNEL

Principal Investigator
Jack E. Crow, Director

Co-Principal Investigators
Greg Boebinger, LANL
Alan Marshall, FSU
J. Robert Schrieffer, Chief Scientist
Neil Sullivan, UF

Deputy Director for Management & Administration
Brian Fairhurst

Chief Technology Officer
Hans Schneider-Muntau

Continuous Field Facilities User Programs
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Bruce Brandt
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lacerda@lanl.gov

LANL Pulsed Field Facilities User Program
Chuck Mielke
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Fax: 505-665-4311

Ultra-High B/T Facility
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www.phys.ufl.edu/~mkelvin/
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jsxia@phys.ufl.edu

NHMFL Key Personnel
continued

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Tim Cross (NMR)
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Alan Marshall (ICR)
Phone: 850-644-0529
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Advanced Magnetic Resonance Imaging/Spectroscopy Facilities
Gainesville, FL
www.mbi.ufl.edu/
csbnmr.health.ufl.edu/

Art Edison
Phone: 352-392-4535
Fax: 352-392-3422
art@mbi.ufl.edu

Geochemistry
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www.magnet.fsu.edu/science/geochemistry/
Vincent Salters
Phone: 850-644-1934
Fax: 850-644-0827
salters@magnet.fsu.edu

NHMFL Committees

Institutional Oversight Committee

The NHMFL Director is accountable to the Institutional Oversight Committee for meeting program objectives and all appropriate federal and state rules and regulations. The committee consists of the top leadership of the three participating institutions and a representative of the Florida Board of Education, which governs the state university system of Florida. The Institutional Oversight Committee is chaired by the President of Florida State University.

President T.K. Wetherell, Florida State University
President Charles E. Young, University of Florida (through January 4, 2004); followed by new UF President James B. Machen
Director Pete Nanos, Los Alamos National Laboratory
Secretary Jim Horne, Florida Board of Education

Users' Committee

Members of the NHMFL Users' Committee are nominated and elected by the user community. The committee provides guidance on the equipment and policies needed for the development and utilization of the laboratory's facilities.

Chuck Agosta
Clark University
Department of Physics

Ward P. Beyermann
University of California, Riverside
Department of Physics

Gil Clark
University of California, Los Angeles
Department of Physics

Nathanael Fortune
Smith College
Department of Physics

Roy Goodrich
Louisiana State University
Department of Physics & Astronomy

Steve Hill
University of Florida
Department of Physics

Neil Kelleher
University of Illinois at Urbana-Champaign
Department of Chemistry

Lowell Kispert
University of Alabama
Department of Chemistry

Lia Krusin-Elbaum
IBM – T.J. Watson Research Center
Yorktown Heights, New York

Charles Sanders
Case Western Reserve
Department of Physiology & Biophysics

George Schmiedeshoff
Occidental College
Department of Physics

Tom Timusk
McMaster University
Department of Physics & Astronomy

Richard Wittebort
University of Louisville
Department of Chemistry

NMR USERS' COMMITTEE

The NHMFL NMR Users' Committee is a recently constituted board to advise the in-house NMR user program. This committee is involved in setting priorities among a wide range of possible development projects and for helping to identify the science drivers for new magnet development proposals, as well as for the next NHMFL renewal. The NMR Users' Committee meets in conjunction with the NHMFL Users' Committee, and there is intentional overlap of two members between the NHMFL and NMR User committees.

Charles Sanders
Vanderbilt University School of Medicine
Center for Structural Biology

Steven Smith
State University of New York, at Stony Brook, Center for Structural Biology

Christopher Sotak
Worcester Polytechnic University
Biomedical Engineering

Timothy Stemmler
Wayne State University, School of Medicine
Department of Biochemistry and Molecular Biology

Andrew Webb
University of Illinois
Beckman Institute for Advanced Science & Technology

Richard Wittebort
University of Louisville
Department of Chemistry

Yue Wu
University of North Carolina
Department of Physics and Astronomy

ICR ADVISORY COMMITTEE

The NHMFL ICR Advisory Committee meets at least annually to set priorities for instrument development, establish new directions for research, organize the biennial North American FT-ICR MS Conference, and advise on future proposals. An additional NHMFL ICR user represents the ICR Program on the NHMFL Users' Committee.

Professor I. Jonathan Amster
University of Georgia
Department of Chemistry

Dr. Steve Beu
S. C. Beu Consulting
Austin, TX 78750

Professor John R. Eyler
University of Florida
Department of Chemistry

Michael Greig
Pfizer Global R&D - LaJolla
San Diego, CA

Prof. Julie A. Leary
University of California, Berkeley
College of Chemistry

David C. Muddiman, Ph.D.
Mayo Clinic
Biochemistry and Molecular Biology

Carol L. Nilsson, MD, Ph.D.
Goteborg University
Department of Medical Biochemistry

Professor Evan Williams
University of California, Berkeley
Department of Chemistry

External Advisory Committee

The External Advisory Committee is appointed by the Chair of the Institutional Oversight Committee and reports directly to this Committee. It reviews and evaluates overall NHMFL performance and provides advice and guidance on matters critical to the success and management of the laboratory. In late 2003, Florida State University's new president, Dr. T. K. Wetherell, began to appoint a new External Advisory Committee, which will meet in May, 2004. As in the past, its members will represent academic, government, and industrial organizations, as well as the NHMFL user community.

Research Program Committee, 2003 Solicitation

The NHMFL Research Program Committee is charged with promoting the laboratory's In-House Research Program (IHRP) and with ensuring the development of the highest quality facilities for the laboratory's research communities. The committee evaluates research opportunities and facilities enhancements available to the NHMFL and recommends programs for the use and enhancement of NHMFL facilities and resources. It oversees the IHRP, encourages the formation of collaborative research efforts, establishes worldwide channels for communication, and identifies cutting-edge high magnetic field research programs. The committee, through its chair, administers the funding of the IHRP. Members of the RPC also participate in the Users' Program proposal review and evaluation.

Chair
John Eyler

Condensed Matter Sciences Subcommittee
Elbio Dagotto
Jim Cao
Steve Hill
Greg Stewart
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The NHMFL Executive Committee reviews and advises on a broad range of issues including organization, staffing, resource allocation, budgeting, and interactions with external agencies and private organizations. Members take into account the objectives and mission of the laboratory, external reviews, and internal evaluations of the overall program.

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