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2002 NHMFL ANNUAL PROGRAMS REPORT

NATIONAL HIGH MAGNETIC FIELD LABORATORY

2002 Annual Programs Report

of the

National High Magnetic Field Laboratory

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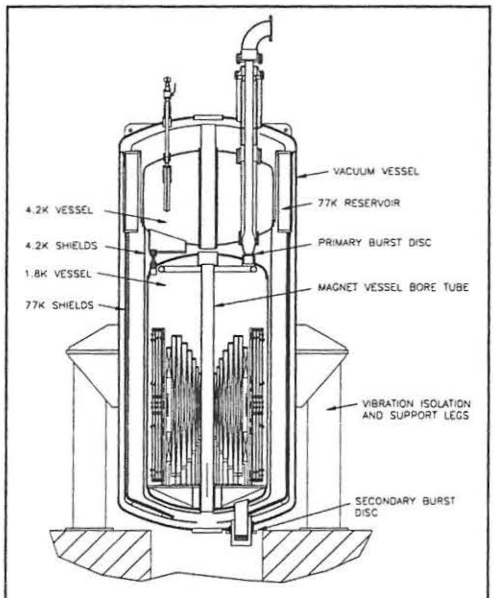
1. Introduction: 2002 Year in Review

The research user program at the National High Magnetic Field Laboratory (NHMFL) continued to grow in strength, size, and diversity in 2002. There was strong collaborative research by users and in-house scientists ensuring broad benefit to the scientific community of the unique facilities of the laboratory. This year 380 research reports were submitted in 16 research areas, as compared to 322 reports in 2001, representing 18% growth of user activity as measured by projects. Research reports in biology and chemistry continue to grow as in previous years. Thirty-seven reports were sponsored by the NHMFL In-House Research Program.

NHMFL Research Reports	2000	2001	2002	Total
Biology	47	49	54	150
Chemistry	27	31	39	97
Cryogenics	5	5	3	13
Engineering Materials	6	5	10	21
Geochemistry	13	10	13	36
Instrumentation	16	10	9	35
Kondo/Heavy Fermion Systems	19	21	26	66
Magnet Technology	6	7	17	30
Magnetic Resonance Techniques	19	24	24	67
Magnetism & Magnetic Materials	36	45	48	129
Molecular Conductors	19	24	27	70
Other Condensed Matter	10	13	15	38
Quantum Solids	3	6	4	13
Semiconductors	27	32	38	97
Superconductivity - Applied	16	11	32	59
Superconductivity - Basic	26	29	21	76
Total	**295**	**322**	**380**	**997**

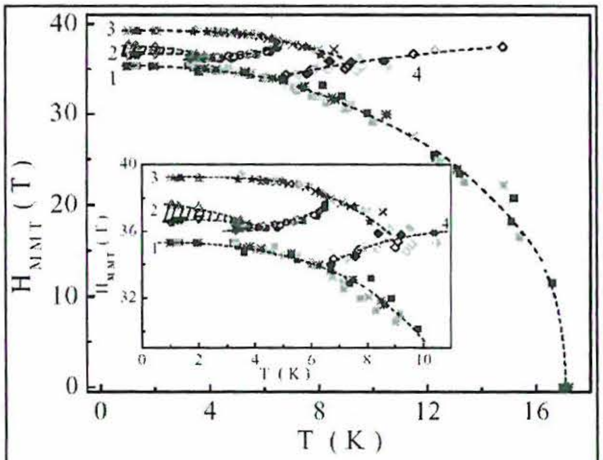
The NHMFL has completed fabrication and bucket testing of the 900 MHz (21.1 T), high-resolution NMR magnet. This system is the centerpiece of the laboratory's NMR program with a high homogeneity ≤ 1 ppb and a warm bore of 105 mm. The 900 MHz magnet will be one of the world's highest field, largest bore, high-resolution NMR systems. The wide bore feature of the NHMFL design allows more options for NMR experiments and will be able to accommodate future high field Nb_3Sn or high temperature superconducting coils capable of boosting the central field to greater than 23.5 T required for 1 GHz.



900 MHz NMR Cryostat

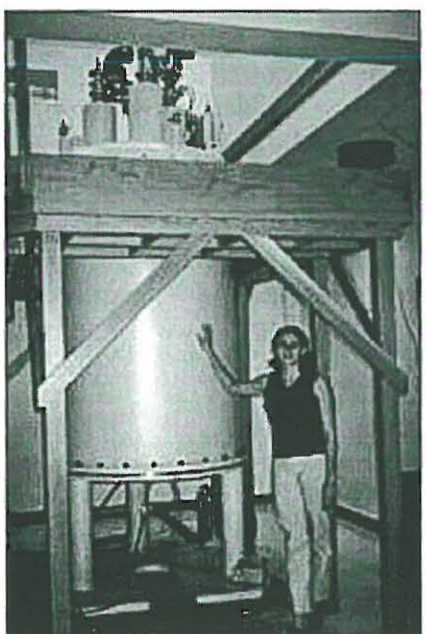
Preparations are well underway to move the 24 ton magnet from its testing stand into its final cryostat. It will be housed in a specially designed pit for easier user access in the NMR wing of the laboratory. The 900 MHz console has been ordered and the first experiments are expected in late summer of 2003. The bucket tests were conducted at ~2.4 K versus the 1.8 K anticipated operating temperature in the final cryostat. During the first attempt the magnet made it to 875 MHz before the first training quench occurred. The system was energized two additional times reaching close to the same field. These tests allowed the team to test many aspects related to magnet operation and also provided a validation of the active quench protection system. The bucket tests provided critical information needed to proceed with the installation of the magnet in the final cryostat.

The world's highest continuous field magnet system—the NHMFL 45 T Hybrid—operates routinely for users during approximately eight months of the year. User demand for the Hybrid has been high and magnet time is allocated by a very competitive proposal process. The science on the Hybrid has been rich and there has been an explosion of interest by the NMR community. During the early commissioning of the Hybrid, the magnet suffered an unprotected quench that compromised a portion of the superconducting outsert. A special cable-in-conduit fabrication station has been developed at the NHMFL to draw long lengths of superconducting cable-in-conduit to be used in the fabrication of a replacement coil for the inner most Nb_3Sn superconducting Hybrid coil.



H-T phase diagram of the URu_2Si_2 metamagnetic transition measured in the 45 T Hybrid and extracted from ultrasonic and a.c. susceptibility measurements. Inset: High field/low temperature part of the same H-T diagram.
Suslov, A.; Sarma, B.K.; Ketterson, J.B. and Hinks, D.G.

The user program at the NHMFL Pulsed Field Facility at Los Alamos National Laboratory has continued to grow and attract new users. Unfortunately, in mid-2000, there was a premature failure of the 60 T Long Pulse Magnet. An in-depth analysis revealed that the failure was caused by low fracture toughness due to brittle Sigma phase in coil reinforcing shells five through eight. The rebuild of the 60 T Long Pulse Magnet is being pursued with slight modifications and improved materials for the reinforcing shells. Construction has also begun on the 100 T Multi-Shot Magnet project. Design and fabrication of two types of insert prototypes is well underway, and fabrication of the apparatus for the proof testing of a prototype 100 T shell at operating temperatures is also underway. Magnet assembly is slated to begin in the third quarter of 2003. During the last year, greater emphasis has been placed on the development and utilization of a variety of capacitively-driven pulsed magnets to support the growing user needs at this part of the NHMFL.



Graduate student Cecile Mohr with state-of-the-art 750 MHz wide bore spectrometer at UF.

The NHMFL High B/T Facility is operated by the University of Florida as a part of its Microkelvin Laboratory. Instrumentation is available to users for studies of magnetization, thermodynamic quantities, transport measurements, magnetic resonance, viscosity, diffusion, and pressure. The NHMFL's MRI facilities are also located at the University of Florida in the Advanced Magnetic Resonance Imaging and Spectroscopy facility (AMRIS). These facilities have supported some rich science, including the first single cell imaging. The centerpiece of the MRI effort is the 11.7 T, 40 cm bore for imaging small animals and a 750 MHz wide bore NMR system—the first 750 MHz wide bore to be installed in the United States and the second worldwide.

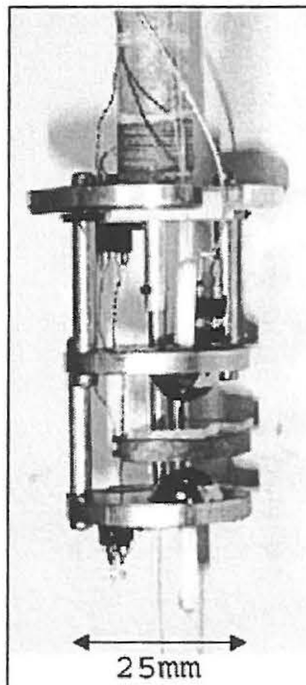
In May 2002 an external review committee selected by the National Science Foundation and chaired by Dr. Miles Klein of the University of Illinois, Urbana-Champaign, conducted an extensive review that was positive and supportive.

> "The NHMFL is the premier magnet laboratory in the world. Its magnets hold the world records for producing the highest magnetic fields, both continuous and pulsed, representing substantial increases over the prior state of the art."

The report continues:

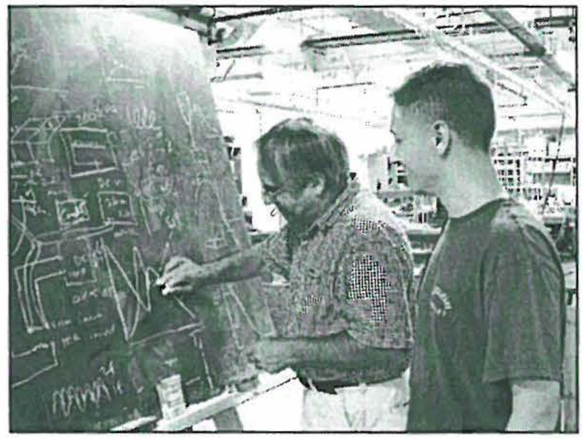
> "Users at the Lab find excellent support staff and instrumentation to assist in setting up their experiments. Since many of the facilities are state of the art and since the visitors are pushing the scientific state of the art with their investigations, the visitors and the staff often collaborate in the research and publish jointly."

In personnel related matters, Brian Fairhurst became the NHMFL Deputy Director of Management and Administration. He brings over 25 years of professional management experience in the private sector. Mr. Fairhurst has implemented a new project management system to provide a better basis for managing risks, costs, and schedules. Dr. Hans Schneider-Muntau has become the Chief Technology Officer of the laboratory. One of the original NHMFL staffers, James Ferner, retired to the Pacific Northwest. Mr. Ferner was the key individual in overseeing the construction of the NHMFL in Tallahassee during the early 1990's and contributed significantly to the management of the NHMFL as Chief Administrative Officer. Mr. Ferner was also instrumental in attracting the Center for Advanced Power Systems to Florida State University and getting it staffed and operational. The multimillion dollar Center is funded by the Office of Naval Research to assist the Navy in the development of the next generation of all-electric ships and was an outgrowth of earlier interactions between the NHMFL and Office of Naval Research. Power Engineer Heinrich Boenig, a pioneer of the NHMFL Pulsed Field Facility, also retired at the end of June 2002. He was responsible for the 600 megajoules generator at the facility and played a critical role in many other aspects of the development of the NHMFL. During the early 1990's, Dr. Boenig spent a sabbatical year at the NHMFL-Tallahassee facility, where he helped to develop the specifications for and supported the procurement of the DC power supplies at Tallahassee.



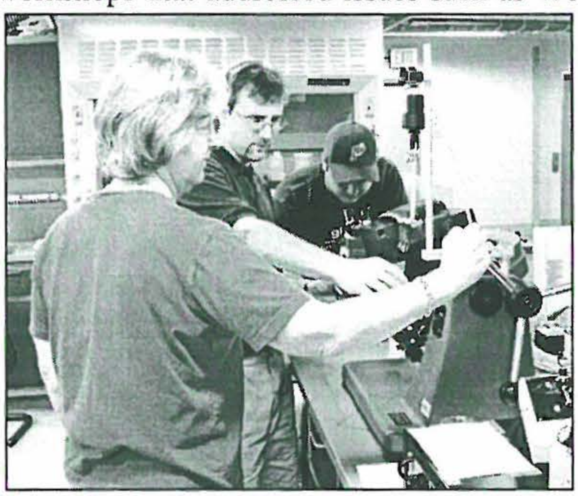
THz probe developed at NHMFL-LANL.

New instrumentation and techniques are critical to the success of the user facilities. 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 between 100 GHz to 2000 GHz has been developed. This technique will certainly open new horizons in low-energy spectroscopy measurements at extreme conditions. In Tallahassee, researchers have completed a new facility for spectroscopy between 140 GHz and 700 GHz in a 25 T high homogeneity resistive magnet. The frequency resolution is better than 0.05 GHz in the entire frequency range. Some examples of measurements that may be done include the study of elementary excitation spectra in high correlated electron systems; spin dynamics in quantum low-dimensional and spin-ordered materials; single-molecule magnetism; electron and magnetic structure of solids; ferromagnetic, antiferromagnetic, and cyclotron resonance phenomena; physics of field-induced and spontaneous phase transitions; high-resolution ESR spectroscopy of transition metal ions; and ESR on paramagnetic ions with large zero-field splitting.



Summer is an especially active time for the laboratory's Center for Integrating Research and Learning. For the eighth consecutive year, the NHMFL hosted undergraduate students through the Research for Undergraduate Program. Undergraduates from around the country received summer internships at the NHMFL: ten students in Tallahassee, three at Los Alamos, and two at the University of Florida in Gainesville.

The Center also provided internship experiences for 18 elementary, middle, and high school teachers in a six-week residential program. The Research Experiences for Teachers Program is funded by a separate grant from the NSF. The Center staff conducted weekly seminars and mini-workshops that addressed issues such as Web-based resources, creating Web pages as tools for the undergraduate students and teachers, incorporating literature in the science classroom, using PowerPoint and other presentation software, and integrating writing into science activities.



The NHMFL announced a new fellowship program for international postdoctoral candidates thanks to a generous gift from Mr. and Mrs. John Schuler of Longboat Key, Florida, who endowed the fellowship. The Schuler Fellowship is designed for scientists and engineers who have received their Ph.D.s within the last ten years and who are affiliated with an institution of higher learning or comparable research organization. It is specially structured to attract those scientists and engineers who aspire to become the next generation's leaders in their chosen fields and who welcome the opportunity to pursue research on their new ideas at the NHMFL. The Schuler Fellowships are also aimed at building bridges between the NHMFL and institutions of higher learning and research organizations throughout the world, which could ultimately lead to broader collaborative relationships between the NHMFL and these institutions.

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 2002. The tables below 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, quietest, DC, and slowly varying magnetic fields in the world. The magnet systems are coupled with state-of-the-art instrumentation. Expert experimental staff provide scientific and technical support to researchers using the DC facilities.

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 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. Eight 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 at the DC Field User Facility, as of January 2003.

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.
17.5/19.5, 52	0.4 - 300 K	
15, 45	10 mK - 1 K	
RESISTIVE and HYBRID MAGNETS		
Field (T), Bore (Mm)	**Power (Mw)**	**Supported Research**
20, 195	20	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.
24.5, 32[1]	15	
25, 32 to 50[2]	15	
30, 32	20	
33, 32	20	
45, 32	36	
25, 52[1]	19	Low to medium resolution NMR, EMR, and Sub/Millimeter wave spectroscopy,

[1] Higher homogeneity magnet.
[2] 32 mm bore tube supports a coil for modulating the magnetic field.

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

Sergei Zvyagin and Jurek Krzystek have recently completed a new facility for millimeter and submillimeter wave spectroscopy (SMWS). Some results obtained in this past year are mentioned below. The radiation sources, a set of Backward Wave Oscillators, provide nearly continuously tunable coverage between 140 and 700 GHz in the 25 T high homogeneity resistive magnet and in the 18/20 T superconductor. SMWS plays an important role connecting far-infrared and conventional long wavelength ($\leq$ 1m) spectral methods. It spans the energy, temperature, and magnetic field scales relevant to numerous fascinating phenomena in condensed matter science, chemistry, and biology.

Some examples of measurements that may be done include elementary excitation spectra in highly-correlated electron systems; spin dynamics in quantum low-dimensional and spin-ordered materials; single-molecule magnetism; electron and magnetic structure of solids; ferromagnetic, antiferromagnetic, and cyclotron resonance phenomena; physics of field-induced and spontaneous phase transitions; high-resolution ESR spectroscopy of transition metal ions (which is of great importance in chemistry, biochemistry, and structural biology); and ESR on paramagnetic ions with large zero-field splitting.

The facility was used in the past year to map field-induced structural phase transitions and to study resonance properties of the spin-Peierls material $CuGeO_3$ + 0.4%Si across the different regions of its phase diagram. The work was done in collaboration with P. H. M. van Loosdrecht (University of Groningen, The Netherlands), G. Dhalenne (Université Paris-Sud, France), A. Revcolevschi (Université Paris-Sud, France).

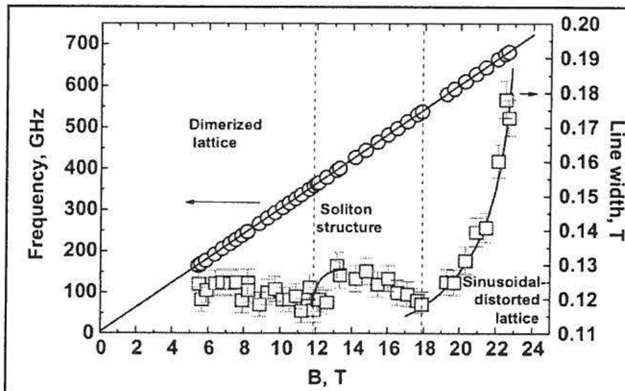


Figure 1. The ESR frequency-field dependence (circles) and the line-width, ΔB/B, behavior (squares) in $CuGeO_3$ + 0.4%Si, *B // a*, T = 4.2 K. The lines are guides to eye.

The organic charge transfer salt, β′ - $(ET)_2SF_5CF_2SO_3$ undergoes a transition at 20 K that has been believed to be a conventional spin-Peierls ordering. A systematic electron spin resonance investigation of the 20 K transition was performed in the frequency range of 200-700 GHz at fields up to 25 T. Results agreed with the nuclear magnetic resonance (NMR) investigation (also done at the NHMFL), revealing evidence that the transition seen at 20 K is not of conventional spin-Peierls order. A significant change of the spin resonance spectrum in β′ - $(ET)_2SF_5CF_2SO_3$ at low temperatures, indicates a transition into a three-dimensional-antiferromagnetic phase. The research group investigating high field magnetic resonant properties of β′ - $(ET)_2SF_5CF_2SO_3$ includes I.B. Rutel, S.A. Zvyagin, J.S. Brooks, J. Krzystek, P. Kuhns, A.P. Reyes, B.H. Ward, J.A. Schlueter, R.W. Winter, and G.L. Gard.

A High Field and Frequency Electron Paramagnetic Resonance (HFEPR) study of field-oriented polycrystalline $Co(PPh_3)_2Cl_2$ provided what we believe to be the first direct measurement of single ion anisotropy, *D*, for a high-spin ($S = 3/2$) Co^{2+} complex and the largest magnitude of *D* ever measured by HFEPR. Both benchmarks were possible only through the combination of the multifrequency capability of the BWOs and the very high fields produced by the resistive magnet, which oriented the polycrystalline sample. This research is a collaboration of J. Telser, J. Krzystek, and S. Zvyagin.

Engel's group, collaborating with D. C. Tsui of Princeton University, has used the microwave conductivity probe in the dilution refrigerators in the superconducting magnet to discover well-defined microwave spectral lines in two regimes of ultra-low disorder quantum Hall effect sample. The lines are interpreted as pinning modes, in which a charge density wave (CDW) oscillates within the pinning potential of impurities; the resonances are strong evidence for CDW formation. One resonance occurs in the bubble phase of higher Landau levels, the other in the edges of the integer quantum Hall plateaus around Landau fillings 1,2,3, and 4. The bubble phase is a CDW of clusters of electrons; the resonance in the integer quantum Hall effect is interpreted as a pinning mode of Wigner crystal-like lattices of quasiparticles or quasiholes, and is the first evidence for such crystallization.

Measurements by Y. Wang, N. P. Ong, *et al.* of the Nernst signal in the vortex-liquid state of the cuprates to fields up to 33 reveal that vorticity extends to very high fields even close to the zero-field critical temperature, T_{c0}. In overdoped $La_{1-x}Sr_xCuO_4$ (LSCO) they found that the upper critical field $H_{c2}(T)$ curve does not end at T_{c0}, but at a much higher temperature. These results imply that T_{c0} corresponds to a loss in phase rigidity rather than a vanishing of the pairing amplitude. An intermediate field, $H^*(T) << H_{c2}(T)$, is shown to be the field scale for the flux-flow resistivity. These measurements were possible only with the low electrical noise levels achieved with the copper cryostat tails and rigid dewar mounts installed in 2001.

A direct optical access probe and optical path for Raman spectroscopy were developed and tested. The system sensitivity and resolution are presently limited by the McPherson 0.75 m single spectrometer, which can cover Raman frequency shifts greater than or equal to 200 cm^{-1}. The cryostat with windows in the tail and external optical components will also be used for other experiments that require fast pulses or polarized light. The first experiments are planned for the 50 mm bore magnets; experience and scientific results there will inform and drive the design of similar systems for the 32 mm bore magnets and the Hybrid.

Fast optical instrumentation with a state-of-the-art ultrafast laser system for kinetics experiments is being developed. A chirped pulse amplifier has been installed, and an optical parametric amplifier will be installed later this year. This system will produce intense coherent electromagnetic radiation with wavelength continuously tunable from 1.15 μm to 18 μm with 100 fs pulse width and 3 μJ pulse energy. This project is supported by an IHRP to C. Stanton *et al.*, regular NHMFL funds for user instrumentation, and an NSF grant to J. Kono of Rice University and D. Reitze of University of Florida.

A probe for temperature dependent far infrared spectroscopy is now available for the 18/20 T superconducting magnet. It includes a high mobility FET amplifier located close to the bolometer to reduce electrical noise. The sample temperature range is 4.2 K to 100 K.

More leads were added to the standard far infrared spectroscopy probe and one user did simultaneous measurements of sample resistance and infrared absorption.

2-3 GPa piston cylinder pressure cells have been purchased as well as developed in-house.

Two new Lake Shore Cryotronic model 370 AC resistance bridges are available for low power resistance measurements.

PLANNED IMPROVEMENTS

1. A new 18/20 T superconducting magnet has been ordered to replace the one labeled SCM2. This will allow SCM2 to be moved to cell 3 for optics experiments.

2. Helium 3 refrigerators with base temperatures ≤350 mK have been ordered and will be delivered in early 2003. They will add to the low temperature capabilities of the lab, providing lower cost alternatives to the dilution refrigerators for users who do not temperatures below 260 mK.

- System ^{3}He-A, which permits top loading of the sample into the liquid ^{3}He, will increase the variety of experiments that can be done in the 18/20 T superconducting magnet.
- System ^{3}He-B allows top-loading of the sample into mixture in the 50 mm bore resistive magnets.
- System ^{3}He-C will provide 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 and thus will allow low temperature heat capacity measurements. It will also make some variable temperature experiments easier.

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

- A 17.5 T superconducting magnet with optical windows in the bottom of the crystat 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.
- A platform in cell 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.

4. Several microcalorimetry techniques and instrumentation are being developed in collaboration with users with funding from the State of Florida Visitors' Program and the IHRP.

5. A new power supply for SCM1 will improve reliability and convenience.

Table 2. DC Field Facility User Statistics (12/1/01 – 11/30/02).

	Total	Minority	Female
Number of Research Projects	150	NA	NA
Number of Senior Investigators, U.S.	80	1	0
Number of Senior Investigators, Overseas	19	NA	0
Number of Students, U.S.	35	0	5
Number of Students, Overseas	11	NA	2
Number of Postdocs, U.S.	24	0	2
Number of Postdocs, Overseas	1	NA	0

Table 3. DC Field Facility Operations Statistics (10/01/01 – 9/30/02).

	Resistive	Superconductor	
User Affiliation	**Number of Magnet-Days**		
NHMFL, UF, FSU, FAMU, LANL			
U.S. University	234	240	29%
U.S. Govt. Lab.	11	16	2%
U.S. Industry	22	16	2%
Overseas	195	108	19%
Test, Calibration, & Maintenance	21	90	7%
Idle	9	31	2%
Total: 1621	**891**	**730**	**100%**

NHMFL PULSED FIELD FACILITY—LOS ALAMOS

The NHMFL-Los Alamos research staff and collaborators have developed a wide variety of experimental capabilities utilizing the short pulse and superconducting magnets, which are summarized in Table 1. Research proposals to utilize the facility are submitted through the laboratory's webpage: (http://www.lanl.gov/mst/nhmfl/).

Magnet time is scheduled following successful review of submitted proposals. Most commonly, users visit for one to two weeks of magnet time, although longer visits and sabbatical stays are also welcome. Additional information on magnets, instrumentation, and personnel, as well as the Research Proposal Form can be obtained by contacting Alex H. Lacerda at lacerda@lanl.gov or 505-665-6504.

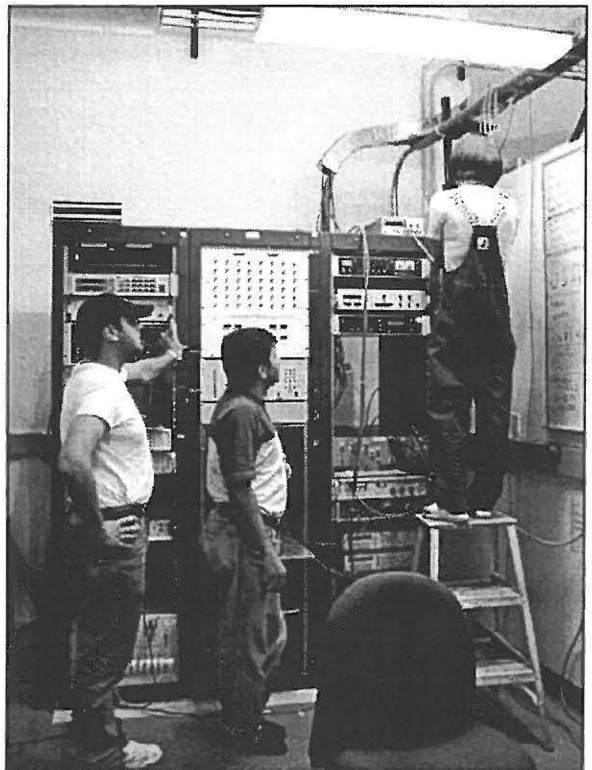


Figure 2. New Mexico State University graduate students (left) Abdel Alsmadi and Sami El Khatib watch Pulsed Field Facility postdoctoral fellow Myung-Hwa Jung as she adjusts data acquisition instruments.

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

Field, Duration, Bore	**Supported Research**
Capacitor-bank-driven magnets Cell#1: 50 T–Short Pulse, 25 msec, 24 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: 60 T–Short Pulse, 25 msec, 15 mm	Magneto-optics (IR through UV), magnetization, and magneto-transport from 350 mK to 300 K Dilution refrigerator with 50 T, 24 mm Pressure from 10 kbar typical, up to100 kbar 60 T – Long Pulse Magnet *to return to service in 3rd quarter 2003. See the Magnet Science and Technology section for details.*
Superconducting magnets 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
14 T-PPMS magnet	Resistivity

The 60 T Long Pulse Magnet Project

The 60 T LP Mark II magnet, a copy of the original design with slight modifications and improved materials, is currently under construction. Of the nine coils that make up the magnet, two have now been potted, two are wound, and two more are partially wound. The magnet dewar and magnet frame casting (specified for a long lead time) are in fabrication with delivery expected in early November 2002. Magnet assembly is projected to begin in early 2003 with planned operations to resume in the third quarter of 2003.

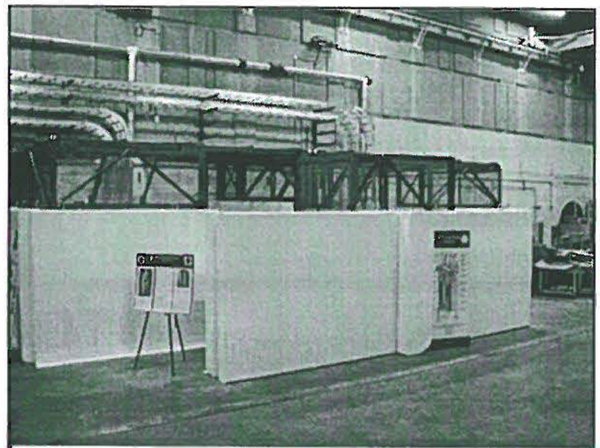


Figure 3. The new structure built to enclose the 60 T LP and 100 T MS magnet projects. The structure consists of eight-foot high concrete blocks surrounding the magnet pits with steel cage above.

The 100 T Multi-Shot Magnet Project

Construction has begun on the 100 T MS magnet; the coil vendor is now constructing the tooling and inspecting the conductor. Winding of 100 T outer coils will commence when the vendor completes the winding of the 60 T LP coils. Work on final busbar and frame details is scheduled to resume in fourth quarter of 2002. The design and fabrication of two types of insert prototypes are under way. Fabrication of the apparatus for the proof testing of a prototype 100 T shell at operating temperatures is underway. Magnet assembly is slated to begin in the third quarter of 2003 with testing of the magnet to commence in late third quarter or early fourth quarter of 2004.

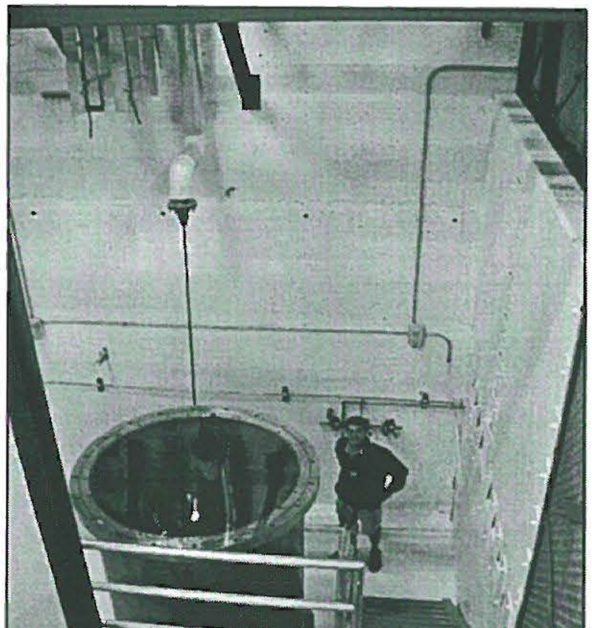


Figure 4. Postdoctorate Ross McDonald stands inside the magnet pit beside the new cryostat for the 100 T MS magnet.

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 May 2003, while the 300 T fields are expected in spring 2004.

CAPABILITIES OF THE PULSED FIELD FACILITY, ILLUSTRATED BY SCIENTIFIC HIGHLIGHTS

A. Migliori (NHMFL Pulsed Field Facility), J. Lashley (LANL - MISL), and collaborators at Los Alamos National Laboratory are attempting to answer several key questions relating to the thermodynamics and electronic structure of plutonium (Pu). The thermodynamic aspects will help answer key questions about this fascinating material. Toward this goal they have made the following important findings: (1) With very accurate measurements of the specific heat of pure Pu (from 5 K to 300 K) anomalies were found near 200 K, 35 K; (2) Discovery of the surprising fact that the slopes versus temperature of the shear and compressional moduli of Ga stabilized fcc Pu near room temperature do not depend on Ga concentration. These are the only data that agree with the one single-crystal room-temperature data point, and they were the first to establish that moduli averaging models work on fcc Pu, the most anisotropic fcc metal known.

Researchers from the Central Research Institute of Electric Power Industry - Tokyo, Japan, and the NHMFL Pulsed Facility (F. Balakirev, *et al.*) demonstrated a peculiar behavior of the Hall coefficient in cuprate superconductors ($Bi_2Sr_{2-x}La_xCuO_{2+\delta}$) in the zero-temperature limit in the doping range where superconductivity is most robust. Among the findings, the most striking is a sharp discontinuity in Hall number at optimal doping, which provides strong support for the existence of a quantum phase transition (QPT), a zero-temperature phase transition, in the normal state of this high-temperature superconductor at precisely the same hole doping for which the superconductivity is optimized. 60 T magnetic fields, however, gently remove the superconductivity in these materials, without introducing any observable changes in the normal state. These measurements require unprecedented noise reduction to detect the micro-ohm.cm Hall resistivity.

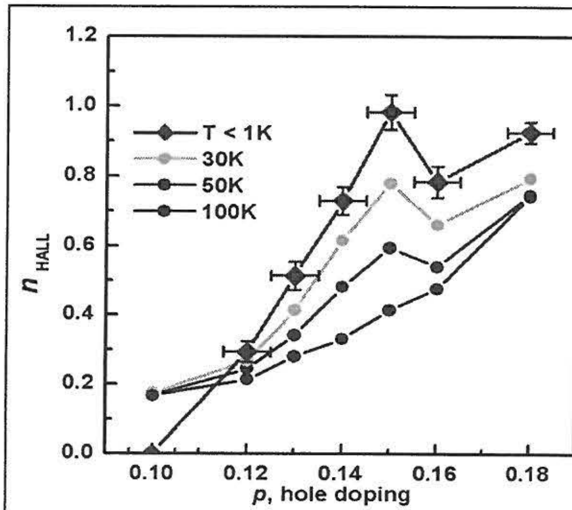


Figure 5. Hall density, n_{Hall}, in cuprate superconductor $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ as a function of hole doping, p, at various temperatures. (Balakirev, *et al.*)

M. Jaime, N. Harrison, and K-H. Kim (Postdoctoral Fellow) NHMFL Pulsed Field Facility, together with John Mydosh from Leiden Univeristy have recently made extensive measurements of the high magnetic field phase diagram of URu_2Si_2 using a variety of experimental techniques, including specific heat, transport, and magnetization in both the 45 T Hybrid magnet in Tallahassee and the 50 T mid-pulse magnet in Los Alamos. The hidden order phase at low T in URu_2 Si_2 has recently been proposed to possess an orbital antiferromagnetic groundstate, so far unprecedented in any other type of system. The complexity of the phase diagram at high magnetic fields is revealed to be like no other f-electron metal, exhibiting phenomena ranging from metamagnetic quantum criticality to multiple order phase transitions.

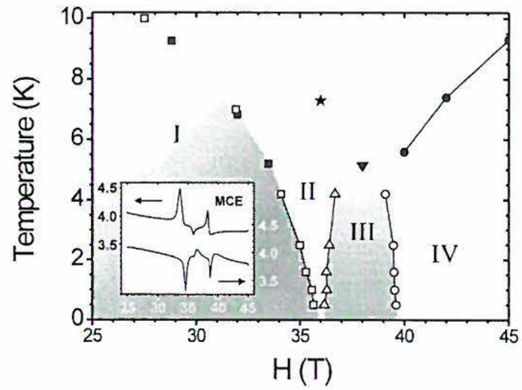


Figure 6. (H,T) phase diagram for URu_2Si_2. Solid symbols were obtained from specific heat measurements in DC fields (Hybrid Magnet, Tallahassee). Open symbols from anomalies observed in the magnetoresistance measured in a 50 T pulsed magnet (LANL). Squares show the suppression of hidden-order phase. (II) Triangles and open circles show new field-induced low temperature phase. (III) Solid circles indicate maximum in Schottky-like component in the specific heat. No phase transitions were observed above 40 T. (Jaime, *et al.*)

K. H. Kim (Postdoctoral Fellow, NHMFL Pulsed Field Facility) and collaborators from Pohan University - Republic of Korea systematically investigate the excess of Mg metal on the high field magnetotransport of MgB_2 (K. H. Kim, *et al. Phys. Rev. B, Rapid Comm.* **66**, 020506R (2002)). This study clearly revealed that the electrical and magnetotransport properties of MgB_2 are very sensitive to the amount of Mg in the sample. In fact, they have clearly shown that MgB_2 samples with unreacted Mg form a two-phase mixture of MgB_2 and Mg metal.

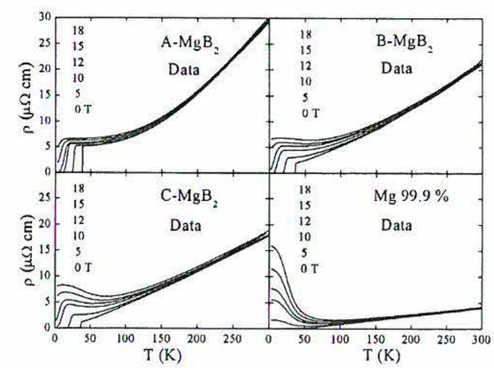


Figure 7. T- and H-dependent resistivity curves for three different MgB_2 samples and element. The quantity of unreacted Mg increases from A to C. (Kim, *et al.*)

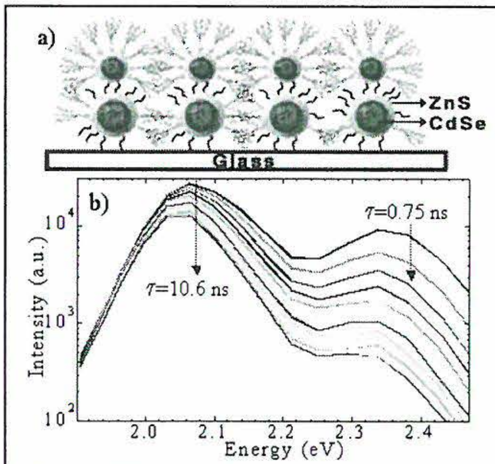


Figure 8. Schematic of nanocrystal quantum dot energy-gradient bilayer for light-harvesting: A monolayer of 1.3 nm dots on a monolayer of 2.0 nm dots. b) "Instantaneous" PL spectra at 500 ps intervals (from 0 to 5 ns), showing rapid collapse of 2.36 eV emission from 1.3 nm dots, indicating energy transfer of excitons from small to large dots in the vertical direction. (Crooker, *et al.*)

S. Crooker (NHMFL Pulsed Field Facility) and collaborators from LANL Chemistry Division performed the first measurement to directly time-resolve rate and efficiency of charge (exciton) transfer between dots. Energy travels "downhill", from small to large dots—as fast as 700 ps (Crooker, *et al.*, *Phys. Rev. Lett.*, in print). This is the first step toward multi-layer systems that efficiently gather light and then channel it in a particular direction, which mimics the first step in photosynthesis. This work may someday make artificial light-harvesting materials.

S. Tozer (NHMFL - Tallahassee), C. Agosta (Physics Dept., Clark University), C. Mielke (NHMFL Pulsed Field Facility), and collaborators have developed a new magnetotransport measurement technique. To overcome the difficulties measuring resistivity at high pressures and high magnetic fields they have combined a resonant tank circuit with a plastic diamond anvil cell. This method has allowed them to make contactless measurements of skin depths at frequencies between 60 and 600 MHz, in materials under pressure in pulsed and DC magnetic fields to millikelvin temperatures. In a reduced dimensional system of current interest, κ-$(ET)_2$-$Cu(NCS)_2$, they were able to make accurate critical field measurements in the superconducting state and measure magnetoresistance oscillations in the normal state using this new method. A 300 micron diameter rf coil located in the pressurized volume of the nonmetallic gasket was connected to a tunnel diode oscillator (TDO) circuit to make the self resonant circuit. (This resonant technique was discussed by C. Mielke in *NHMFL Reports*, **9** No. 3 (2002)). At the Pulsed Field Facility, a unique tail construction for the He-3 refrigerator and the He-4 dewar, and the small size of the cell (Ø 9 mm) results in adequate sample space to combine this new method with a single axis rotator, a critical feature in the study of these anisotropic systems.

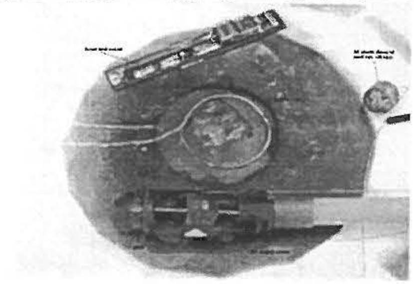


Figure 9a. The tank circuit electronics, the 8 mm diameter plastic DAC, and the single axis rotator are shown resting on a photo taken through the diamond of the 4-turn 300 micron diameter coil within the pressurized volume of the diamond anvil cell. Ruby chips around the perimeter of the opening in the gasket are used to calibrate the pressure at the temperature of interest. (Tozer, *et al.*)

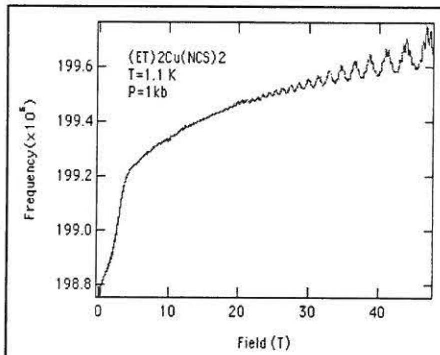


Figure 9b. Resonant frequency of the tuned tank circuit as a function of field. The data show the critical field at 5 T and, finally, the magnetoresistance oscillations and the magnetic breakdown at higher fields. (Tozer, *et al.*)

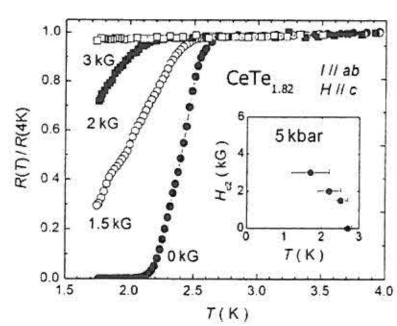


Figure 10. Temperature dependence of the in-plane resistance R(T) / R (4 K) normalized to 4 K value at 5 kbar for fields applied along the c-axis: 0, 1.5, 2, and 3 T. The inset shows the upper critical field Hc2(T) from the onset of the superconducting transition. (Jung, *et al.*)

M-H Jung (Postdoctoral Fellow, NHMFL Pulsed Field Facility) and collaborators from Hiroshima University observed a pressure-induced superconducting transition in a semimetallic magnetic material $CeTe_{1.83}$. Superconductivity is found at around 2.7 K for pressures above 2 kbar. Remarkably, this material displays various collective states at different temperatures, such as a charge-density-wave transition, and the coexisting magnetic structure of mixed ferromagnetism and antiferromagnetism. The observation of pressure induced superconductivity is completely unexpected and the experimental data may bring new insights on current theoretical models of possible pairing symmetry and mechanism. This measurement is an excellent example of the importance of combining high pressure and high magnetic field to reveal new phases at extreme conditions.

Table 5. NHMFL-Los Alamos Facility User Statistics for 2002.

	Total	Minority	Female
Number of Research Projects	90	NA	NA
Number of Senior Investigators, U.S.	39	3	3
Number of Senior Investigators, Overseas	14	NA	2
Number of Students, U.S.	21	1	3
Number of Students, Overseas	8	NA	2
Number of Postdocs, U.S.	25	1	4
Number of Postdocs, Overseas	1	NA	NA

Table 6. NHMFL-Los Alamos Facility Operations Statistics for 2002.

	SC Magnets	Cell 1	Cell 2	Cell 3,4	Total
User Affiliation	**Number of Magnet Days**				
NHMFL	91	10	0	64	**165**
LANL	238	10	0	0	**248**
Other Nat'l Labs	36	0	4	0	**40**
U.S. University	126	30	33	75	**264**
Industry	42	0	0	0	**42**
Non-U.S.	33	0	94	106	**233**
Total	**566**	**50**	**131**	**245**	**992**

*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

**40 Days of magnet time in Cells 1, 2, 3 and 4 were lost due to capacitor bank failures in April and August of 2002.

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

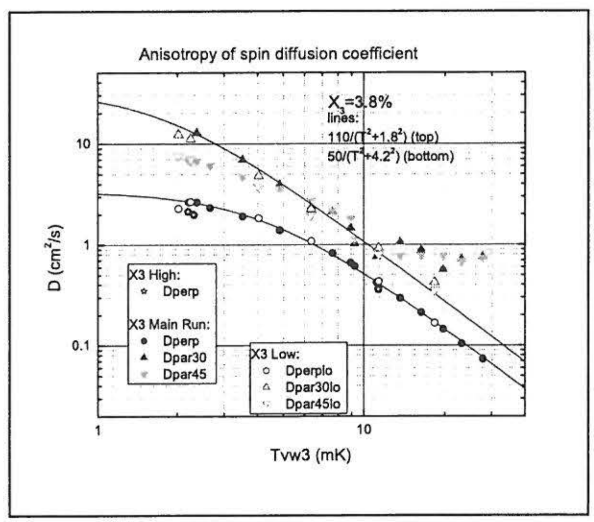
HIGH B/T FACILITY—GAINESVILLE

The NHMFL High B/T Facility at the University of Florida is operated as part of the Microkelvin Laboratory that 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 (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.

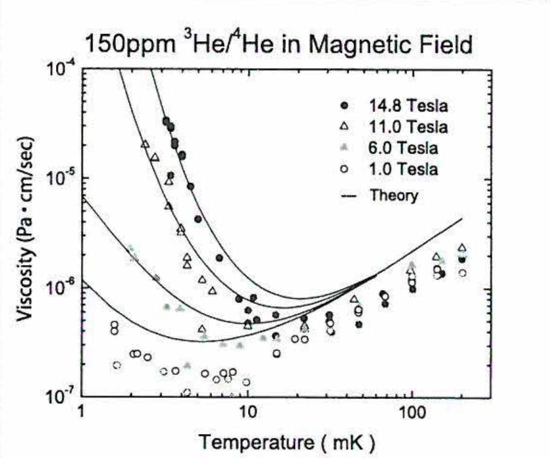
Access to the facility is through submission of a proposal that is evaluated by the High B/T Facility staff. The use of the High B/T Facility is restricted to experiments that need the special low temperature and high field configurations. Experiments needing higher temperatures should contact Bruce 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

Recently we completed and successfully implemented pulsed UHF NMR techniques for applications at ultra-low temperatures. This is the first time that high power pulsed experiments of this kind have been carried out in the mK to sub-mK temperature range. The techniques of Candela, *et al.* used a reentrant microwave cavity that could function at relatively high temperatures (hundreds of mK) while the system under study was located in a cold finger at mK to sub-mK temperatures. This technique allowed users (Akimoto, Candela, and Mullin of the University of Massachusetts in collaboration with UF Physics faculty) to carry out studies of the anisotropy of spin diffusion in dilute Fermi liquids. Studies in these dilute systems are of fundamental importance because the theoretical parameters can be calculated accurately (unlike the Fermi factors for high concentrations).



We have also completed the construction and testing of a vibrating wire viscometer for studies of viscosity in quantum fluids at very low temperatures. The instrument designed by Xia, *et al.* has enabled the measurement of the dependence of the magnetization on spin polarization in Fermi fluids. The design could also have potential applications as a reliable secondary thermometer that could be attached via sintered silver heat links to experimental cells operated at very low temperatures.



Sintered silver heat exchangers continue to be extremely important for cooling samples and electrical leads. The high surface area of the sintered silver in contact with liquid ^3He provides the most reliable link to the nuclear cooling stage through large areas of sintered metal. This technique has been used for recent low temperature studies of non-Fermi liquids, such as $CeNi_2Ge_2$ (Stewart and Steglich).

Goals and Future Plans

Current capabilities allow experiments to be conducted to temperatures as low as 0.4 mK and for fields up to 16.5 T if the superconducting magnet is operated at 1.5 K. The highest priority for the Gainesville NHMFL 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.

A small 5 T magnet that can operate in vacuum has been designed to make a second experimental volume available above the nuclear refrigerator. This volume will enable a variety of new measurements for users who need ultra-quiet and low temperature capabilities. These studies include transport and thermodynamic measurements in low fields but at temperatures down to 0.45 mK. Although the 5 T magnet has not been obtained because of the expensive compensation required, experiments have been run using a 2 T homemade magnet. The 5 T capability, if funded, could double the number of users that the High B/T facility could accommodate in each experimental cycle.

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

Equipment	Feature	Usage
CW Spectrometer	Low Noise High Sensitivity	Acoustic measurements in high magnetic fields
Sub-Femtoamp Source Meter	Low Noise Low Current	High Ohm experiments at low temperature in high magnetic fields

Table 8. High B/T Facility User Statistics (1/1/02 through 12/31/02).

	Total	Minority	Female
Number of Research Projects	3		
Number of Senior Investigators, U.S.	10	1	
Number of Senior Investigators, Overseas	1		
Number of Students, U.S.	3		
Number of Students, Overseas	2		
Number of Postdocs, U.S.	3		
Number of Postdocs, Overseas	1		

Table 9. High B/T Facility Operations Statistics (1/1/02 through 12/31/02).

Number of Magnet-Days	Number for each category	Percent of total
NHMFL, UF, FSU, FAMU, LANL	71	20%
U. S. University	227	64%
U. S. Govt. Lab.		
Industry		
Overseas		
Experiment setup, & Maintenance	57	16%
Idle		
Total	**355**	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 2003.

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 and Solution NMR
900 MHz+	21.1, 105	1 ppb	Solid State & Solution NMR, MRI
830 MHz	19.6, 31	100 ppb	Solid State and Solution NMR
720 MHz	16.9, 50	1 ppb	Solid State and 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	11.75, 89	1 ppb	Solid State NMR
400 MHz	9.3, 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	1 ppm	Multifrequency EMR
470 GHz	17, 61	3 ppm	Multifrequency EMR
336 GHz	12.5, 88	3 ppm	Transient EMR
95 GHz	≤6 T		W-band Pulsed EPR
9 GHz			X-Band EPR
ICR	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
	15, 103+	1 ppm	MALDI, ESI, FD FT-ICR
	9.4, 220	1 ppm	ESI FT-ICR
	9.4, 155+	1 ppm	EI, CI, FD, MALDI FT-ICR
	7, 155+	1 ppm	EI, CI, FT-ICR
	7, 150	1 ppm	ESI FT-ICR
	3, 150	10 ppm	Ion fluorescence, FT-ICR

+ Under development * ECR: Electron Cyclotron Resonance

Table 11. CIMAR Facilities at the University of Florida, as of January, 2003.

MAGNETIC RESONANCE SYSTEMS in Gainesville			
Frequency	**Field (T), Bore (mm)**	**Homogeneity**	**Measurements**
750 MHz	17.5, 89	1 ppb	Solution state NMR & MRI
600 MHz	14, 50	1 ppb	Solution state NMR & MRI
500 MHz	11.75, 50	1 ppb	Solution state NMR
500 MHz	11.1, 400	0.1 ppm	MRI & NMR of animals
200 MHz	4.7, 330	0.1 ppm	MRI & 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 in Gainesville in 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. The faculty also participate in efforts to achieve funding for major efforts including grant writing endeavors.

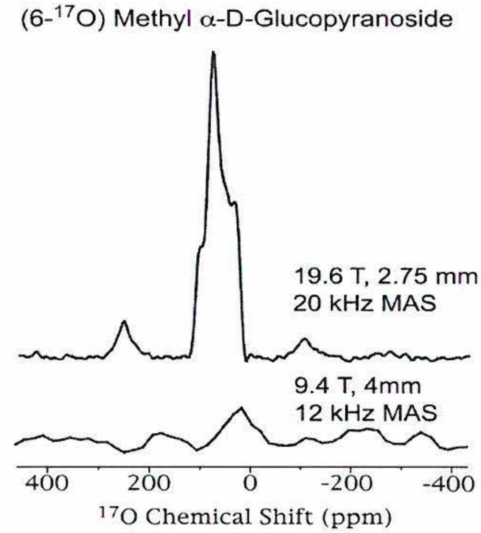


Figure 13. A comparison of magic-angle spinning spectra of ^{17}O labeled sugar using a 400 MHz (9.4 T) instrument at Ohio State Univ. and the 830 MHz (19.6 T) narrow bore spectrometer at the NHMFL. The data collecting time was 1 hour (19.6 T) and 1 week (9.4 T). These spectra show very high sensitivity gains, nearly a factor of 10 in increasing the field from 9.4 to 19.6 T. (P. Grandinetti/Ohio State and Z. Gan/NHMFL).

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. 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 HRMAS solution probe and ^{1}H/^{19}F 2 mm, 40 kHz, MAS probe will be built in 2003 to extend the NMR capability of resistive magnets to solution samples and high frequency nuclei. A new Tecmag Discovery NMR console, delivered at the end of 2001, has been tested and is available for NMR work on the 45 T Hybrid, the 25 T Keck, 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.

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 added in 2002, and we expect a 7 mm, 12 kHz, MAS large sample volume probe for insensitive nuclei and a 2 mm, 40 kHz, fast MAS probe for ^{1}H/^{19}F nuclei in 2003.

720 MHz solution NMR spectrometer. The console for the 720 MHz instrument will be upgraded to an Inova class. This console will have four independent rf channels with improved rf linearity and time resolution compared to the existing Unityplus console. We recently purchased a new triple-resonance probe for this instrument. Similar console upgrades are planned for the 500 and 600 MHz high resolution instruments. The 500 MHz console is being upgraded to optimize the performance of a triple-resonance 5 mm cryoprobe for biomolecular studies (Delivery expected in spring 2003).

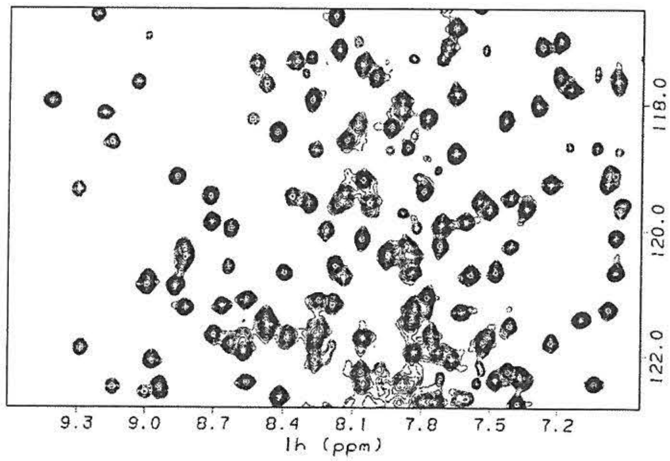


Figure 14. Expansion of contour plot from a 2D [^{15}N,^{1}H]-TROSY spectrum showing the well-resolved crosspeaks. Solution conditions: 1 mM ^{15}N-labeled Arginine Kinase, 5 mM Na-citrate (pH = 6), [90:10] [H_2O;D_2O] and 30 °C. NMR parameters: B_o, 720 MHz; t_{1max}, 72 ms; t_{2max}, 49 ms; measurement time, 6 hr. Final matrix processed to 1.2 and 0.5 Hz/pt. resolution in ^{1}H and ^{15}N dimensions, respectively.

600 MHz, 89 mm bore. This system has been used routinely for solid state and microimaging NMR. An order was placed in September 2002 to upgrade the existing console to the Bruker Avance system for the 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 constructed and will be available soon for NMR studies of membrane protein samples.

Gainesville Update

Bruker Avance 500 MHz. This has been used routinely for solution state NMR. With Prof. Joanna Long, our new hire in solid-state NMR, we will upgrade this instrument to full solid-state capabilities. We will purchase new high-power amplifiers, a triple resonance magic angle spinning probe, preamplifiers, and other necessary items. After the upgrade, this instrument will be utilized 50% for solids and 50% for solution.

Bruker Avance 600 MHz. A Bruker triple resonance cryoprobe is almost installed and should be fully functional by the end of 2002. It is completely equipped for all solution state NMR experiments. We have also purchased a microimaging upgrade that will allow imaging of samples up to about 20 mm in diameter. We anticipate using the instrument on a cycle of two months with cryoprobe followed by one month for imaging.

Bruker Avance 750 MHz wide-bore. This instrument is fully functional for solution-state and imaging. Soon we will be obtaining a 2H probe and amplifier for solid-state NMR. A number of microcoils are being developed for this instrument for both solution state NMR and microimaging through an NIH resource grant that supports the facility. Bill Brey (NHMFL) and Richard Withers (Bruker) are also designing and building a 3 mm triple resonance HTS probe as part of the NIH resource grant.

Bruker 4.7 T/33 cm. This horizontal imaging system is fully functional for routine animal imaging. It is now equipped with 4 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 functional and ready for data collection. Because this is the first of its kind in the world, a number of details of the installation remain to be completed. A limited number of coils are available right now for use, and a number of new coils are being designed and built through the NIH resource grant.

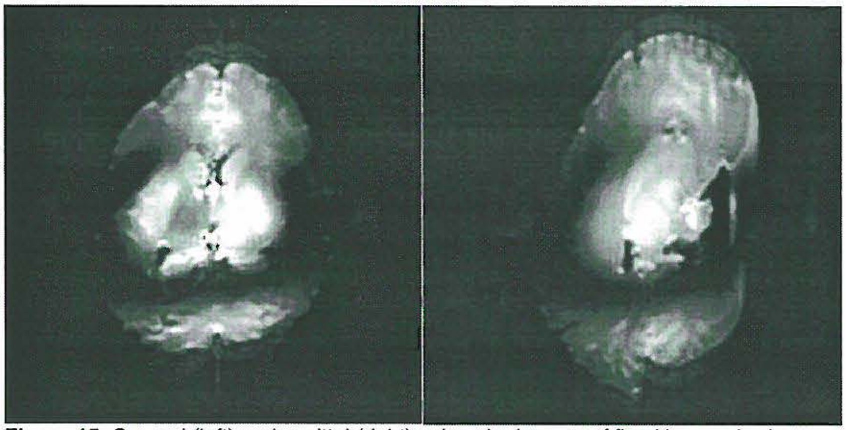


Figure 15. Coronal (left) and sagittal (right) spin echo images of fixed human brain obtained on the 11.1 T/40 cm magnet at UF. Spin echo parameters: 128*128 matrix, FOV 25 cm, TR 671, TE 17, 1 average, 3 mm thick slice, rf pulse width of 8000 μs. Note the large signal drop out arising from rf interactions with a conductive sample. (Data acquired by Barbara Beck, *et al.*, UF.)

Siemens 3 T/60 cm head magnet. This brand new system was installed over the summer and is fully functional. It is being used for human head imaging on research subjects. It is also being used for larger animal studies.

Future Developments

A new research faculty member, Jack Skalicky, has joined the NHMFL in Tallahassee to work with solution NMR users. He comes to the NHMFL following recent terms in the laboratories of Josh Wand and Tom Szyperski. He is particularly interested in dynamics of macromolecular systems and in supercooled samples. Another new member of our research team, Oscar Rhudy, is developing collaboratory tools for enhancing communication between users and the facility. Considerable progress has been made with the development of an electronic notebook and a major database for handling information from one of the consortia that participate in our user base.

In Tallahassee it is anticipated that the NHMFL's 900 MHz NMR magnet with a Bruker spectrometer system will become operational during 2003. This 105 mm bore magnet system will be used to explore a wide range of spectroscopy and imaging applications that take advantage of the wide bore and high magnetic field. Probes are both being purchased from Bruker and being constructed through in house efforts. In particular an In-House Research Proposal with Stan Opella and Robert Griffin has been funded to develop triple resonance probes for aligned and magic angle spinning samples.

Table 12. NMR Spectroscopy and Imaging Facility User Statistics.

	Total	Minority	Women
Number of Projects	89		
Number of Research Groups	85		
Number of Users	181		
Number of Senior Investigators (U.S.)	98	1	7
Number of Senior Investigators (non-U.S.)	20		2
Number of Postdocs (U.S.)	15	1	5
Number of Postdocs (non-U.S.)	4		
Number of Students (U.S.)	41	1	6
Number of Students (non-U.S.)	3		1

Table 13. NMR Spectroscopy and Imaging Facility Operations Statistics.

	833 NB	720 SB	600WB
User Affiliation	**Number of Magnet Days**		
NHMFL	76	256	235
U.S. Universities	66	72	0
U.S. Government Labs	0	0	4
Industry	18	0	0
Overseas	64	20	37
Development & Maintenance	42	17	25
Idle	99	0	64
Total	**365**	**365**	**365**

FOURIER TRANSFORM ION CYCLOTRON RESONANCE MASS SPECTROSCOPY

During 2002, 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 five rotating postdocs who are available to collaborate and/or assist with projects.

FT-ICR MAGNET AND INSTRUMENTATION UPDATE

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, 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 (IRMPD; pulsed UV-VIS available), and electron-induced (ECD).

A **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 FT-ICR instruments are under development. The 9.4 T magnet is currently used for electron ionization (EI), field desorption (FD), and matrix-assisted laser desorption/ionization (MALDI). 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 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 routinely in a similar (lower field) instrument. 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 and MALDI experiments and both should be capable of glass inlet/EI experiments by June 1, 2003.

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 (*J. Am. Soc. Mass Spectrom.*, **13**, 295-299 (2002)). Sites and nature of post-translational modification (e.g., glycosylation, phosphorylation, etc.) are readily determined (*Anal. Chem.*, **73**, 4530-4536 (2001)). 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, conformational changes in *Yersinia* tyrosine phosphatase were induced by point mutation and inhibitor binding and monitored by H/D exchange and FT-ICR (*Biochemistry*, **37**, 15289-15299 (1998)).

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, crude oil samples can be analyzed and components resolved without chromatographic separation. In one recent study 11,000 distinct components were resolved and identified (elemental formulas) in a single electrospray FT-ICR mass spectrum of a South American crude oil (*Anal. Chem.*, **74**, 4145-4149 (2002)).

Table 14. ICR Facility User Statistics (1/1/02 through 12/31/02).

	Total
Number of Projects	63
Number of Research Groups	55
Number of Students	23
Number of Postdocs	10

Table 15. ICR Facility Operations Statistics (1/1/02 through 12/31/02).

	9.4 T, 220 mm	**9.4 T, 155 mm**
Affiliations	**Number of Magnet Days**	
NHMFL, UF, FSU, FAMU, LANL	183	345 (development)
U.S. University	58	
U.S. Govt. Lab	11	
U.S. Industry	11	
Overseas	41	
Maintenance	14	
Idle	27	0
Total	**345**	**345**

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: The first one includes studies of highly concentrated spin systems, typical for material sciences. The second category of applications mainly concerns 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. The major new developments for this year have been the introduction of broadband backward wave oscillator (BWO) sources for the very high field measurements in the resistive magnets and a commercial spectrometer for pulsed EPR at 9.7 and 95 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 impracticable due to the extremely small size, and 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.

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—a new addition in 2002—is a low/medium frequency commercial 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: +/- 3×10^{-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. It features both sub-ns time-resolution and a high g-resolution. The room-temperature sensitivity in CW-mode is of the order of $3x10^{11}$ 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 equipped with an RF coil for high-field ENDOR. Temperature range is 3 to 400 K.

25 T "Keck" Magnet Spectrometer. This instrument is built around the 25 T, high homogeneity magnet. The "Keck" magnet is perfectly poised for EMR—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" bolometer detector with a magnetically extended response is used as detector. The system performance specifications are: 150 to 700 GHz for a g=2 system, sensitivity: 10^{13} spins/gauss at room temperature. Field calibration: g determination error: +/- $3x10^{-5}$. Resolution: better than 10 ppm. Sample temperature: 1.6 to 400 K.

Bruker Elexsys E680 X- and W-Band Pulsed Spectrometer. This commercial spectrometer was installed in mid-2002, and 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 9.7 (X-band) and 95 GHz (W-band) enable a diverse range of pulsed experiments like ESEEM, HYSCORE, DEER, pulsed ELDOR, pulsed ENDOR and TRIPLE, etc., and is especially valuable for the study of the electron-electron and electron-nuclear spin coupling. Typical sample holders are 4 mm OD/3 mm ID quartz tubes for 9.7 GHz and 0.9 mm OD/0.5 mm ID tubes for 95 GHz. The X-band spectrometer is equipped with a 1.5 T magnet, and a 6 T split coil superconducting magnet at W-band. The temperature range at both frequencies is 4 to 300 K.

Table 16. EMR Facility User Statistics, 1/11/2001 to 10/31/2002.*

Research Projects/Groups	**Total**	**U.S.**	**Overseas**
Number of Research Projects	62	46	16
Number of Research Groups	71	47	24
Users	**Total**	**Minority**	**Female**
Numbers of Users	107	2	15
Number of Senior Investigators, U.S.	38	1	3
Number of Senior Investigators, Overseas	24		3
Number of Students, U.S.	23	1	4
Number of Students, Overseas	10		2
Number of Postdocs, U.S.	7		2
Number of Postdocs, Overseas	5		1

Table 17. EMR Facility Operations Statistics, 2001/11/01 to 2002/10/31.*

	17 T	**9 T**	**W-band***
User Affiliation	**Number of Magnet Days**		
NHMFL, UF, FSU, FAMU, LANL	46	64	110
U.S. University	82	34	
U.S. Government Lab	2		
Industry	7		
Overseas	43	20	3
Development	6	52	
Maintenance/Repair	12	74	14
Total	**198**	**244**	**127**

* The W-band was in operation during the period 1/4/2002 to 10/31/2002.

LARGE MAGNET COMPONENT TEST LABORATORY

To support the continued development of a variety of cryogenic/electrical components for large superconducting magnet systems, the Large Magnet Component Test Laboratory (LMCTL) has been established in Cell 16 of the DC Field Facility in Tallahassee. These facilities, which provide high current (up to 80 kA), high field, and low temperatures, have been essential in recent years to programs within the Magnet Science and Technology Group at NHMFL as well as to external groups from both the government and commercial sectors.

Table 18. Magnets in the Large Magnet Component Test Laboratory.

Identifier	Type	Max. Field (T)	Bore (m)	Special Features
Oxford Split	Nb_3Sn/NbTi split solenoid, high-J, impregnated winding	14	0.150	30 x 70 mm^2 radial access
CWTX	NbTi split solenoid, low-J, ventilated winding	8	0.380	67-mm dia. radial access
TACL	NbTi cos(θ) dipole, high-J, ventilated winding	7	0.040	1-m long uniform field region
SMES CTA	NbTi simple solenoid, low-J, ventilated winding	4	2.0	Separate cryogenic test volume in bore

LMCTL Usage in 2002

Test of the 900 MHz NMR Solenoid in an "open" cryostat prior to installation in its final cryostat.

Tests by representatives of Fermi National Accelerator Laboratory to ascertain tolerable levels of quench heating in high-current superconductors potentially applicable to future high-field dipole magnets.

GEOCHEMISTRY PROGRAM

During the past two years the Geochemistry Program has concentrated on using existing instrumentation for geochemical and environmental research, and we have been successful in obtaining external funds for these programs. The majority of the funding for the Geochemistry program comes from the Earth Science Directorate at NSF. There are two active NSF research grants to V. Salters, two NSF grants to Y. Wang, and one EPA grant to R. Odom. 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. The solid Earth geochemistry research spends considerable effort on obtaining a better understanding of melting processes within the Earth and especially beneath ocean ridges. The research this year resulted in a publication in *Nature* on the mineralogy of the source of mid ocean ridge basalts. The Geochemistry program also receives funding from FSU through a Program Enhancement Grant (Salters, PI) and a Center of Excellence grant (Wang). This year two students successfully defended their Ph.D. theses.

The Geochemistry program continued its presence in the environmental science area. It is especially in this area that the interaction with the rest of the NHMFL lies. Major progress was made in this area, and it was shown that electrospray ionization FT-ICR MS does not significantly fragment the organic compounds that make up humic and fulvic acid. In addition, these studies have identified 4,626 individual molecules belonging to 266 homologous series in Suwannee River fulvic acid. The identification of the individual molecules and the discovery of the systematics in what used to be an amorphous entity hold great promise in characterizing and predicting the chemical behavior of dissolved organic matter. We are pursuing speciation studies of metals with dissolved organic matter in natural waters in which we examine metal complexes using FT-ICR-MS, EPR and ICP-MS instruments. This research also involves collaboration with researchers at the Analytical Chemistry Division at Oak Ridge National Laboratory. A new environmental research project was funded through the EPA. This project uses the natural variations in mercury isotopes to determine mercury sources and cycling in the environment.

Instrumentation was maintained and improved without major new developments.

Table 19. Types and Configuration of Geochemistry Mass Spectrometers

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

E = energy filter
M= magnetic mass filter

Table 20. Geochemistry Facility User Statistics (1/1/02 through 12/31/02).

	Total	Minority	Female
Number of Research Projects	19		
Number of Senior Investigators, U.S.	10	2	2
Number of Senior investigators, non-U.S.	4	0	2
Number of Students, U.S.	11	0	7
Number of Students, non-U.S.	0	0	0
Number of Postdocs, U.S.	1	0	0
Number of Postdocs, non-U.S.	0	0	0

Table 21. Geochemistry Magnet Day Statistics (1/1/02 through 12/31/02).

	Isolab	262/RPQ	ICP-MS	Total
User Afffiliation	**Number of Magnet Days**			
NHMFL, UF, FSU, FAMU, LANL	130	140	170	440
U.S. University	10	40	20	60
U.S. Govt. Lab	0	0	0	0
U.S. Industry	0	0	0	0
Overseas	40	20	40	100
Maintenance	56	40	20	116
Total	**226**	**240**	**250**	**716**

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 AND TECHNOLOGY

The Magnet Science and Technology group has three main responsibilities within the NHMFL:

- Major magnet development projects supported by the NHMFL
- Research and development programs to enhance magnet technology
- External activities such as magnet design and development in collaboration with outside organizations.

The first and largest of these activities is a group of major magnet development projects for the NHMFL such as:

- The 45 T Hybrid
- DC "Florida Bitter" resistive magnets
- Short pulse, capacitively driven magnets
- Long pulse magnets powered by the motor generator
- The 900 MHz NMR superconducting magnet.

In addition, MS&T participates in non-NHMFL magnet development projects in part to take advantage of the human capital developed for magnet projects for the NHMFL. The NSF through its review committees has clearly stated that outside development activities are critical to the future of magnet technology and therefore should continue to represent a significant portion of the MS&T workload. A few examples of major external project activities that engaged MS&T staff over the past year are:

- The superconducting "sweeper" magnet system for the Michigan State University, National Superconducting Cyclotron Laboratory
- A radiography pulse magnet system for Sandia National Laboratory
- A repeating pulse magnet for the LANSCE neutron facility at Los Alamos
- A 5 T HTS insert coil prototype in collaboration with Oxford Instruments for high field NMR applications.

Over the past year, there has been significant progress in all the above areas as well as in the basic support technologies. Highlights of these achievements are listed below. Further details are given in the individual project/program reports.

MAJOR PROJECTS

The construction activity associated with rebuilding the Nb_3Sn coil A of the 45-T Hybrid superconducting outsert is well underway. The critical path item is delivery of the conductor from industry, scheduled for January 2003. The project includes replacing the conventional vapor cooled current leads with HTS leads to improve thermal performance. Once the coil A and current leads are complete, the Hybrid will cease operation for approximately nine months for installation of the new components.

to the requirement to allow relatively easy access to the magnet, achieved an operating temperature of approximately 2.3 K. Notable results from the bucket test are as follows.

- The magnet system was charged to within 3% of its final operational field of 900 MHz, 21.1 T. Three quenches were experienced in the following order: 875 MHz, 810 MHz and 842 MHz. Evidence from the final charging run and quench emphasized the reduced thermal stability of the bucket test in a saturated helium I environment ($T > 2.2$ K) in comparison with the sub-cooled helium II ($T \sim 1.8$ K) environment of the permanent cryostat.
- The bucket test revealed a higher than specified field decay rate. However, a method is being implemented in the permanent cryostat which, according to calculation, will correct for this field decay.
- The field homogeneity was measured and the strengths of the eight superconducting shim sets were confirmed to meet specification.
- The bucket test confirmed that the magnet can survive a near full-field quench without damage and allowed the 900 MHz team to make several important modifications to the electronics and quench detection system.
- Most importantly, the bucket test served its primary purpose of providing a sufficient cryogenic environment required to successfully test the magnet system while still allowing relatively easy access to the magnet for modifications.

The bucket test was a successful final system test in all aspects. Although 900 MHz was not achieved, no fundamental limitations in the magnet system were found, and it is fully expected that the more favorable cryogenic environment of the permanent cryostat will provide the thermal stability required to achieve 900 MHz.

After the bucket test was completed, assembly of the permanent cryostat hardware around the magnet assembly began. Most of the cryostat hardware has been prefabricated at Ability Engineering Technologies. Due to the interconnected nature of the magnet and cryostat assemblies, however, the final permanent cryostat assemblies must be assembled around and onto the magnet at the NHMFL. The 4.2 K and 1.8 K assemblies and hardware are the first items located onto the magnet assembly after completion of the bucket test. These are followed by the radiation shields and multi-layer insulation and finally by the vacuum vessel.

In parallel with fabrication of the permanent cryostat, the final user facility is being prepared in anticipation of installation of the 900 MHz assembly. The electrical, vacuum, and other utilities have been installed. The quench detection and data acquisition systems have been located into the control room. The user area platforms have been prefabricated. Final installation of the 900 MHz system is expected in spring 2003.

Table 1. Project Schedule: Wide Bore 900 MHz Magnet System

Milestone	Current Schedule
Receive 4.2 K Vessel Assembly	October 2002
Complete 1.8 K Vessel Assembly onto Magnet	January 2003
Attach 4 K and 77 K Shields	May 2003
Weld Vacuum Vessel in place around Magnet	June 2003
Install Magnet into Final User Facility	August 2003

MAJOR PROJECTS

PROJECT TITLE: **RESISTIVE MAGNET PROGRAM**
REPORT DATE: **DECEMBER 31, 2002**

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 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 eight new coils in our own facility. We have also completed the delivery of a set of four coils for a 33 T magnet to the High Field Laboratory at the University of Nijmegen, The Netherlands. In addition, the Nijmegen lab has built two duplicate sets of coils under a license agreement with the NHMFL. These magnets will be the heart of the new 20 MW DC magnet facility in Nijmegen that should be operational in February 2003. In addition, we completed a coil for the Tsukuba Magnet Laboratory in Tsukuba, Japan.

The following activities are funded under the core NSF grant and will be starting in earnest. They are listed in priority order, with highest priority first. 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 by using a four-coil system similar to our existing 32 mm bore magnets. Design of the coil is complete. Design of mechanical parts (endplates, bus bars, etc.) is underway.
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 is underway.
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.
4. Installation of a wire wound, water-cooled Helmholtz coil in the bore of the existing 25 T, 50 mm bore magnet. The gradient coil will be driven by either ac or dc, for use in magnetometry experiments.
5. Upgrade the field homogeneity of the 52 mm bore, 25 T magnet from 12 ppm to 1 ppm over a 10 mm diameter spherical volume by installing resistive shims coils in the bore of the existing magnet.
6. Design and build a magnet to provide field perpendicular to the access tube. The access tube will have a 32 mm inner diameter and the field provided will be in the range of 20 to 30 T. We are presently considering two design concepts: a traditional split pair of coils and an innovative tilted coil concept. The magnet designed for two 10 MW power supplies should be capable of providing field around 20 T. If the design uses all four 10 MW power supplies, it should be in the 30 T range.

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

Milestone	Current Schedule
Project Starts	December 2001
Coil Design Complete	October 2002
Mechanical Design Complete	Third quarter 2003
Magnet Operational	Third quarter 2004

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

Milestone	Current Schedule
Project Starts	November 2002
Coil Design Complete	First quarter 2003
Mechanical Design Complete	First quarter 2004
Magnet Operational	Fourth quarter 2004

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

Milestone	Current Schedule
Project Starts	First quarter 2003
Coil Design Complete	Second quarter 2003
Mechanical Design Complete	First quarter 2004
Magnet Operational	First quarter 2005

MAJOR PROJECTS

PROJECT TITLE: **45 T HYBRID MAGNET**
REPORT DATE: **DECEMBER 31, 2002**

Objective

This project goal is to restore the superconducting outsert magnet to its full design performance, i.e. 10 kA operating current and 14 T on-axis field contribution. Plans are in place to fabricate a new Nb_3Sn coil and to replace the damaged one. The project 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 reliability.

Background

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 caused by an unprotected quench. Work is underway to build a replacement for that coil. Then, as the fabrication nears completion, the Hybrid will be shut down, the outsert removed, and the degraded coil replaced.

Status

Preparations to rebuild coil A of the superconducting outsert are underway:

- Nb_3Sn wire has been delayed by process failure at the billet-restack level. New restack elements have been reproduced and are in process of drawing to final size. The presently projected delivery is January 2003.
- Cable-design modifications have been successfully worked out through a development program with the cabling vendor, New England Electric Wire Company and an order for the final production is in place.
- The special-order, modified-316LN steel has been successfully produced and tubing for the conductor jacket has been produced from it and delivered to the NHMFL.
- A production facility has been established at the NHMFL to handle all further processing, including: insertion of 800 m of cable into the steel tubing, butt-welding tube sections, leak-testing, conduit shaping, cleaning, insulating, winding, heat-treating, vacuum-pressure impregnation, and assembly.

The schedule now hinges primarily on delivery of acceptable Nb_3Sn wire to the cabling vendor. Future fabrication tasks will be labor-intensive using in-house NHMFL staff. The estimated completion date for the Coil A rebuild is the first quarter of 2004.

Six to nine months prior to an accurate projection for completion of the new Coil A, we plan to halt Hybrid operations and begin extraction of the outsert from the cryostat, allowing disassembly to proceed in parallel with fabrication of the new coil. Reassembly and replacement of the outsert could be accomplished in an additional six months, making the system ready for cooldown and operation in mid to late 2004.

During the extraction and repair of the superconducting outsert, we also plan to replace the "normal" cryogenic current leads presently installed in the Hybrid cryostat with leads incorporating high-temperature-superconductor (HTS) elements and liquid-nitrogen cooling at the HTS/normal interface. We have completed a conceptual design, modeled and tested critical components, procured long-lead items (e.g. HTS tape, special copper for the heat exchangers, and special stainless-steel sheet for the HTS shunt), and are presently carrying out detailed design. The plan is to construct the lead system (leads, cooling system, and controls) and subject it to a thorough test program before making the decision to open the cryostat and extract the present leads.

Table 5. Project Schedule: 45 T Hybrid Magnet

Milestone	Current Schedule
Receive Nb_3Sn Conductor	January 2003
Complete Nb_3Sn Coil A	First quarter 2004
Extract Coil A from Hybrid	Third quarter 2003
Complete Fabrication and Test of HTS Leads	Fourth quarter 2003
Complete Installation of Coil A and HTS Leads	Third quarter 2004

MAJOR PROJECTS

PROJECT TITLE: **60 T LONG-PULSE MAGNET, "MARK II"**
REPORT DATE: **OCTOBER 31, 2002**

Objective

The "Mark II" 60 T Long-Pulse (60 T LP-II) magnet is now currently under construction. This magnet is a slight modified copy with improved materials of the previous 60 T Long-Pulse (60 T-LP) magnet. The engineering recovery plan in place projects the magnet assembly to begin in early 2003 with planned operations to resume in the third quarter of 2003. A magnet review panel will be organized to analyze all aspects of the 60 T LP-II before full operation.

Status

- Quality assurance and metallurgical requirements for the coil shells were achieved and negotiated with the vendor.
- Coil fabrication is progressing; coil #2 has been received.
- 60 T LP-II Liquid Nitrogen Magnet Dewar, G-10 Epoxy Fiberglass Dewar Lid, Magnet Support Spool weldment, and Liquid Nitrogen Catch Tank Dewar have been ordered and are scheduled to arrive in early December 2002.
- Inner Cluster Stainless Steel Support Spool casting has been ordered and is scheduled to arrive November 11, 2002.
- Liquid Nitrogen Displacement Shell (large diameter filament wound epoxy fiberglass composite shell) has been ordered.
- G-10 Epoxy Fiberglass frame structure for top and bottom of magnet has been rough cut and is ready for final machining.

Table 6. Project Schedule: 60 T Long-Pulse Magnet

Milestone	Current Schedule
Coils 1 – 6, 8 and 9 Fabrication	November, 2002
Coil 7 Fabrication	February, 2003
Assembly of Inner Cluster (Coils 1-5) and Busbar Collector Ring	February, 2003
Assembly of Outer Cluster (Coils 6-9)	April, 2003
Assembly of Inner Cluster into Outer Cluster; Assembly of Busbar Riser Sections, G-10 Support Structure, and LN2 Displacement Hardware	May, 2003
Assembly of Magnet into Liquid Nitrogen Dewar; Assembly of All Required Support Hardware	July, 2003

MAJOR PROJECTS

PROJECT TITLE: **100 T OUTER COIL PROJECT**
REPORT DATE: **OCTOBER 31, 2002**

Objective

The objective of this project is the design and construction of the outer coils for the 100 T Multi-Shot magnet (100 T – MS). When completed, this magnet will achieve magnetic field of 100 T by combining a 44 T long pulse magnet with an up to 56 T short pulse insert magnet. The design, development, and production of the short pulse inner coil are the responsibility of MS&T in Tallahassee (see report on the 60 T LP-II magnet). Magnet outer coil assembly is slated to begin construction in the third quarter of 2003 with testing of the magnet to commence in late 3rd quarter or early 4th quarter of 2004. This project is jointly funded by the Department of Energy and the National Science Foundation through the NHMFL.

Status

- Winding of 100 T outer coils will commence when the vendor completes the winding of the 60 T LP-II coils.
- Work on final busbar and frame details is scheduled to resume in 4th quarter of 2002.
- Busbar and support structure design is finalized with assembly and fabrication drawings 95% complete.
- G-10 Magnet frame structure design is complete with fabrication drawings in progress.
- 100 T – MS Liquid Nitrogen Magnet Dewar, Stainless Steel Dewar Lid Ring, Magnet Support Spool weldment, and Liquid Nitrogen Catch Tank Dewar have been fabricated and delivered.

Table 7. Project Schedule: 100 T Magnet Outer Coil

Milestone	Current Schedule
Coil 1 – 7 Fabrication	March, 2003
Assembly of Coils 1-7 into Frame Plate Structure	Begin October 2003; Complete March, 2004
Assembly of Busbars to Coil Leads; Attachment of Busbar Support Structure to G-10 Frame Structure	Concurrent with previous milestone schedule
Assembly of Magnet into Liquid Nitrogen Dewar; Assembly of all required support hardware	April, 2004
Coil 1 – 7 Fabrication	March, 2003
Assembly of Coils 1-7 into Frame Plate Structure	Begin October, 2003; Complete March, 2004
Assembly of Busbars to Coil Leads; Attachment of Busbar Support Structure to G-10 Frame Structure	Concurrent with previous milestone schedule

MAJOR PROJECTS

PROJECT TITLE: **100 T INSERT MAGNET PROJECT**
REPORT DATE: **DECEMBER 31, 2002**

Objective

The objective of this activity is to design, construct, and test a 15 mm bore, capacitor powered 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

- Four conceptual designs for the 100 T insert have been reviewed. The insert calculations have been made assuming an outer coil set field contribution of 44 T at peak field. The outer coil set generates a 47 T flattop and undergoes a 3 T field suppression to 44 T when the insert coil is fired. These designs are not all 100 T inserts.
- Detailed design activity has first focused on the development of the 65 T-ZM concept to fully evaluate the lead and coil mechanics. The planning then will be to produce a 75 T prototype operating under realistic fatigue conditions. The 75 T-ZM coil is a 75 T, 15 mm bore coil design that incorporates the 100 T insert CuNb conductor into a "user" magnet design.
- Cyclic fatigue testing of the CuNb conductor material is underway to quantify the reliability of a given design.

Table 8. Project Schedule: 100 T Magnet Insert Project

Milestone	Current Schedule
Receipt & Processing of MP35N	December 2002
Development of Transitions & Leads	February 2003
Resolution of Protection Issues	February 2003
Construction/Operation of 75 T CuNb Coil	March 2003
Materials Testing Protocol for High Shot coils to Access Risk and Design Integrity	January 2003 to June 2003
Production of First Insert	Summer 2003

MAJOR PROJECTS

PROJECT TITLE: PULSED MAGNETS FOR USER FACILITY
REPORT DATE: DECEMBER 31, 2002

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 magnet technology
(3) Upgrade user magnet performance in terms of field, reliability and pulse frequency
(4) Identify and pursue the needed materials R&D to continuously advance the magnet technology.

Status

The NHMFL pulse magnet group presently supplies the user facility with three short pulse magnet configurations:

(1) 50 T-UG series magnets: 24 mm ID, 10 ms rise time, and 20 minute cycle time between shots. The 50 T-UG series magnets are standardized as they are the oldest design in production. Typically these magnets achieve a full field shot life in excess of 800. The 50-T UG design remains in production because it has a larger bore and a rapid shot-to-shot cycle time.
(2) 50 T mid-pulse magnets: 15 mm in bore, a 30 ms rise time, and 120 minute cycle time between shots. The 50 T mid-pulse magnets were developed to provide longer time pulse physics at 50 T as necessary alternative to the to the 60 T long pulse system. The first improved 50 T mid-pulse began operation in November 2000 and has operated since that date accumulating in excess of 400 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 unit ends its life cycle. We will continue production of the 50 T mid-pulse magnets in 2003 on an as required basis.
(3) 60 T-ZMD series magnets: 15 mm in bore, a 6 ms rise time, and 30-35 minute cycle time between shots. The group has continued to improve reliability of the 60 T-ZM series user magnets. The ZM design series is now up to a "ZMD" designation to reflecting a forth production/design revision. Presently there are two additional reserve coils in inventory at this facility to ensure reliable user operations.

Operationally, the time between shots, or cycle time, increases with peak field. The 50 T-UG coils require 20 minutes to cool down after a full field shot. 60 T-ZMD coils require approximately 30-35 minutes to cool down. The 50 T mid-pulse coils cool down in about 120 minutes. The issue of cycle time has become a design specification for magnets. Therefore, the present prioritized objectives for new user systems are: (1) reliability, (2) higher fields, and (3) increased shot-to-shot cycle time. The group intends to meet these engineering goals by designing nested coil assemblies with a cooling annulus between coils. Conceptually, a two coil system with a single annular gap can reduce cycle time by a factor of three. We have developed a detailed design that incorporates this technology. We plan to introduce "gap technology" into prototype pulse coils by the end of 2002.

The present development plan, or roadmap, specifies that we first produce a 65 T "gap technology" short pulse user magnet. The magnet will be comprised of two coils in a nested axially symmetric assembly. Each coil will have six winding layers. The inner coil is an internally reinforced structure. Significant design and engineering effort has gone into the coil mechanics and the lead configurations. The operational design targets for the prototype are: (1) a 65 T operating field, (2) a temporal rise time of 9 ms, (3) a cycle time 20 minutes between shots, (4) an initial reliability of 500-1000 full field shots. The pulse magnet group is now fully engaged in prototype production of this magnet.

After completing the 65 T gap magnet, gap technology will be used to produce additional coils: (1) a ~75 T prototype user coil using CuNb conductor material from the 100 T insert program, (2) a 100 T insert prototype extrapolated technically from the 65 T inner-coil design, and (3) a 55 T mid-pulse class coil with the same technology. This plan integrates the requirements of the 100 T program with the user magnet program.

Table 9. Project Schedule: Pulse Magnets for User Facility

Milestone	Current Schedule
Delivery of 65 T Prototype User Coil	December 2002
Delivery of 75T Prototype User Coil	June 2003

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: HIGH FIELD HTS INSERT COILS AND COIL TECHNOLOGY
REPORT DATE: DECEMBER 31, 2002

Objective

The goal of this activity is the development of high field insert coils using high temperature superconductor (HTS) materials. The generation of 5 T in a 20 T background corresponds to a 1.1 GHz NMR system. Toward this end, the immediate objectives are:

- Conductor development and characterization for improved electrical and mechanical behavior
- Coil winding studies for the development of suitable techniques for layer wound coils with co-wound reinforcement and improved packing factor
- Testing of double-pancake coils and prototypical inserts to better understand coil performance, leading to improved coil design
- Development of a 5 T pre-prototype insert for testing in the large bore resistive magnet in spring 2003
- Development of insulation for layer-wound coils.

Accomplishments

In the past year significant progress has been made in the 5 T insert coil project. This project continues to be a close collaboration with Oxford Superconducting Technology (OST) in Cateret, New Jersey. This past year, the NHMFL has wound and tested twenty-three double pancake coils for the 5 T insert coil. From these we have at least six A-coils and seven B-coils that qualify for the final coil stack. All A- and B- coils will be react-and-wind coils. This is a significant improvement from the original 5 T coil design that results from improvements in the reacted HTS conductors. All coils are manufactured by co-winding insulated stainless steel strip with the HTS conductor. The stainless steel serves as a carrier for the turn-to-turn insulation (deposited at the NHMFL using the continuous sol-gel system) and as reinforcement. Furthermore, we have wound two layer-wound coils of the same diameter as the C-coil. These are the first layer-wound HTS coils manufactured at the NHMFL. Testing of these coils showed no reduction in coil Ic as compared to short sample Ic, no turn-to-turn or layer-to-layer shorts, and no degradation in Ic at the turnaround (where one layer ends and the winding process must step-up one layer in height and reverse direction). These are also wound with co-wound insulated stainless steel. The layer wound coils are wet-wound.

In the past year, we have studied the effects of magnetic fields on the growth of BSCCO-2212 conductors. Initial studies on thick monofilament tapes showed significant increases in the critical current density and in the thickness of well-aligned grain colonies within the core. Building upon this, we have done similar studies on multifilamentary conductors from OST. Increases in critical current density on the order of 50% and greater were obtained.

Activities

In the past year we have continued to measure a large volume of short samples of HTS conductors. Recently, two sources of conductors have consistently required currents well above the 600 A limit of our multi-sample probe and thus have required measurement on a high-current single sample probe. In response to this, we sponsored a group of Mechanical Engineering seniors from the FAMU-FSU College of Engineering to design a 1 kA, eight-sample, multi-sample probe as their senior design project. The design is complete, and we are finalizing shop drawings.

One source of the high current samples is OST. These conductors have a much higher critical current density and a higher fill-factor than previous conductors. Thus, they require extensive mechanical performance testing. The present 5 T design (which was based upon a much lower critical current density than these recent conductors) is current-limited and not strain-limited, so margin exists for these conductors to have slightly reduced mechanical performance, or, being more optimistic, to take advantage of their electrical performance.

Progress on the 5 T coil continues, and we anticipate testing the coil in the large bore resistive magnet in the second quarter of 2003. Design of a coil-testing safety system is required.

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: HIGH STRENGTH MATERIALS
REPORT DATE: DECEMBER 31, 2002

Objectives

The high strength material program enhances the NHMFL facilities by development of high strength materials used for high field magnets and promotes fundamental material research by examination and utilization of nanostructures in selected high strength conductors and reinforcement materials. This program focuses on:

- Exploration of new materials that have the potential to be used for next generation magnets
- Assessment and development of different fabrication routes for different conductors and reinforcement materials for various magnets in collaboration with industrial partners
- Evaluation of the impact of the properties, microstructure and phase transformation on the performance of both materials in the high field magnets.

Accomplishments

Cryogenic Deformation of Conductors. The exploration of new conductors for the future magnets is concentrated on a continuous effort of cryogenic deformation of Cu and Cu+ nano-particles. The thermal instability of the high strength conductors is also assessed in temperature ranges higher than 285 K in order to simulate the performance of such materials in the magnets because both DC and pulsed magnets may operate at temperatures as high as 373 K. The materials produced by cryogenic deformation have higher strength and comparable conductivity compared to the room temperature deformed conductors. In addition to the fabrication and mechanical property measurements, the research this year has been concentrated on the thermal properties of the cryogenic deformed Cu. The heat and critical temperatures of recovery and crystallization of both room temperature and cryogenic deformed Cu were measured because such parameters are related to the maximum operation temperature of the magnets. The cryogenic temperature deformation doubled stored energies in the conductors compared to room temperature deformations. In addition, the critical temperatures are decreased from 510 K to about 470 K. Although this temperature decrease will not have significantly impact the performance of the conductors in the magnets because the majority of the pulsed and DC magnets operate at temperatures lower than the critical temperatures of the new conductors, it shows that such high strength Cu is less stable than commercially available hard Cu.

In order to increase the strength and stability of the conductors, nano-particles are added to the Cu to pin the defects accumulated at cryogenic temperatures. The assessment of the microstructure and properties of cryogenic deformed Cu+nano-particles indicates that the structure and strength formed by 77 K deformation is stabilized. The results indicate that the low temperature deformation introduces more strain hardening in Cu+ nano-particles conductors at various strain levels so that higher strength can be achieved compared to either pure Cu or room temperature deformed Cu+ nano-particles conductors. Therefore, such materials have the potential to be used as high strength conductors for next generation magnets.

New Reinforcement Particles. The single-walled carbon nanotubes (SWNTs) are also considered as strengthening components for conductors, reinforcement materials, and insulations for high field magnets because of their high strength, conductivity, and fiber shape. Although it is unclear if the SWNTs will be more efficient than the traditional nano-particles as strengthening components, the anisotropy and very high strength of the SWNT does have the attractions because the majority of the materials used in the magnets require high strength and anisotropy properties. For instance, the reinforcement materials for pulsed magnets require higher strength in hoop direction than in other directions. It is expected that the SWNTs should have the anisotropy distributions in order to use the anisotropy feature of the SWNTs. The preliminary work is therefore concentrated on the alignment of the SWNTs and characterization of the anisotropy of the SWNTs. The alignment appears to result in the anisotropy of the resistivity and elastic modulus of the SWNTs reinforced composites.

Cu-Ag and Cu-Nb. The study of fabrication routes and properties of the "conventional" high strength Cu-Ag, and Cu-Nb conductors has taken an approach to relate both the properties and basic science of nanostructured materials to the design requirements of the magnets. Fabrication of Cu-Ag, and Cu-Nb aims to make high strength conductors with nanostructures and appropriate sizes required for the magnets. The Cu-Nb materials have been made from rod into sheet using conventional rolling techniques. It appears that rolling increased the hardness of the Cu-Nb materials (from 250 HV to about 270 HV) that have the potential to be used in DC magnets. In addition, the rolling also introduced strong textures mainly in Cu matrix as in drawn materials. The cold work also increased interfaces areas so that the system stores excessive energy. The complex crystallographic structure and nanostructure bring about sophisticated strengthening mechanisms in Cu-Nb: (1) the large interface areas in the unit volume, (2) the lattice distortions induced by the deformations, and (3) the refinement of the structures. Therefore, in order to strengthen the conductors further for high field magnets, all these factors have to be taken into account, as well as the fact that all these structure changes increase the stored energy in the system. The stored energy has been measured systematically in Cu-Ag with respect of the fabrication routes. As the strain increases, the stored energy in the system increases, as measured by a differential scanning calorimeter. Therefore, the higher strength conductors may require lower operating temperatures for future magnets. Further clarification of the roles of the strengthening mechanisms and stored energy will help the materials scientist to understand the performance of the conductors in the magnet and pave the way for fabrication of this material into various shapes required for high field magnets.

Cobalt-Nickel Alloys. The reinforcement materials investigated are cobalt-nickel alloys in sheet form for various pulsed and hybrid magnet. 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. The cobalt-nickel alloys are strengthened mainly by dislocations and nano-platelets that are only a few atomic layers thick. The size, density, and volume fraction of the nano-platelets are quantified and related to the heat treatment and mechanical properties of the cobalt-nickel alloys. The aging, which increase the strength by more than 20%, does not increase the thickness or change the orientation of the platelets. Instead, the total length of the platelets is increased by aging. Apparently, the increase in the platelets diameter or length strengthens the materials but reduce the ductility, as observed by mechanical tests. As the reinforcement materials for pulsed magnets require the material stronger in the rolling direction, further research is undertaken to re-orientate the nano-platelets to achieve higher strength in the hoop direction of the magnets.

RESEARCH AND DEVELOPMENT PROJECTS

PROJECT TITLE: **CRYOGENIC COMPONENT DEVELOPMENT**
REPORT DATE: **DECEMBER 31, 2002**

Objective

The primary objective of this program is to support the development of cryogenic systems for NHMFL superconducting magnet technology. The program also actively seeks 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 R&D to advance cryogenic technology for improved application
- 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. These are as follows:

- Continued support for the development for the 900 MHz NMR magnet cryostat. Fabrication is underway at Ability Engineering and Technology. Installation of the completed 900 MHz magnet is scheduled to be complete by spring 2003. The CCD group is heavily involved in the detailed component design, final assembly, and testing of the final system.
- Analysis and development on the cryogenic system for HTS transformers. This work is jointly funded by the NHMFL and the Center for Advanced Power Systems (CAPS). It is also carried out in parallel with a similar HTS transformer project sponsored by the Korean government. The primary activity involves development thermal optimization models for HTS transformers and applying these models to the design of prototype cryogenic systems.

In addition, the CCD group is pursuing several independently funded R&D activities 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.** This program is supported by a grant from the National Science Foundation. The work involves experimental application of modern particle imaging techniques to flow conditions in liquid helium.

- **Liquid Helium Fluid Dynamics Studies.** This program is supported by a grant from the Department of Energy. The work focuses on cryogenics issues for cooling of future particle accelerators.

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.

Seven IHRP solicitations have now been completed with a total of 278 proposals being submitted for review. Of the 278 proposals, 134 were selected to advance to the second phase of review, and 57 were funded (21% of the total number of submitted proposals).

2002 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 second year during 2002 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 31 pre-proposals received, the committee recommended that 12 pre-proposals be moved to the full proposal stage. Of the 12 full proposals, 6 projects were awarded. A breakdown of the review results is presented in the following tables.

Table 1. IHRP Awards for 2002

Research Area	# Pre-Proposals Submitted	# Proceeding to Full Proposal Status	# of Projects Funded
Condensed Matter Science	18	7	3
Biological & Chemical Sciences	10	4	3
Magnet & Magnet Materials Technology	3	1	0
Total	**31**	**12**	**6**

Table 2. IHRP Funded Projects for 2002

Lead P.I.	NHMFL Institution	Project Title	Funding
James Brooks	FSU	Spatially Resolved EMR Studies of Physical, Chemical, and Biological Spin Structures in High Magnetic Fields	$243,521
Zachary Fisk	FSU	Metamagnetism and Unconventional Superconductivity in f and d Electron Systems	$209,843
Riqiang Fu	NHMFL	Use of High Field Solid State ^{19}F NMR Spectroscopy to Study Membrane Proteins	$198,167
Yoonseok Lee	UF	Effect of Strong Magnetic Fields on Dirty Superfluids ^{3}He	$139,768
Charles Mielke	LANL	The Radio Frequency Amplitude Modulated Calorimeter	$209,802
Jack Skalicky	NHMFL	Functional Dynamics of Arginine Kinase: Development of TROSY-Based NMR Spectroscopy	$142,059

2003 Solicitation

The 2003 Solicitation Announcement will be released in March, 2003. Awards will be announced in August.

5. EDUCATION PROGRAMS

The NHMFL's Center for Integrating Research and Learning continues to develop and facilitate new programs to enhance science education in elementary, middle and high school classrooms. The challenge of bringing science to students and teachers is greater than ever and educators at the Center are focused on increasing outreach and expanding support for classroom science. This support takes many forms that are outlined in this report. While structured programs make up the bulk of the Center's educational offerings, more and more we are faced with reacting to the needs of individual teachers, schools, school districts, and states. This requires that the Center be able to change focus and develop new programs in response to the needs of the science education community. It is a challenge that requires flexibility and innovation and one that the Center accepts knowing that it reinvigorates already existing programs and encourages creativity in developing new programs.

Center educators continue their commitment to finding ways to engage underserved students and communities and to develop programs that encourage young women to pursue science and engineering careers. We recognize our responsibility to surrounding communities, and we relish the unique opportunities the NHMFL offers for science educators. Each new idea, new program, or new challenge reinforces our commitment to enhancing and extending the science experience for young people. In support of teacher renewal and retention, the Center is continuing its active program of regional workshops to help teachers support educational standards through inquiry-based classrooms and to demonstrate ways to incorporate science that results in greater achievement and higher levels of science literacy for their students.

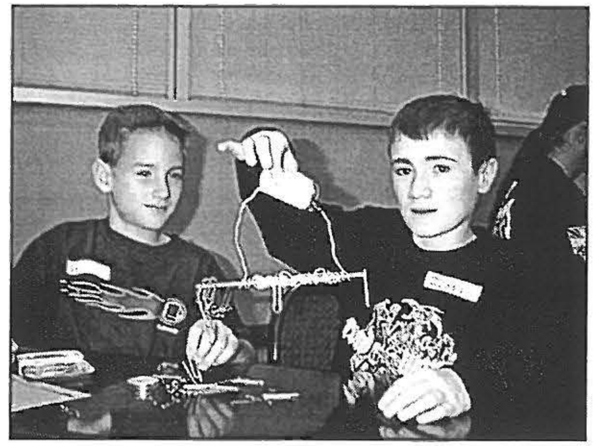
STUDENT EDUCATION

A signature program of the Center, the **Research Experiences for Undergraduates** program, drew 126 applications from 28 states. In all, 16 students were placed in the program, 11 at the main site in Tallahassee, 2 at the University of Florida NHMFL facilities, and 3 at Los Alamos National Laboratory. The number of applications increases each year and separate funding has been applied for in order to facilitate full REU programs at each of the three NHMFL sites. Center educators are fully committed to providing a research mentorship that addresses intellectual, social, and educational needs of students through seminars, colloquia, and workshops in addition to the daily laboratory work. This rich experience culminates with students publishing research as co-authors with supervising researchers.

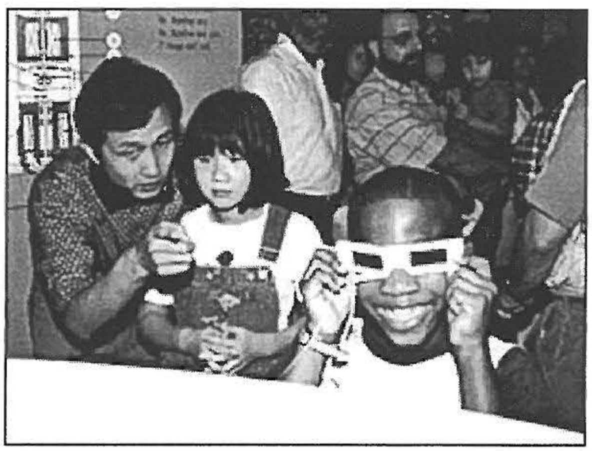
Table 1. Research Experiences for Undergraduates, 2002

REU Participant	NHFML Mentor	School	Area of Research
Keirse Crockett	Justin Schwartz	Harvard University	Effects of Doping in the MgB_2 Superconductor
Jason Crowe	Philip Gao	Clarkson University	
Winston Czakon	Alex Lacerda	Georgia Institute of Technology	Fast Response Frequency Counter
Alisha Elsebough	Roy Odom	Florida State University	Staurolite Indicates Regional Metamorphism
Vanousheh Ghandehari	Hamid Garmestani	University of California-Berkeley	Biomechanical Comparison of Reptilian and Mammalian Prismatic Enamel Microstructures
Evan Goetz	James Brooks	University of Washington	Heat Capacity of Heavy Fermion Compounds
Alex Graffeo	Luis Balicas	FSU-FAMU College of Engineering	Changes in Resistance of Certain Materials While Exposed to Various Magnetic Fields (0-33 T) at Different Angles
Melinda Lee Graham	Roy Odom	Florida State University	Staurolite Indicates Regional Metamorphism
April Jue	Philip Gao	University of North Carolina- Chapel Hill	The Purification of "Mycobacterium Tuberculosis" Membrane Proteins
Jerrold Keilbasa	Mark Meisel	University of Florida	Low Temperature Techniques for Detecting Structural and Magnetic Transitions
Kathleen Leenerts	Alex Lacerda	Colorado State University	Magnetic Properties including the Brillouin Function
Andrew Steinberg	Mark Meisel	Duke University	Biomagnetics: Middle Range Magnetic Fields and Its Effect on the Transcription of the Adh/GUS and Adh/GFP Promotor-Reporter Systems in ARABIDOPSIS thaliana
Elizabeth Stringer	Dragana Popovic	University of the South	An Examination of Gallium Arsenide Semiconductors
Mark Wang	Yang Wang	Dartmouth College	Carbon Isotopic Ratios of Ancient Herbivore Diets
Mary Woodruff	Alex Lacerda	Iowa State University	Ytterbium Nickel Boron Carbide in High Magnetic Fields
Autumn Wyda	Justin Schwartz	Carnegie Mellon University	Effects of Doping in the MgB_2 Superconductor

In spring 2002, **17 middle school students** worked with 9 mentor scientists and researchers conducting real-world science research projects. The culminating event, a public presentation of research, served as an example of what students can accomplish when given the opportunity to experience the excitement of science in the context of a national laboratory. Presentations were an outstanding illustration of the extraordinary abilities of young students when given the chance to work with world-class scientists who volunteer their time to make the program a success.



In an effort to expand **high school outreach** and work with local schools to provide meaningful internship/externship experiences, 15 high school students worked with engineering students from the FAMU/FSU College of Engineering on Senior Design projects. Each high school student had a senior engineering student mentor who provided content instruction as well as practical help to create coils for a model MagLev train. The program is expected to continue in academic year 2002-2003.



Continuing in the tradition of providing quality outreach to classrooms and schools, Center educators conducted outreach and tour activities with **3,449 elementary, middle and high school students**. This represents approximately **13,500 contact hours**. The total number of people who experienced outreach from the NHMFL was **5300** (not including the March 2002 Open House) representing **15,500 contact hours**.

The Center takes an active role in establishing and maintaining community partnerships that expand, enhance, and extend science experiences to K16 students. Following is a list of student-centered programs supported by outreach, seminars, and lectures provided by the Center. **Frenchtown After School Project** targeting K12 students in underserved areas via community centers; **Middle School Girls Enhancement Project**, a pilot program developed with the Florida Agricultural and Mechanical University's Center for Equity; **Bryan Hall Living Community**, one-semester mentorship program for undergraduates; **Women in Math, Science, and Engineering (WIMSE)**; **Partners for Excellence,** Sealey Magnet School for Mathematics and Science and Fairview Pre-IB Middle School; **FAMU Outreach Day**, providing science experiences for middle school girls from a 5-county area; **MagLab Night**, an evening of scientific exploration and discovery for parents and children.

TEACHER EDUCATION

The **Research Experiences for Teachers** program completed its 4th summer, with **18 elementary, middle and high school teachers** creating innovative, inquiry-based explorations for their students that are based upon the research conducted in NHMFL laboratories. Each of the teachers also participated in a public presentation of research, describing the projects completed under the guidance of NHMFL scientists. Five teachers returning for their second year provided peer counseling and mini-workshops for teachers new to the program. New features were incorporated into the existing program as a result of the NSF-sponsored BRISC (Bringing Research Into Science Classrooms) Conference in April 2002. Two projects have evolved from the RET program: a superconductivity laboratory at Apopka High School (Florida) and a museum-quality traveling exhibit on magnets, magnetism, and superconductivity that is being developed.

Providing quality **professional development opportunities and workshops** for teachers in the State of Florida and around the county continues to be a focus for the Center. There are more requests for workshops than we can provide, pointing up the desire among teachers to enhance content knowledge and to find new ways to create inquiry-based classrooms in support of national and state standards. The Center has forged a partnership with the **Endeavour Academy**, the educational programs department of the **Technological Research Development Authority** in Florida. This partnership will help facilitate quality science workshops for teachers in Florida.

Science, Tobacco & You continues its success in Florida and across the nation. The science curriculum is being used in 20 states and in the 2002-2003 academic year was again funded through the Florida Department of Health. Center educators provided workshops and materials for 500 Florida teachers. In addition, workshops were held in Kentucky, Virginia, West Virginia, South Carolina, Louisiana, and Arkansas. Two evaluations are currently being conducted of the program to ensure its competitiveness with other science-based tobacco programs.

Summer Institutes have replaced school-year teacher workshops as the professional development opportunity of choice for elementary, middle and high school teachers. In summer 2002, with funding from local school districts, the Center developed and facilitated a 4-day content-rich summer institute for **44 teachers**. School districts have already requested that the Center develop new 4-day programs for summer 2003, and have encumbered funds for two new institutes. In addition, summer institutes will be conducted for Broward County, Florida teachers.

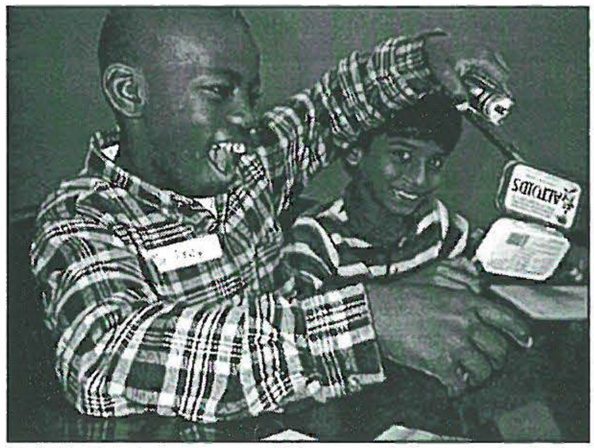
The **NHMFL Ambassador Program** continues to be a principal feature of Center programs and enables us to maintain close ties with teachers from North Florida and South Georgia. Teachers serve as advisors for Center programs and provide valuable firsthand knowledge of what is happening in today's classrooms relative to science education. As an extension of the Ambassador Program, the Center supports a wide variety of teacher events in the counties surrounding the laboratory.

Table 2. Research Experiences for Teachers, 2002

RET Participant	NHMFL Mentor	School	Area of Research
Ken Bowles	Justin Schwartz	Apopka High School Altamont Springs, FL	Superconductors: A Mobile Museum Exhibit
Pat Cramer	James Walker	Deerlake Middle School Tallahassee, FL	Measuring Canine Olfactory Function
Matt Guyton	James Brooks	Griffin Middle School, Tallahassee, FL	1. The physics of microgranular material 2. A practical handbook of material science
Laura Harrison	James Brooks	Preservice teacher, Flagler College	1. The physics of microgranular material 2. A practical handbook of material science
Joann Hartmann	Bob Goddard	Preservice teacher, Flagler College	Illusions - That's How I See It
David Lang	Yusuf Hascicek	Sealy Elementary School, Tallahassee, FL	Preparing & Testing Superconductors
Scott Mazur	James Walker	Killearn Lakes Elementary School, Tallahassee, FL	This Chamber's Smokin'
Brian McClain	Justin Schwartz	Godby High School, Tallahassee, FL	Superconductors: A Mobile Museum Exhibit
Rich McHenry	Phil Kuhns and Arneil Reyes	Leon High School Tallahassee, FL	Modeling Nuclear Magnetic Resonance
Monique Quinones	Eric Palm	Hunter's Creek Elementary School, Orlando, FL	Be Cool In School: The History of Refrigeration
David Rodriguez	Roy Odom	Raa Middle School Tallahassee, FL	Uranium Dating of Conglomerate Samples
Farrell Rogers	Yusuf Hascicek	Marshall Middle School-Lakeland, FL	Preparing & Testing Superconductors
Jennifer Rogers	Eric Palm	Metro West Elementary School, Orlando, FL	Be Cool In School: The History of Refrigeration
Alan Turner	Bob Goddard	Roosevelt Middle School Danielson, CT	Illusions - That's How I See It
Carlos Villa	Roy Odom	Preservice teacher Florida State University	Uranium Dating of Conglomerate Samples
Pat Wagner	Roy Odom	Essrig Elementary School Palm Harbor, FL	Uranium Dating of Conglomerate Samples
John Willoughby	Phil Kuhns and Arneil Reyes	Rickards High School Tallahassee, FL	Modeling Nuclear Magnetic Resonance
Kim Zenon	Bob Goddard	Braden River Middle School, Bradenton, FL	Illusions - That's How I See It

In an effort to keep in touch with issues in science education, the Director continues to teach **undergraduate classes** in science methods. Working with pre-service teachers and mentor teachers in area schools as far away as South Georgia provides a balanced picture of science education in classrooms. This experience furthers the Center's commitment to quality science experiences for K12 students. The Director of the Center also committed to assisting with instruction of physics graduate students participating in the GK12 program at Florida State University, teaching a mini-course on curriculum and implementation in K12 classrooms.

GENERAL PUBLIC AWARENESS



The NHMFL's Annual Open House attracted over **2100** people. Visitors were treated to demonstrations and interactive experiences that translated research done at the laboratory for a general audience. Laboratory scientists, researchers, and staff helped encouraged visitors to participate in all exhibits and events on their self-guided tours, including those provided by educational, cultural, and environmental community partners from around the region. In addition to the Open House, tours and outreach were conducted for **1525** members of the general public, representing approximately **3000** contact hours.

Other community outreach efforts included participation in troop events for the **Girls Scouts of the USA, Education Expo: Raising a Healthy Child, Chain of Parks Community Outreach** and **Governor's Square Mall Science in Your Community Event.**

CURRICULUM DEVELOPMENT

Development of additional components to the **Science, Tobacco & You** curriculum package has been ongoing and will be completed by spring 2003. Other ongoing curriculum development projects are expanded **Pre/Post Materials** for K12 visitors to the laboratory, new Activity Books for elementary and middle school students, newspaper-based resources as part of the NHMFL Open House, Web-based activities for teachers and students, and expansion of the **Science, Optics & You** materials. Curriculum materials were developed to support Literature in Science, Motion, Forces and Energy, and Current Issues in Science mini-workshops conducted with the Florida Writing Project and the Physics Department at Florida State University.

EDUCATIONAL RESEARCH

The Center renewed its effort to establish research partners and network with other groups currently conducting research. Participation in an NSF-funded study of Research Experiences for Teachers programs has led to incorporation of new features into the NHMFL RET Program. In addition, collaboration with other science-based educational programs has provided a new perspective with which to view current educational programs at the NHMFL. Consequently, two Center-supported evaluation programs are being conducted: one is an overall evaluation of the Center's activities, and the second will look at the RET program specifically. The RET-focused research deals with student outcomes as a result of teacher participation in NHMFL programs.

EDUCATIONAL RESOURCE LABORATORY

In fall 2002, the Center actively promoted labwide use of the Educational Resource Laboratory (ERL), offering assistance with meetings, seminars, classes, and presentations. This has met with great enthusiasm on the part of scientists, researchers, students, and staff, and Center educators are encouraged by the collaborations that have resulted. The ERL is used as part of teacher workshops and summer institutes to provide educators with strategies for incorporating technology into science classrooms. In addition, the ERL is heavily used during the summer for the REU and RET participants, both in structured workshops, reserved time on computers, and for general support of research.

PARTNERSHIPS AND COMMUNITY ACTIVITIES

Training Solutions Interactive, Inc. continues in its role as sole marketing group for the NHMFL's *Science, Tobacco & You* science curriculum outside of the State of Florida. The Center continues to consult with its subsidiary **I^4 Learning** on other health-related science curriculum products.

The Center continues its active role in the community through general membership and membership on the Board of Directors of the **Community Classroom Consortium**, a group of 30 to 50 educational, cultural, scientific and environmental non-profit groups with a mission of community outreach and professional development.

The Center maintains memberships on the Board of **Leon Association of Science Teachin**g and the **Tallahassee Scientific Society**, supporting efforts to provide quality materials, professional development, and enrichment activities for science educators. In addition, through LAST, students are awarded scholarships to attend regional, statewide, and international science fairs.

Currently, the Center has several partnerships with groups housed at **Florida Agricultural and Mechanical University** (FAMU). We are active participants in events, activities, mentorships, and internships for the Florida-Georgia Alliance for Minority Participation, FAMU's Center for Equity, and the Regional Institute for Math & Science (RIMS). The Center coordinates tours, outreach, and internships for participants in these programs, exhibits at regional and national symposia, and works with these groups to create new programs for typically underserved and underrepresented groups in math, science, and engineering.

In 2002, the Center established a working relationship with **The Endeavour Academy**, the educational programs arm of the **Technological Research Development Authority**. The Center has contracted to provide workshops for Florida teachers on magnets and magnetism and is working toward providing an extended series of workshops through the Academy's programs.

6. COLLABORATIONS

The National Science Foundation challenged the NHMFL from the beginning to outreach to other institutions of all types to address one of the laboratory's core missions:

> *...the laboratory is expected to engage in the development of future magnet technology. The development of new materials for high field magnets will be an important aspect of this activity.*

These collaborative activities provide a valuable resource for the exchange of ideas, techniques, and innovative instrumentation. Many of the NHMFL's external collaborations result in more long-term projects such as SBRIs, STTRs, CRADAs, or Memorandums of Understanding. The laboratory has also actively pursued collaborations with the other international high magnetic field laboratories. These interactions have resulted in the NHMFL assisting its counterparts in procuring and fabricating state-of-the-art magnets designed by the laboratory's Magnet Science and Technology group.

PRIVATE SECTOR ACTIVITIES

American Superconductor Corporation (AMSC), Westborough, MA. As part of the ONR-supported high temperature superconductors (HTS) motor program, the NHMFL has characterized AMSC conductors. In particular, the NHMFL has focused on the effects of mechanical stress and strain (both tensile and compressive), one of the current-carrying capabilities of AMSC conductors. The NHMFL has developed special facilities to extend testing of these AMSC conductors to a temperature of 27 K. In addition, we are working with AMSC through a Department of Energy funded program to investigate the stability and quench propagation behavior of Y-Ba-Cu-O coated conductors. Furthermore, with funding from the Air Force Office of Scientific Research, we are characterizing AMSC coated conductors using short-sample transport measurements at high magnetic field, and the magneto-mechanical behavior 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's 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.

MAGLEV 2000, Brevard County, FL. The NHMFL is a contributing partner to this project in east central Florida. MAGLEV 2000 is supported by Florida industry, academia, and the state Department of Transportation. For a decade the State of Florida has had an ongoing interest in maglev technology as the next-generation alternative to high-speed rail in congested central and south Florida. A recently adopted state constitutional amendment mandates that the state develop a high-speed rail project.

Mary Brogan Museum of Arts & Sciences, Tallahassee, FL. The Center for Integrating Research and Learning at the NHMFL has developed a working relationship with the Mary Brogan Museum of Arts & Sciences, the capital city's newest museum. The Museum and the Center are currently developing educational programs and exhibits that feature the NHMFL and magnet science and technology. Several activities are being planned, including permanent exhibits at the Tallahassee museum, traveling exhibits that will be featured at Florida's other science museums, and collaborative educational programs for students, teachers, and the general public.

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.

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 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.

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 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's 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.

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.

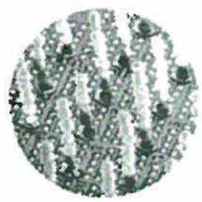
Université de Reims, France. The collaboration between the NHMFL and the Université de Reims is related to the characterization of nano-structure materials. The materials include Cu-Nb used for pulsed magnets and Fe-Pt multi-layers that have unique magnetic properties.

7. Conferences and Workshops

42nd Sanibel Symposium

February 23-March 1, 2002
St. Augustine, Florida

The NHMFL helped to sponsor this symposium held by the Quantum Theory Project at the University of Florida. The 42nd meeting was dedicated to Per-Olov Löwdin, who founded the symposia in 1960 and featured several plenary sessions covering subjects that were part of his many and diverse research interests, including forefront theory and computation in quantum chemistry, condensed matter physics, molecular dynamics, quantum biochemistry, and biophysics. Invited and poster sessions and informal discussions focused on nanostructural materials, quantum control and computing, metals in biology, and protein folding.



4th International Conference on the Scientific and Clinical Applications of Magnetic Carriers

May 9-11, 2002
Tallahassee, Florida

The laboratory helped to host this biennial conference organized by the Cleveland Clinic Foundation (Dr. Urs Hafeli) in collaboration with IFAB, Rostock, Germany, and Florida State University. The meeting was devoted to the development and application of magnetic microspheres in the basic and clinical sciences. Topics included preparation and modification of biodegradable magnetic particles; characterization of magnetic particles; application in cell separation and analysis; applications in molecular biology; and targeted drug delivery. Clinical applications of magnetic nano- and microspheres for cancer treatment, hyperthermia, and magnetic resonance contrast enhancement were also covered.

NHMFL Director Jack Crow was one of the invited speakers, along with FSU Professor Kurt Hofer, who talked on "Hypothermia in Cancer Therapy." Professor Tim St. Pierre, a Senior Lecturer in the Biophysics Program at the University of Australia, gave a series of lectures on the physics knowledge necessary for people working in the field of magnetic targeting.

NMR Symposium of the 44th Rocky Mountain Conference on Analytical Chemistry

July 28-August 1, 2002
Denver, Colorado

The laboratory provided support for this symposium that focused on the development and applications of solid-state NMR and other topics of interest to NHMFL users. The conference featured sessions on Applications in Environmental Chemistry, New Detection Methods, Polymers and Dynamics, Glasses and Dynamics, New Methods and Modeling, and Biological Structures. The 2002 Vaughn Memorial Lecturer was Professor Jeffrey Reimer of the University of California at Berkeley.

32^{nd} Southeast Magnetic Resonance Conference and Symposium Honoring Edward O. Stejskal

October 24-27, 2002
Research Triangle Park, North Carolina

The NHMFL has been a regular sponsor of SEMRC in recent years and was pleased to work with this year's host institution, North Carolina State University. SEMRC provides an ideal opportunity for scientists in all areas of magnetic resonance to come together and share new applications and technique developments. This year's meeting was particularly noteworthy because of a special symposium held in honor of Edward O. Stejskal, who made a number of significant contributions to the science of magnetic resonance. The invited speakers were R. David Britt of the University of California, Davis; Balarama [Raman] Kalyanaraman of the Medical College of Wisconsin; and David D. Thomas of the University of Minnesota. Plenary speakers were Jacob Schaefer, Washington University, and Alex Pines, University of California at Berkeley.

High Field EMR Workshop

December 13-14, 2002
NHMFL, Tallahassee, Florida

This workshop was co-sponsored by the Istituto per i Processi Chimico-Fisici, CNR Pisa, the NHMFL, the Department of Chemistry and Biochemistry of Florida State University, Bruker BioSpin, and Oxford Instruments. It focused on applications and future developments of multifrequency electron magnetic resonance in chemistry, biology, and materials science. There were a variety of sessions, including ones on protein structure, photosynthesis, molecular and single-molecule magnets, protein dynamics and simulation, catalysis, low-dimensional magnetic materials, instrument development, and quantum computing.

8. BUDGET & STAFFING

Introduction

The National High Magnetic Field Laboratory (NHMFL) operates with funding provided by federal, institutional, and industry sources. In addition, the laboratory's 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. Some of these awards offset the operating costs by shifting costs during the periods of time in which staff members are engaged in individual research activities. 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 amendment.[1] The renewal period is from January 1, 2001, through December 31, 2005. The following table provides a comparison of the current NSF budget allocation with the previous five-year budget:

Table 1. NHMFL NSF Budget Comparison.

Division/Program	1996 - 2000 5-Year NSF Summary	% of Budget	2001 - 2005 5-Year NSF Summary	% of Budget	% Change +/-
Director	2,912,811	3.33%	4,262,763	3.58%	46.35%
Reserve	0	0.00%	620,503	0.51%	
Facilities & Administration	5,698,737	6.51%	8,546,454	7.18%	49.97%
Instrumentation & Operations	26,285,125	30.04%	25,004,463	21.02%	-4.87%
Instrumentation & Operations - Electrical Power for DC Facility			11,863,750	9.97%	
Magnet Science & Technology	22,122,487	25.28%	24,746,477	20.80%	11.86%
Science	7,343,739	8.39%	7,268,901	6.11%	-1.02%
LANL	20,838,959	23.82%	26,513,609	22.29%	27.23%
CIMAR - NMR - FSU	361,550	0.41%	2,508,095	2.11%	593.71%
CIMAR - EMR	248,902	0.28%	727,045	0.61%	192.10%
CIMAR - ICR *	175,650	0.20%	3,444,454	2.90%	1860.98%
CIMAR - NMR - UF - AMRIS	812,414	0.94%	1,601,306	1.35%	97.10%
UF - High B/T	699,626	0.80%	1,862,180	1.57%	166.17%
Total NSF Cooperative Agreement	**87,500,000**	**100.00%**	**118,970,000**	**100.00%**	**35.97%**

* ICR Facilities budget does not include the NSF Chemistry Division award in the amount of $1,236,496 (FY2001), $1,266,064 (FY2002), $1,056,779 (FY2003), and $994,881 (FY2004).

[1] Baseline Budget $117,500,000
Amendments:
Increased electricity costs 1,470,000
Amended Budget $118,970,000

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

Table 2. NHMFL NSF Funding Profile by Program.

Division/Program	2001	2002	2003	2004	2005	Total Budget
Director	660,851	409,078	539,879	424,914	1,015,548	3,050,270
CIRL	241,627	233,787	239,638	245,641	251,800	1,212,493
Reserve	-1,812,814	-3,021,837	544,690	1,894,765	3,015,699	620,503
Facilities & Administration	1,836,671	1,662,349	1,642,680	1,682,138	1,722,616	8,546,454
Instrumentation & Operations	4,559,355	6,475,015	4,542,984	4,655,672	4,771,437	25,004,463
Instrumentation & Operations - Electrical Power for DC Facility	1,737,750	2,400,000	2,520,000	2,574,000	2,632,000	11,863,750
Magnet Science & Technology	4,716,226	7,019,044	5,341,715	4,112,384	3,557,108	24,746,477
Science	1,614,964	1,621,915	1,643,400	1,677,103	711,518	7,268,901
LANL ***	5,372,655	5,709,835	5,008,545	5,159,579	5,262,995	26,513,609
CIMAR - NMR - FSU	413,798	711,503	450,048	460,829	471,919	2,508,095
CIMAR - EMR	124,640	96,387	164,591	168,638	172,790	727,045
CIMAR - ICR **	48,640	1,141,783	443,037	464,737	1,346,258	3,444,454
CIMAR - NMR-UF-AMRIS	303,110	312,202	320,288	328,500	337,114	1,601,306
UF - Hi B/T ***	182,527	198,939	598,505	651,010	231,198	1,862,180
Total ******	**20,000,000**	**24,970,000**	**24,000,000**	**24,500,000**	**25,500,000**	**118,970,000**

* Budget amounts are inclusive of overhead distribution by program.
** ICR Facilities budget does not include the NSF Chemistry Division award in the amount of $1,236,496 (FY2001), $1,266,064 (FY2002), $1,056,779 (FY2003), and $994,881 (FY2004).
*** LANL and UF funding is distributed through subcontracts.
**** The allocation does not include NSF support for the NHMFL RET program, which was $106,000/year for 2001, 2002, (and 2003).

NHMFL Matching Commitment

The NSF grant includes a matching commitment by the State of Florida through Florida State University. For calendar year 2002, the State of Florida matching commitment for the NSF grant is $6,783,400. The State of Florida provides additional institutional funds to the laboratory above the NSF matching requirement. The NHMFL utilizes these additional state resources as available cost sharing funds for other funding opportunities, as well as to help support some of the NSF core activities. Table 3 presents the current State of Florida matching requirements and contribution provided through Florida State University. Contributed support from UF and LANL is included with the detail budgets relevant to these units.

Table 3. Fiscal Year 2002/2003 State of Florida Matching and Contribution.

	State Matching	State Contribution	Total State Funding
State of Florida recurring funds cost sharing	4,492,318	2,237,694	6,730,012
Indirect Cost (51%)	2,291,082	1,141,224	3,432,306
Total	**6,783,400**	**3,378,918**	**10,162,318**

Program Budget Discussion

Calendar year 2002 is the second year of the current grant award for funding from the National Science Foundation. The total NSF budgetary allocation for calendar year 2002 was $24,970,000, which includes the National Science Board approved allocation of $23,500,000 plus a special supplement of $1,470,000 to offset increased energy costs. The NHMFL also receives an annual operating budget from the State of Florida through Florida State University. (In fiscal year 2001/2002, the State budget was $6,809,937[2] (exclusive of equivalent overhead) for direct expenses. The total state budget for fiscal year 2001/2002 (inclusive of equivalent overhead) was $10,351,101. The NHMFL internally allocates the annual budgets by program area.

Table 4 details the budget allocations by program for both NSF and institutional support.

Table 4. NHMFL Program Budget by Source.

Program	NSF Budget Calendar Year 2002	State Matching Fiscal Year 2002/2003	State Contributed Fiscal Year 2002/2003	Total Budget
Director	409,078	1,613,281	618,928	2,641,287
CIRL[3]	233,787	91,693	40,585	366,065
Reserve	-3,021,837	0	0	-3,021,837
Facilities & Administration	1,662,349	51,640	22,857	1,736,846
Instrumentations & Operations	6,475,015	411,405	182,097	7,068,517
Instrumentations & Operations - Electrical Power for DC Facility	2,400,000	0	0	2,400,000
MS & T	7,019,044	742,585	585,849	8,347,478
Science	1,621,915	585,772	259,276	2,466,963
LANL (Subcontract)[4]	5,709,835	-	-	5,709,835
CIMAR - Administration	0	33,089	14,644	47,733
CIMAR - NMR	711,503	381,217	256,013	1,348,733
CIMAR - EMR	96,387	255,524	113,100	465,011
CIMAR - GAMMA	0	30,318	13,420	43,738
CIMAR - Geochemistry	0	74,994	33,194	108,188
CIMAR - ICR Facilities[5]	1,141,783	220,800	97,731	1,460,314
CIMAR – NMR – UF – AMRIS[6]	312,202	-	-	312,202
UF- High B/T[7]	198,939	-	-	198,939
Overhead[6]		2,291,082	1,141,224	3,432,306
Total	**24,970,000**	**6,783,400**	**3,378,918**	**35,132,318**

2 After adjusting for 9-month faculty, which had not been included when the 2001 Annual Report was prepared.
3 The allocation does not include NSF support for the RET Program, which was $106,000.
4 LANL contributed $3.6 million to the Pulsed Field Program in fiscal year 2001, and contributed $3.78 million in fiscal year 2002.
5 For fiscal year 2002, the ICR Facilities were supported primarily by a NSF Chemistry Division award in the amount of $1,266,064 (reference 5024-609-22).
6 Amount of institutional match/contribution from UF is provided in the detail budgets that follow.
7 The NSF budget includes overhead, and the equivalent overhead is included in the state budget to reflect the NSF spending. FSU's federally negotiated overhead represents 51% of the budgeted direct costs, excluding capital equipment items.

Table 5. Cumulative NSF Budget and Expenses (1/1/2001 – 12/31/2002).

Expense Classification	Budget	Spent and Encumbered	Balance 12/31/2002
Salaries, Wages & Benefits	11,251,082	14,187,460	(2,936,378)
Subcontracts	12,203,411	13,053,042	(849,631)
Capital Equipment	6,504,505	5,375,984	1,128,521
Other Direct Cost	7,919,699	7,223,734	695,965
Subtotal	**37,878,697**	**39,840,220**	**(1,961,523)**
Indirect Costs	7,353,318	7,330,527	22,791
Total	**45,232,015**	**47,170,747**	**(1,938,732)**
Program Income Included Above	262,015		

Program Budgets

Director's Office

DIRECTOR'S OFFICE		
Program	NSF Budget 2002	State Matching Budget 2002/2003
Director	108,685	300,041
Deputy Director	15,100	187,516
Budget Administration	15,100	113,541
Government & Public Relations	270,193	205,242
Visiting Scientist Program		266,021
Director's Research		95,595
Reserve		371,260
Total	**409,078**	**1,539,216**
Institutional Contribution		586,147

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 lab. 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 the NHMFL's public relations and support including monitoring 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 Visitors' Program are internally peer reviewed, and awards are made based on input provided through the internal review process.

Center for Integrating Research and Learning (CIRL)

This unit is included in the Director's Office, but as the program has expanded, it has been set up as a separate cost center. 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. CIRL administers the Research Experience for Undergraduates (REU) program that has been extremely successful over eight years. The Research Experience for Teachers (RET) is also coordinated and run by the Center. In calendar year 2002, the NSF provided a supplemental allocation, in the amount of $106,000, for the RET program. The RET program continues to fit very effectively with the summer REU students. 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 OMP has been hugely successful in its educational efforts and continues to receive worldwide recognition. In addition to establishing an in-house Magneto-Optical Imaging Facility, the OMP is developing 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 OMP 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 microscopy research program are offset with funding from other sources.

CENTER FOR INTEGRATING RESEARCH & LEARNING		
Program	NSF Budget 2002	State Matching Budget 2002/2003
Education	168,787	91,692
REU Program	65,000	
Optical Microscopy		74,066
Total	**233,787**	**165,758**
Institutional Contribution		73,366

Facilities and Administration

Facilities and Administration includes general administrative functions for the lab, including the ABA program. The ABA is responsible for accounts payable, accounts receivable, payroll, procurement, receiving, and other accounting activities. The Facilities staff is responsibilities 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 also 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

FACILITIES & ADMINISTRATION		
Program	NSF Budget 2002	State Matching Budget 2002/2003
ABA	677,040	27,727
Facilities	749,090	23,913
Safety	236,219	
Total	**1,662,349**	**51,640**
Institutional Contribution		22,857

facility maintenance and modifications required to support research and other activities related to the mission of the NHMFL. Additional institutional funding, in the amount of $640,000 (not included in the Institutional contribution above), was provided for the facilities operation in fiscal year 2001/2002, and was directed to activities that are important to NHMFL mission, but do not directly support user programs.

Instrumentation and Operations

This unit, headed by the Director of DC Fields Operations, is responsible for the operation of the DC magnet systems at Tallahassee, as well as the Millikelvin facility. This unit also provides operational machine shop, electronics, cryogenic system support, and computer networking support for the entire laboratory. Most of the staff is dedicated to supporting user activities from the technical level to assistance from instrumentation scientists. This group focuses on keeping abreast of the cutting edge instrumentation specialties and improving the performance level of the user instrumentation through the development of new approaches to measurements. The Instrumentation and Operations group also helps coordinate annual meetings of the NHMFL Users' Committee, as well as interfaces with other activities within the user community.

INSTRUMENTATION & OPERATIONS		
Program	NSF Budget 2002	State Matching Budget 2002/2003
Administration	438,137	45,057
Computer Services	347,426	
Cryogenics	2,263,604	
Electronics	366,536	
Magnet Operations	438,424	
Electrical Power – DC Facility	2,400,000	
Mechanical Instruments	420,399	
User Services	2,200,489	366,348
Total	**8,875,015**	**411,405**
Institutional Contribution		182,097

Magnet Science and Technology

The Magnet Science and Technology (MS&T) group is responsible for the design, engineering, fabrication, and maintenance of the DC, pulsed, and advanced superconducting magnets, along with the development of advanced materials for magnet applications. This group has brought together some of the best and brightest talent ever assembled to advance magnet technology and magnet materials. MS&T has broad interactions with the private sector, other national laboratories, and international institutions involved in high field magnet research and development. Future advances in magnet technology will be heavily dependent on

MAGNET SCIENCE & TECHNOLOGY		
Program	NSF Budget 2002	State Matching Budget 2002/2003
Administration	454,410	28,768
Personnel	3,057,622	713,817
Resistive Magnets	589,222	
High Field Systems	2,662,790	
Materials Development	65,000	
Pulsed Magnets	120,000	
Cryogenics	25,000	
HTS Magnets	25,000	
Analysis	20,000	
Total	**7,019,044**	**742,585**
Institutional Contribution		585,849

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 where 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.

Basis of Estimate of 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, NM, 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 approved overhead rate of 51% has been used for all costs at Tallahassee. The institutional overhead rate used for costs at University of Florida is 44.5%; the rate used for Los Alamos is 49.4%.

Overhead Base: At FSU and UF, overhead is applied to all costs except the following:

- Permanent Equipment
- Undergraduate, Graduate, and Ph.D. Programs (CIRL)
- Electric Power for magnet operations
- Subcontracts (excluding the first $25,000 of each subcontract).

At LANL, full overhead is applied to all costs, except projects designated as capital projects, which have a reduced overhead (10%) applied.

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

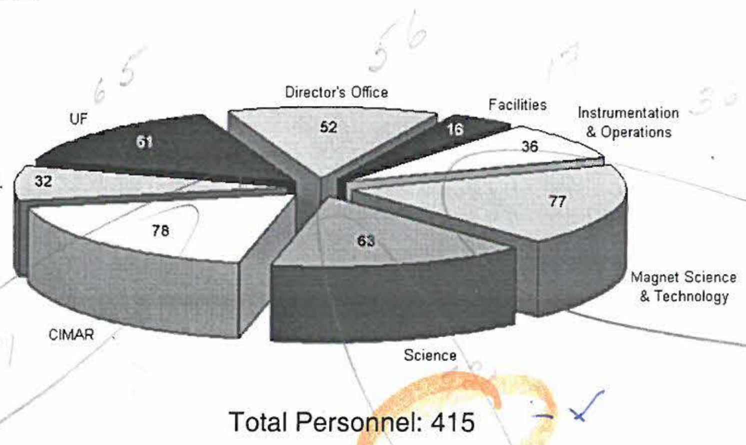
Administrative and Facility Maintenance Costs: Certain administrative and facility maintenance costs are accrued solely for the benefit and function of the NHMFL. These costs are included as direct costs in the budget estimates as allowed by the OMB regulations.

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.

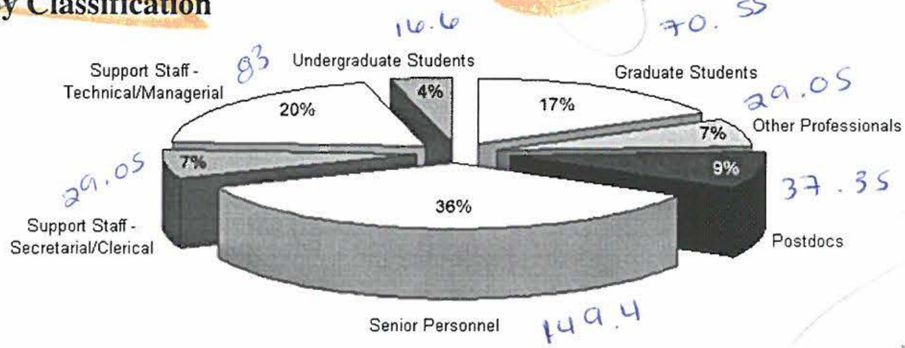
NHMFL Staffing

The laboratory annually evaluates staffing levels and distribution relative to the priorities of the laboratory and user activities. This year's staffing level remained essentially stable (413 in 2001; 415 in 2002), but reductions in the Director's Office allowed for a pick up of a few positions in the Magnet Science & Technology, CIMAR, and Science Programs. The following charts show the laboratory's personnel profile; the organization chart, as of December 2002, appears on the following page.

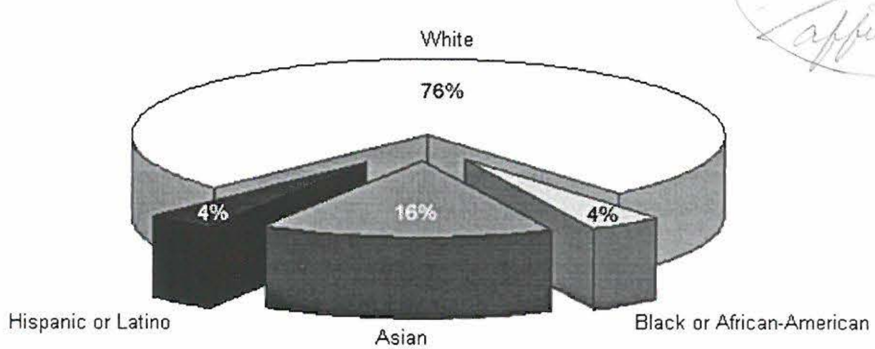
Personnel Distribution



Personnel by Classification

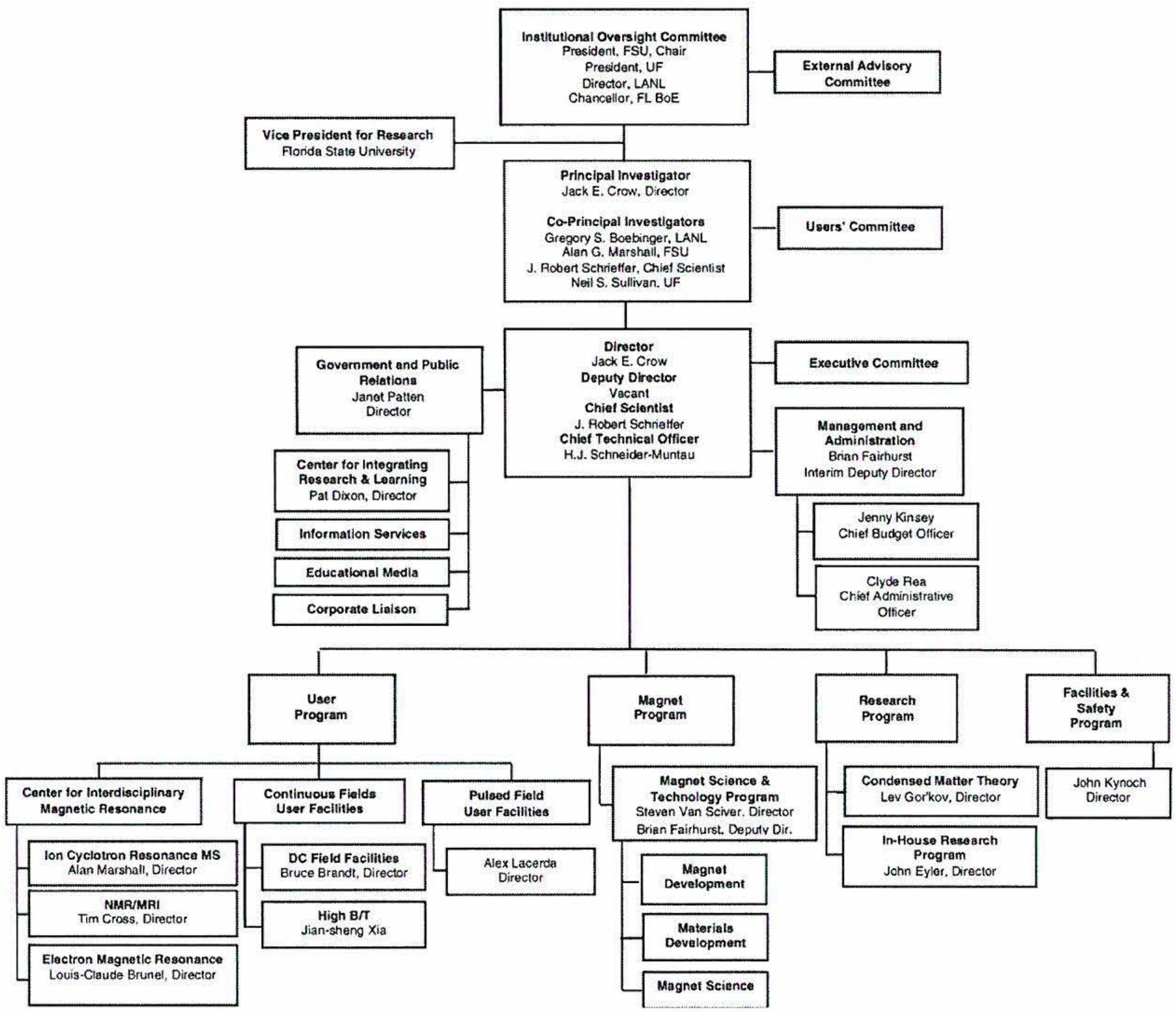


Personnel by Race Ethnic Status



Notes: The gender distribution is 80% male, 20% female. The date of information is November 6, 2002.

National High Magnetic Field Laboratory



APPENDIX A: USERS & PROJECTS

USERS & PROJECTS: DC FIELD FACILITY, 12/1/01-11/30/02

+Postdoc *Student (f)Female

Users	Institutions	Funding	Project
Agosta, Chuck Tozer, Stan Mielke, Chuck Murphy, Tim Palm, Eric Hall, Donavan	Clark U. NHMFL LANL NHMFL NHMFL NHMFL	NSF	Pressure Studies of Anisotropic Conductors Using a TDO
Andraka, Bohdan Mydosh, John Takano, Yasu Tsuji, Hiro+ Katsumata, Kiohci	U. of Florida Leiden U. of Florida U. of Florida Riken Harima	NSF	Heat Capacity Study of Strongly Anisotropic Heavy Fermion Systems
Andraka, Bohdan Sato , Hideyuki Tsujii, Hiroyuki+ Sugawara, Hitoshi Rotundu, Costel*	U. of Florida Tokyo Metropolitan U. U. of Florida Tokyo Metropolitan U. U. of Florida	NSF	High Magnetic Field Study of Canonical Heavy Fermion Systems
Balicas, Luis	NHMFL	NSF	Metamagnetism in the Antiferromagnetic Correlated Metal $Ca_{1-x}Sr_xRuO_4$ for x = 0.2
Barilo, Sergi Khalyavin, Dmitry Zvyagin, Sergei Krzystek, Jurek	Institute of Solid State & Semiconductor Physics ISSSP NHMFL NHMFL	NSF / NHMFL	Field Induced Metamagnetic Transitions in Cobalt Sub Lattices of $RBaCo_2O_{5.5}$ Single Crystals (R=Pr, Eu, Gd, Tb, Dy) on the Verge of Co^{3+} Spin-State Transition: Magnetic Excitation Spectrum Study
Basov, Dimitri Wang, Yong-Jie Hellman, Frances Zink, Barry* Strongin, Myron	U. of California at San Diego NHMFL UCSD UCSD Lawrence Berkeley National Laboratory	NSF	FIR Spectroscopy of Alpha-Si Rare Earth Metals
Bird, Mark Gavrilin, A.V.	NHMFL NHMFL	NSF	Quench and Stability Analyses for the Sweeper Magnet During Bucket Test
Bowers, C. Russ Engel, Loyd Olshanetsky, Eugene Caldwell, Joshua*	U. of Florida NHMFL U. of Florida U. of Florida	NHMFL	Transport Measurements of GaAs/AlGaAs Quantum Wells Temperature Dependence of Q.W. to Measure Activation Gap at g=1 Filling Factor
Brooks, James Yamada, J. Choi, Eun-Sang+ Jobiliong, Eric*	Florida State U. Himeji Institute of Technology Florida State U. Florida State U.	NSF	Fermi Surfaces of Low-Dimensional Materials

Brooks, James Rutel, Issac Zvyagin, Sergei Krzystec, Jurek	Florida State U. Florida State U. NHMFL NHMFL	NSF	Spin-Peierls Mapping and Universality in λ-$(BETS)_2FeCl_4$ and ß-$(ET)_2SF_5CF_2SO_3$
Brooks, James Choi, Eun Sang+ Rutel, Isaac* Kobuyashi, Hayo Kobayashi, A.	Florida State U. NHMFL Florida State U. Institute for Molecular Science - Okazaki IMS - Okazaki	NSF	Thermoelectric Studies of the Field Induced Superconducting Ground State in the Organic Material λ-$BETS_2FeCl_4$
Butler, Les Eilertsen, Jan+ Hall, Randall	LSU LSU LSU	NSF	NMR of Methylaluminoxanes: Co-Catalyts for Polyolefins
Cao, Gang Balicas, Luis Molinuevo Crow, Jack	U. of Kentucky NHMFL NHMFL	NHMFL	Novel Quantum Phenomena in Ruthenates
Carrington, Antony Meeson, Philip Hussey, Nigel Balicas, Luis Cooper, John	U. of Bristol U. of Bristol U. of Bristol NHMFL U. of Bristol	EPSRC	de Haas-van Alphen Oscillations in MgB_2
Clark, Gil Gavilano, Jorge Kuhns, Phil Moulton, Bill Vonlanthen, Patrik Reyes, Arniel	U. of California at Los Angeles Lab fur Feskorperphysik NHMFL Florida State U. UCLA NHMFL	NSF	NMR Investigation of High Frequency SDW Dynamics in Organic Conductors and 1-D S=1 Antiferromagnetic
Crawford , Michael Tozer, Stan Wei , Xing	DuPont Company NHMFL NHMFL	DuPont Co.	Zeeman Effect for Excitons and Chromium in Rutile TiO_2
Crow, Jack Hall, Donavan Cao, Gang McCall, Scott+ Zhou, Zhixian* Alexander, Scott*	NHMFL NHMFL U. of Kentucky NHMFL Florida State U. NHMFL	NHMFL	Fermiology of $BaRuO_3$
Crow, Jack Pietri, Richard+ Crow, Jack Hellman, Frances Zhao, Zhixian* McCall, Scott+ Alexander, Scott+	NHMFL NHMFL NHMFL U. of California at San Diego Florida State U. NHMFL NHMFL	NHMFL-IHRP	Nb-Si Sensors and Pt Heaters
Curro, Nicholas Reyes, Arneil Smith, James Coohy, Jason	LANL NHMFL LANL LANL	LANL - LDRD	NMR Investigations of Novel Phases of URh_2Si_2 in High Fields
Du, Rui Rui West, Kent Pfeiffer, Loren Simmons, Jerry Zhang, Jian	U. of Utah Bell Labs Bell Labs Sandia Natl. Labs U. of Utah	DOE	Quantum Hall Effect
Engel, Lloyd Tsui, Daniel C. Chen, Yong* Lewis, Rupert+ Pfeiffer, Loren Simmons, Jerry	NHMFL Princeton U. Florida State U. NHMFL Bell Labs Sandia Natl. Labs	NSF	Microwave Resonances in High B Wigner Crystal Regime of 2D Electron Systems

Epstein, Arthur Nandyala, Raju	Ohio State U. Ohio State U.	NSF	Anomalous Magnetoresistance of Organic Based Magnet V(TCNE)X
Fisk, Zachary Nakatsuji, Satoru+ Hall, Donavan Yeo, Sunmog* Balicas, Luis	Florida State U. NHMFL NHMFL Florida State U. NHMFL	NHMFL	Non Fermi Liquid Phenomena of Heavy Fermions
Fisk, Zachary Balicas, Luis Nakatsuli, Satoru+ Hall, Donavan Yeo, Sunmog*	Florida State U. NHMFL NHMFL NHMFL Florida State U.	NHMFL	Search for a Field-Induced Metastable Ground State in a Heavy Fermion Compound
Fisk, Zachary Balicas, Luis Nakatsuji, Satoru+	Florida State U. NHMFL NHMFL	NSF	Spin-Liquid State of Geometrically Frustrated YMn_2
Fortune, Nathanael Hannahs, Scott Tozer, Stan	Smith College NHMFL NHMFL	NHMFL Visiting Scientist Program	Calorimetric Investigation of Angle Dependent High Field, Low Temperature Phase Transition in Layered Structure Electronic Materials
Garmestani, Hamid Haik, Marwan+ Hussain, Yuesef Sablin, Simon Kawni, Marwan+ Yan, Shi-Shen+ Hayek, Saleh* Askar, Cheikh-Ali+	FAMU-FSU College of Engineering NHMFL Florida State U. Florida State U. NHMFL NHMFL FAMU-FSU CoE FAMU	NSF	Effect of Magnetic Heat Treatment (Annealing and Solidification) on Texturing of Hard (NdFeB, FePt, SmCo,...)and Soft (Fe-Si) Magnetic Materials
Garmestani, Hamid Bacaltchuk, Cristiane* Castello Branco, Gilbert* Gault, Barbara* Kawani, Marwan+ Hayek, Salch* Yan, Shishen+ Scheer, Mark	FAMU-FSU College of Engineering Florida State U. Florida State U. Florida State U. NHMFL FAMU-FSU CoE NHMFL FAMU-FSU CoE	U.S. Army	Effect of Magnetic Processing on Nano-Tube (Composite) Orientation and Magnetic Properties
Garmestani, Hamid Askar, Cheikh - Ali+ Scheer, Mark Yan, Lin Aslanoglu, Ziya Meda, Lamartine+	FAMU-FSU College of Engineering FAMU FAMU Indiana U. NHMFL FAMU	NSF	Effect of Recrystallization and Grain Growth in Diamagnetic (Cu, Zn,...) and Paramagnetic (Ti, ..) Materials
Gegenwart, Philipp Jaime, Marcelo Steglich, Frank Suslov, Alexia+ Sarma, Bimal	Max-Planck Institute LANL Max-Planck Institute for the Chemical Physics of Solids U. of Wisconsin U. of Wisconsin	MPI Dresden	Specific Heat Study of the Field Induced Gap in the One Dimensional S=1/2 Antiferromagnetic Yb_4As_3
Goldberg, David Zvyagin, Sergei Krzystek, Jurek Ieiser, Joshua	Johns Hopkins U. NHMFL NHMFL Roosevelt U.	NSF	High- Field and Frequency EPR of Novel Metallo Porphyrinoid Complexes

Goodrich, Roy Von Molnar, Stephen Mueller, Fred Zvyagin, Sergei	Louisiana State U. Florida State U. LANL NHMFL	DOE EPSCoR	Cyclotron Resonance in MgB_2 Films and ESR in AL Doped GaAs
Goodrich, Roy Balicas, Luis Fisk, Zachery Smith, James Sarrao, John Maple, Brian Thompson, Joe Hall, Donavan Palm, Eric	Louisiana State U. NHMFL NHMFL LANL LANL U. of California, San Diego LANL NHMFL NHMFL	DOE EPSCoR	dHvA at mK Temperatures on Heavy Fermion Materials
Goodrich, Roy Balicas, Luis Fisk, Zachery Smith, James Sarrao, John Maple, Brian Thompson, Joe	Louisiana State U. NHMFL NHMFL LANL LANL U. of California at San Diego LANL	DOE EPSCoR	Fermi Surface Measurements on Superconductors and Heavy Fermions
Guillot, Maurice Hall, Donavan Jones, Glover	Laboratoire des Champs Magnetiques Intenses / Grenoble NHMFL NHMFL	French Government	Magnetic and Magneto Optical (Faraday Rotation) in Magnetic Insulators
Halperin, William Sen Gupta, Pratim Sigmund, Eric* Reyes, Arnel Kuhns, Phil Chen, Bo*	Northwestern U. Northwestern U. Northwestern U. NHMFL NHMFL Northwestern U.	NSF	NMR High Field and Gradient Studies of Glass-Forming Liquids
Han, Ke Ishmaku, Aferdita+	Florida State U. NHMFL	NHMFL	Magnetic Field Effects on Phase Transformation of Stainless Steel Used for Pulsed and Hybrid Magnets
Hari, Parameswar Taylor, Craig Reyes, Arneil Guzel, Selahattin	California State U. at Fresno U. of Utah NHMFL California State U. at Fresno	NSF	High Field NMR Studies of Chalcogenide Glasses
Harrison, Neil Jaime, Marcello Kim, Kee Hoon	LANL LANL LANL	NSF, DOE	Quantum Critically and Field Induced Phases in URu_2Si_2 Part I (de Haas-van Alphen and Transport Study)
Hascicek, Yusuf Kawni, Marwan Aslanoglu, Ziya Akin, Yalcin	NHMFL NHMFL NHMFL NHMFL	NSF	The Effect of Magnetic Annealing in Enhancing the Current Density (Jc) of Coated YBCO Superconducting Tapes
Hebard, Arthur F. Du, Xu* Maslov, Dmitri	U. of Florida U. of Florida U. of Florida	NSF	Search for Luttinger Liquid Signature in the Magnetoresistance of Graphite in the Ultraquantum Limit

Hilke, Michael Armstrong, Alistair* Engel, Lloyd Tsui, Daniel C. Pfieiffer, Loren West, Ken	McGill U. McGill U. NHMFL Princeton U. Lucent Technologies Lucent Technologies	NSF	High B Field and High Frequency Measurements of Tunneling Characteristics
Hill, Steve Balicas, Luis Montgomery, Lawrence Schlieter, John Kovalev, Alexey+ Edwards, Rachel+ Takahashi, Susumu*	U. of Florida NHMFL Indiana U. Argonne Natl. Lab U. of Florida U. of Florida U. of Florida	NSF	Millimeter-Wave Spectroscopy of Novel Electronic Systems in High Magnetic Fields
Hong, Seung Parrell, Jeffrey Zhang, Youshu Field, Hyman H. Cisek, Paul	Oxford Superconducting Technology Oxford Instruments OST OST OST	Oxford Superconducting Technology	Critical Current of Nb_3Sn Wire
Houpt, Thomas Smith, James Cassell, Jennifer Riccardi, Christina Denbleyker, Megan Kwon, Bumsup Golden, Glen	Florida State U. Florida State U. Florida State U. Florida State U. Florida State U. Florida State U. Florida State U.	NIH	Behavioral and Neural Effects of High Strength Magnetic Fields
Huber, Tito Graf, Michael J. Celestine, Kizi	Howard U. Boston College Howard U.	NSF	Angle-Dependent Resistance of Bismuth Wires
Hussey, Nigel Carrington, Antony Balicas, Luis	U. of Bristol U. of Bristol NHMFL	EPSRC (UK)	Angular Magneto-resistance Oscillations in $Ti_2Ba_2CuO_6$ (Ti2201)
Hwang, Sung-Woo Son, Maeng-Ho Engel, Lloyd Jun, Myung-Sim	U. of Seoul U. of Seoul NHMFL U. of Seoul		Magneto-Tunneling Through Stacked InAs Self-assembled Quantum Dots
Jaime, Marcelo Mydosh, John Guillermo, Jorge Kim, Kee Hoon Harrison, Neil	LANL U. of Tokyo LANL LANL LANL	NHMFL	Electric Transport and Specific Heat in High Fields
Jones, Eric D. Wei, Xing Waldrip, Karen Reno, John Modine, Normand Tozer, Stan	Sandia National Labs NHMFL Sandia National Labs Sandia National Labs Sandia National Labs NHMFL	DOE	Pressure Dependent Magnetoluminescence at the Gamma-X Crossing in III-V Semiconductors
Kang, Woowon Pfieffer, LW	U. of Chicago Lucent Technologies	Packard Foundation	Quantum Well Samples Under High Magnetic Field
Kang, Woun Kang, Haeyong* Jo, Younjung*	Ewha Women's U. Ewha Women's U. Ewha Women's U.	Korean Research Foundation	Study for the Mechanism of Two Dimensionality in the Bechgaard Salt - Hydrostatic and Uniaxial Pressure Study
Kim, Young Hor, Pei	U. of Cincinnati U. of Houston	NSF	Reflectivity Study of YBCO Film

Kono, Junichiro Munekata, Hiroo Stanton, Chris Santos, Michael Khodaparast, Giti+	Rice U. Tokyo Institute of Technology U. of Florida U. of Oklahoma Rice U.	DARPA, NHMFL-IHRP, NSF	DARPA - Optical & Terahertz Response Spins in Magnetic III-V Semiconductors IHRP - Ultrafast Optics of Excitons In High Magnetic Fields NSF - Optical Spectroscopy of Quantum Coherence, Correlations and Many-Body Effects in Nanostructures
Krusin-Elbaum, Lia Shibauchi, Takasada Martel, Richard	IBM Research Kyoto U. IBM	NSF	Probing Novel Quasiparticle Resonance in High Temperature Superconductors via Intrinsic c-axis Tunneling Spectroscopy at High Magnetic Fields
Krzystek, Jurek Zvyagin, Sergii	NHMFL NHMFL	NHMFL / NSF	Testing the BWO- Based EMR Spectrometer
Landee, Chris Turnbull, Mark Zvyagin, Sergei Brunel, Louis-Claude Krzystek, Jerzy	Clark U. Clark U. NHMFL NHMFL NHMFL	NSF	EMR Studies of Molecular-Based Quantum Antiferromagnets
Larbalestier, David Squitieri, Alex Lee, Peter Braccini, Valeria Godeke, Arno	U. of Wisconson - Madison UW - Madison UW - Madison UW - Madison UW - Madison	DOE-HEP	High Field Properties of Nb_3Sn and MgB_2 by Transport Ic and Tc Measurements
Liu, J Ping Garmestani, Hamid Yan, Shi-Shen Kawni, Marwan	Louisiana Technical U. FAMU-FSU College of Engineering FAMU-FSU CoE Florida State U.	DARPA	Microstructural and Magnetic Properties of Magnetic Materials Enhanced by High Magnetic Field Annealing
Long, Virginia Landee, Chris Makumbe, Pedzisayi Hall, Donovan Wei, Xing Schundler, Elizabeth	Colby College Clark U. Colby College NHMFL NHMFL Colby College	Clare Boothe Luce Funds	High Field Polarized Optical Transmittance of Haldane Materials
Ludtka, Gerard Kisner, Roger Kalu, Peter England, Roger Sheikh-Ali, Askar Nicholson, Donald Wayroba, David	Oak Ridge National Lab ORNL FAMU-FSU College of Engineering Cummins Engines NHMFL ONRL NHMFL	DOE/ORNL	Enhanced Performance and Energy Savings Through Ultrahigh Magnetic Field Processing of Ferromagnetic Materials
Lyon, Stephen Shaner, Eric* Engel, Lloyd Wei, Xing	Princeton U. Princeton U. NHMFL NHMFL	NSF	Terahertz Time-Domain Spectroscopy of 2D Electrons in GaAs at Millikelvin Temperatures

Maeda, Hiroshi Pamidi, Sastry Jianhua, Su Trociewitz, Ulf Schwartz, Justin Caruso, Angelo Martha, Michael Hamil, Karl	Kitami Institute Of Technology NHMFL NHMFL NHMFL FAMU-FSU College of Engineering FAMU-FSU CoE FAMU-FSU CoE FAMU-FSU CoE	NSF, NHMFL-IHRP	Magnetic Field Induced Texture in High Tc Superconductors
Mandrus, David G. McCall, Scott+ Rongying , Jin+ He, Jian* Drymiotis, F.*	Oak Ridge National Lab NHMFL ORNL U. of Tennessee Florida State U.	DOE Basic Energy Research	Quantum Oscillation of Resistivity Superconductivity Investigation
Maple, Brian Taylor, Ben Yuhaz, William* Scanderbeg, Dan*	U. of California at San Diego UCSD UCSD UCSD	NSF	Vortex Glass Transition in High Magnetic Field
McCombe, Bruce D. Luo, Hong Kim, Gibum Na, Manhong Abacs, George	State U. of New York at Buffalo SUNY at Buffalo SUNY at Buffalo SUNY at Buffalo SUNY at Buffalo	DARPA / ONR	Spintronics and Spin Photonics in Ferromagnetic GaAs/Mn, GaSb/Mn - Based Heterostructures
Meisel, Mark Paul, Anna-Lisa Ferl, Robert Brooks, James	U. of Florida U. of Florida U. of Florida NHMFL/Florida State U.	NSF	Low Gravity Plant Growth Experiment Using High Magnetic Field Gradient Levitation
Meisel, Mark Talham, Daniel Culp, Jeff* Park, Ju-Hyun* Gamble, Sara* Kielbasa , Jerry *	U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida U. of Florida	ACS - PRF, NSF	New Magnetic Properties of Self-Assembled Two-Dimensional Films
Mendez, Emilio Magno, Richard Bennett, Brian Lin, Tom	SUNY at Stony Brook Naval Research Laboratory NRL Penn State U.	NSF	Magnetotransport in Type II Heterostructures
Miura, N.	U. of Tokyo	DARPA	Electron-Electron and Electron-Phonon Interactions in Si/SiGe and CdTe/CdMgTe Probed Through Cyclotron Resonance
Molodov, Dmitri Konijnenberg, Peter	Aachen U. of Technology Aachen U. of Technology	Aachen U. of Technology	High Temperature Annealing (400 C) of Zinc Bicrystals in High Magnetic Field (>25 T)
Mukovskii, Yakov	Moscow State Steel and Alloys Institute		Temperature Dependencies of Resistivity in Different Magnetic Fields
Murphy, Sheena Santos, Michael Chokomakoua, Jean Claude*	U. of Oklahoma U. of Oklahoma U. of Oklahoma	NSF	QHE in InSb Structures

Murphy, Tim Tozer, Stan Palm, Eric	NHMFL NHMFL NHMFL	IHRP	Normal State Magnetoresistance and Tunnel Diode Oscillator Measurements of the Heavy Fermion Superconductor $CeCoIn_5$
Musfeldt, Janice Wang, Yong-Jie Choi, Jongwoo+ Woodward, Jon+	U. of Tennessee NHMFL U. of Tennessee U. of Tennessee	SUNY Binghamton	Spectroscopic Investigations of Magnetically Driven Phase Transitions in Inorganic and Organic Solids
Neumeier, John Balicas, Luis Nakatsuji, Satoru+	Florida Atlantic U. NHMFL NHMFL	NSF	Study of a Magnetic Field Structural Transition in $Ca_{1-x}Sr_xRuO_4$
Nagel, Urmas	ICPB - Estonia	Estonian Science Foundation	Far-Infrared Study of Low-Dimensional Spin-Gap System and Testing of the Variable Temperature Cryostat in the 32 T Magnet
Noh, Tae W. Lee, Jong Seok* Lee, Hae Ja* Kim, Myung Whun* Wang, Yong-Jie Cho, B. K.	Seoul National U. Seoul National U. Seoul National U. Seoul National U. NHMFL K-JIST	Korea - MS & T	Magnetic Field Dependent Optical Properties of Some Strongly Correlated Electron Systems
Ong, Nai-Phuan Wang, Yayu*	Princeton U. Princeton U.	NSF	High Field Nernst Effect of Bi-2201 High Tc Cuprates
Palm, Eric Murphy, Tim Goodrich, Roy G. Sarrao, John	NHMFL NHMFL Louisiana State U. LANL	NHMFL	Analyzing Hc_2 of $CeCoIn_5$ at Different Fields and Temperatures
Papavassiliou, George Brooks, James Yamada, Jun-ichi Yasuzuka, Syuma Wade, Aaron* Uji, Shinya	Theoretical & Physical Chemistry Institute Florida State U. Hieji Institute of Technology, Hyoro National Institute for Materials Science U. of West Florida NRIM	NSF	Electronic and Magnetic Mechanisms in Low Dimensional Materials
Papavassiliou, George Dimitropoulos, Constatin	Theoretical & Physical Chemistry Institute EPFL Lausanne		NMR Measurement
Park, Yung Woo Roth, Siegmar Campbell, Eleanor Yu, Han Young* Kim, Bio* Suh, Dong-Seok Shirakawa, H. Aleshin, A.N.	Seoul National U. Max-Planck Institute Chalmers U. of Tech. Seoul National U. Seoul National U. Seoul National U. U. of Tsukuba Seoul National U.	Korean Science & Engineering Foundation	Magnetotransport in Synthetic Nanowires
Petrou, Athos Wei, Xing Itskos, Grigorios Mallory, Robert McCombe, Bruce D. Jonker, Berry	State U. of New York at Buffalo NHMFL SUNY at Buffalo SUNY at Buffalo SUNY at Buffalo NRL	NSF	Magneto-Optical Studies of Spintronic Materials and Devices

Popovic, Dragana Jaroszynski, Jan Anrearczyu, Tomasz* Karczewski, Grzegorz	NHMFL NHMFL Institute of Physics Polish Academy of Sciences Polish Academy of Sciences	NHMFL	Quantum Hall Ferromagnetism
Porzio, Raymond Snodgrass, Jon Goodemote, John	Sanders, Lockheed Martin Etrema Products Sanders, Lockheed Martin	U.S. Navy	Multiband Transducer (High Power Multiple Bandwidth Magneto-Acoustic Naval Transducer)
Pourrahimi, Shahin McNiff, Ed Painter, Tom	Superconducting Systems, Inc. Superconducting Systems, Inc. NHMFL	Superconducting Systems, Inc.	I_c Testing of Nb_3Sn Superconducting Wires Between 12 and 17 T
Qualls, Jeremy Hall, Donavan Manson, Jaime	Wake Forest U. NHMFL Argonne National Lab	Wake Forest U.	Magnetization Studies of Molecular Magnetic Systems
Qualls, Jeremy Lachgar, Abdessadek* Carter, Arthur* Peng, Lu* Okuyama, Yumi*	Wake Forest U. Wake Forest U. Wake Forest U. Wake Forest U. Wake Forest U.	Wake Forest U.	Novel Transport Phenomena in Low Dimensional Metals
Ramachandran, Narayanan Leslie, Fred Ciszak, Ewa	Universities Space Research Assoc. NASA, Marshall Space Flight Center NASA, Marshall Space Flight Center	NASA	Bizarre Under the Cryostat Experiments Looking at Some Sort of Crystal Growth
Reitze, David Miura, Noboru Abernathy, Cammy Wang, Yong-Jie Stanton, Christopher Kono, Junichiro Jho, Young-Dahl+ Hebard, Art Wei, Xing	U. of Florida ISSP – U. of Tokyo U. of Florida NHMFL U. of Florida Rice U. U. of Florida U. of Florida NHMFL	NHMFL-IHRP	Excitons Under Magnetic Confinement in InGaAs Quantum Wells
Reyes, Arneil	NHMFL	IHRP	^{63}Cu NMR Studies of Spin Dynamics in $NdBa_2Cu_3O_{7-\delta}$
Rosenbaum, Ralph Brandt, Bruce Rosenbaum, Rachel	Tel Aviv U. NHMFL Tel Aviv U.	Tel Aviv U.	Electronic Transport of Metallic and Insulating Films in High Magnetic Fields
Sarma, Bimal Ketterson, John Hall, Donavan Souslov, Alexei+ Lowe, Ryan	U. of Wisconson - Milwaukee Northwestern U. NHMFL UW - Milwaukee UW - Milwaukee	NSF	Magnetometry and Ultrasonic Research in UPt_3
Schwartz, Justin Hill, Sam Trociewitz, Ulf Weijers, Hubertus	FAMU-FSU College of Engineering NHMFL NHMFL NHMFL	Battelle Grant	5 T Project Coil Characteristics

Schwartz, Justin Weijers, Hubertus Trociewitz, Ulf Thompson, Hill Van der Laan, Danko	FAMU-FSU College of Engineering NHMFL NHMFL Florida State U. NHMFL	Battelle Grant	HTS Conductor Characteristics
Shayegan, Mansour Tutuc, Emanuel * Shkolnikov, Yakov* De Poortere, Etienne * Melinte, Sorin	Princeton U. Princeton U. Princeton U. Princeton U. Princeton U.	NSF	Magnetotransport in High-Mobility Electrons in AlAs and GaAs Quantum Wells
Singleton, John Klehe, Anne-Katrin Tozer, Stan Day, Peter Akutsu, Akane Narduzzo, Alessandro* Akutsu, Hiroki Bangura, Alimamy*	Clarendon Lab at U. of Oxford Clarendon Lab at U. of Oxford NHMFL Royal Institution, UK Royal Institution, UK Clarendon Lab at U. of Oxford Royal Institution, UK Clarendon Lab at U. of Oxford	Engineering & Physical Sciences Research Council	DC and Millimeter-Wave Studies of Conductivity, Two-Axis Rotation Under High Pressure
Singleton, John Ardavan, Arzhang Coldea, Amalia+ Narduzzo, Alessandro* Bangura, Alimamy* Schlueter, John Day, Peter Klehe, Anne-Katrin	U. of Oxford U. of Oxford U. of Oxford U. of Oxford U. of Oxford Argonne National Lab Royal Institute of Great Britain U. of Oxford	Engineering & Physical Sciences Research Council	Quantitative Studies of Quasi-One-Dimensional Fermi Surfaces in Organic Molecular Metals
Stern, Raivo Kageyama, Hiroshi+ Yoshimura, Kazuyoshi Reyes, Arneil Kuhns, Phil	NICPB - Estonia ISSP - Japan Kyoto U. NHMFL NHMFL	Estonian Science Foundation	Quantum Transitions in Frustrated Multidimensional Antiferromagnetic Dimer Systems with Spin Gap
Stewart, Greg Kim, Jung Soo	U. of Florida U. of Florida	NSF	Non-Fermi Liquid Behavior in High Magnetic Fields
Stormer, Horst Tsui, Daniel Pfeiffer, Lauren West, Ken Baldwin, Kirk Pan, Wei* Syed, Sheyum* Manfra, Mike	Columbia U. Princeton U. Lucent Technologies Lucent Technologies Lucent Technologies Princeton U. Columbia U. Bell Labs	NSF	Fractional Quantum Hall Effect Studies on Two-Dimensional Electrons at the Interface of AlGaN and GaN
Stormer, Horst L. Manfra, Michael Wang, Yong-Jie Syed, Sheyum*	Columbia U. Bell Labs NHMFL Columbia U.	NSF	Cyclotron Resonance of 2DEG in AlGaN/GaN
Takano, Yasu Andraka, Bohdan Tsujii, Hiro+ Katsumata, Koiti Honda, Zentaro	U. of Florida U. of Florida U. of Florida RIKEN Saitama U.	NSF	Heat Capacity and Proton Spin Relaxation, T1, of the Haldane-Gap 1D Antiferromagnet NDMAP in Magnetic Fields
Takano, Yasu Kageyama, Hiroshi Tsujii, Hiro+ McDonald, Frank*	U. of Florida U. of Tokyo U. of Florida U. of Florida	NSF	Specific Heat of $SrCu_2(BO_3)_2$ in Magnetic Field

Takano, Yasumasa Andraka, Bohdan Katsumata, Koichi Honda, Zentaro Tanaka, Hidekazu Meisel, Mark	U. of Florida U. of Florida RIKEN Horima Institute Saitama U. Tokyo Institute of Technology U. of Florida	NSF	Heat Capacity Measurement
Tanaka, Hisashi Tokumoto, Madoka Brooks, James Kobayashi, Hayao Kobayashi, Akiko Jobiliong, Eric* Choi, Eun Sang+ Graf, David*	NRI - AIST NRI - AIST Florida State U. IMS U. of Tokyo Florida State U. Florida State U. Florida State U.	NSF	Electronic and Magnetic Mechanisms in Low Dimensional Materials - Observation of Fermi Surfaces of Organic Molecular Conductors
Telser, Joshua Krystek, Jurek Zvyagin, Sergei	Roosevelt U. NHMFL NHMFL	Roosevelt U.	High Field and Frequency EPR of High-Spin Transition Metal Complexes
Tozer, Stan Agosta, Charles Sarrao, John Goodrich, Roy G. Hall, Donavan	NHMFL Clark U. LANL Louisiana State U. NHMFL	NHMFL	Fermiology Studies of Organic Conductors and the Heavy Fermion System, $CeRhIn_5$
Tozer, Stan Palm, Eric Hall, Donavan Murphy, Tim Sarrao, John Goodrich, Roy G. Abate, Adam Radovan, Henri*	NHMFL NHMFL NHMFL NHMFL LANL Louisiana State U. Harvard U. NHMFL	NSF	Physics of 115's: Heavy Fermion Superconductivity: Magnetization, Transport and High Pressure
Tsui, Dan Stormer, Horst Pan, Wei * Baldwin, Kirk Pfieffer, Loren West, Ken	Princeton U. Columbia U. / Lucent Technologies Princeton U. Bell Labs Innovations Bell Labs Innovations Bell Labs Innovations	NSF	Half Filled Landau Levels in Very High Magnetic Fields
Tsui, Daniel Xie, Ya-Hong Pan, Wei* Lai, Keji	Princeton U. U. of California at Los Angeles Princeton U. Princeton U.	DOE & NSF	Fractional Quantum Hall Effect in $Si/Si_{1-x}Ge_x$
Viehland, Dwight Rutte, Ben	VA Tech VA Tech	U.S. Navy	High-Magnetic Field Investigations of Induced Phase Transformations in Bismuth Ferrite
Walsh, Bob	NHMFL	NSF	Engineering Properties of Cotton-Phenolic Laminates
Walsh, Bob	NHMFL	NSF	Strain-Control Reverse-Cycle Fatigue Tests, 77 K
Wang, Ben Schnieder-Muntau, Hans Han, Ke Zhang, Chuck	FAMU-FSU College of Engineering NHMFL NHMFL FAMU-FSU CoE	Air Force Science Research	Development of Multifunctional Nanocomposites with Magnetically Aligned Bucky Papers

Wang, Kang Zvyagin, Sergei Khitun, Alex	U. of California, Los Angeles, Electrical Engineering NHMFL U. of California at Los Angeles	NSF	Submillimeter Wave Spectroscopy
Wang, Yong-Jie Zhang, Yong Tu, C.W. Wei, Xing	NHMFL National Renewable Energy Lab U. of California at San Diego NHMFL	NHMFL	Magneto-Optical Study of Giant Band Gap Reduction for Dilute $GaAs_{1-x}N_x$ Alloys
Warren, Warren Lin, Yung-Ya Murali, Nagarajan Brey, William Ahn , Sangdoo+ Gan, Zhehong	Princeton U. Princeton U. NHMFL NHMFL Princeton U. NHMFL	NSF	Resolution Enhancement Using Homogenized Detection of Solution State NMR on the Keck Magnet
Wu, Gang Wong, Alan Gan, Zhehong Gorkov, Peter	Queen's U. Queen's U. NHMFL NHMFL	National Science & Engineering Research - Canada	Solid State NMR of Quadrupolar Nuclei at Very High Fields
Yasuzuka, S. Brooks, James	NIMS - Japan NHMFL	NSF	Fermiology of the New Hybrid Organic Conductor ET-TCNQ
Zeitlin, Bruce Walsh, Robert Palm, Eric	Supergenics LLC NHMFL NHMFL	NHMFL	J_c and H_c Measurements
Zheng, Guo-Qing Clark, Gil Moulton, Bill Reyes, Arneil Kuhns, Phil Sakai, Akihiro	Osaka U. U. of California at Los Angeles NHMFL NHMFL NHMFL Osaka U.	Ministry of Education - Japan	Magnetic-Field Response of Pseudogap in High T_c Superconductors
Zvyagin, Sergei	NHMFL	NSF	High-Field/Resolution ESR on the Spin-Peierls Compound $CuGeO_3$+0.4%Si

Number of DC Field Projects: 124

USERS & PROJECTS: PULSED FIELD FACILITY

+Postdoc *Student (f) Female

Users	Institutions	Funding	Project
Aronson, Meigan (f) Bennett, Marcus* Berkeley, Emily (f)* Balakirev, Fedor	U. of Michigan U. of Michigan U. of Michigan NHMFL - Los Alamos	NSF	High Field Studies of Doped CaB_6
Balatsky, Sasha Crooker, Scott Rickel, Dwight	LANL - T11 NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Faraday Noise Spectroscopy
Boebinger, Greg Ando, Yoichi Ono, Shimpei* Balakirev, Fedor Betts, Jon	NHMFL - Los Alamos CRIEPI - Japan CRIEPI - Japan NHMFL - Los Alamos NHMFL - Los Alamos	DOE	High Field Hall Effect on BSLCO
Brooks, James Harrison, Neil Papavassiliou, G Murata, K. Graf, David* Choi, Eun-Sang+	Florida State U. NHMFL - Los Alamos Natl. Tech. U. of Athens-Greece Osaka City U. - Japan Florida State U. Florida State U.	NSF	Novel Probes of the New High Field Insulating Phase in Tau-Structured Materials
Brooks, James Mielke, Chuck Graf, David* Murata, K. Konoike, T.*	Florida State U. NHMFL - Los Alamos Florida State U. Osaka U. - Japan Osaka U. - Japan	NSF	High Field Phase in Tau-Phase Materials
Brown, Stuart Yu, Wei-Qiang* Mielke, Chuck Migliori, Albert Boebinger, Greg	UCLA UCLA NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos	NSF	Test of RF Detection Electronics
Brown, Stuart Clark, Gil Zamborszky, Ferenc+ Dunsiger, Sarah (f)+	UCLA - Physics UCLA - Physics UCLA - Physics LANL - MST10	NSF	Spin Dynamics of an Electron-Doped High-T_c Superconductor
Canfield, Paul Bund'ko, Sergey Avilar, R.+ Jung, Myung-Hwa+ Lacerda, Alex	Ames lab. - ISU Ames lab. - ISU Ames lab. - ISU NMSU - Physics NHMFL - Los Alamos	NSF	Magnetotransport Properties of Long Annealed $YbNi_2B_2C$
Cava, Robert Harrison, Neil Ramirez, Art	Princeton University NHMFL - Los Alamos LANL - MST10	NSF	High Field Fermi Surface Investigation of $Ca_2Ru_3O_7$
Cheong, S-W Jaime, Marcelo Kim, Kee-Hoon+ Jorge, Guillermo* Nieva, Gladys (f) Correa, Victor	Rutgers University NHMFL - Los Alamos NHMFL - Los Alamos U. of Buenos Aires CAB - Argentina CAB - Argentina	NSF	Specific Heat of Pyrochlore Systems
Civale, Leonardo Coulter, Yates Lacerda, Alex Jaime, Marcelo	LANL - STC LANL - STC NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Critical Current Measurements on Coated Conductors
Crooker, Scott Hollingsworth, J. (f) Klimov, Victor Efros, Alexander	NHMFL - Los Alamos LANL-C LANL-C Naval Research	DOE	Nonradiating Exciton States in Quantum Dots at Millikelvin Temperatures

Crooker, Scott Barrick, Todd* Astakhov, Georgy+ Yakovlev, Dmitrii	NHMFL - Los Alamos U. of New Mexico U. of Wuerzburg-Germany U. of Wuerzburg-Germany	NSF	Spin Polarization Photoluminescence Excitation Spectroscopy
Goodrich, Roy Harrison, Neil Maple, Brain	LSU NHMFL - Los Alamos UC San Diego	NSF	Fermi Surface Investigation of a New Series of Heavy Fermion Compounds: $PrOs_4Sb_{12}$
Goodrich, Roy Harrison, Neil Hall, Donovan Sarrao, John Fisk, Zach	LSU - Physics NHMFL - Los Alamos NHMFL - Tallahassee LANL - MST10 Florida State U.	NSF	Fermi Surface Investigations of $RERhIn_5$ Alloys
Guertin, Robert Zhou, Z.X.* Harrison, Neil	Tufts U. Florida State U. NHMFL - Los Alamos	NSF	A Search for Field-Induced Magnetic Transitions in Three Divergent Weakly Magnetic Materials
Haddon, R. Jaime, Marcelo Ramirez, Art Chi, X.+	UC Riverside NHMFL - Los Alamos LANL - MST10 LANL - MST9	NSF	Specific Heat of Neutral Radical Molecular Conductors
Hollingsworth, J. (f) Crooker, Scott Klimov, Victor	LANL - C NHMFL - Los Alamos LANL - C	DOE	Forster Energy Transfer in Bilayer Nanoassemblies
Jia, Quanxi Taylor, Toni (f) Trugman, Stuart Crooker, Scott	LANL - STC LANL - MST10 LANL - T11 NHMFL - Los Alamos	DOE	High-Field THz Spectroscopy of YBCO
Jones, Eric Waldrip, Karen Bajaj, Krishan Crooker, Scott	Sandia Natl. Labs Sandia Natl. Labs Emory U. NHMFL - Los Alamos	NSF	High Field Diamagnetic Shifts and FWHM Linewidths in Semiconductors
Kastner, Marc Matan, Kx Lee, Y. Wakimoto, S. Birgeneau, Robert Balakirev, Fedor Khaykovich, Boris	MIT MIT MIT MIT U. of Toronto NHMFL - Los Alamos MIT	NSF	Upper Critical Field and Hall Effect in La_2CuO_{4+y}
Kastner, Marc Khaykovich, Boris+ Jorge, Guillermo* Jaime, Marcelo	MIT MIT - Physics U. of Buenos Aires NHMFL - Los Alamos	NSF	Specific Heat in Superoxigenated $LaCuO_4$
Keppens, Veerle Petcule, Gabriela (f) Betts, Jon Migliori, Albert	U. of Mississippi U. of Mississippi NHMFL - Los Alamos NHMFL - Los Alamos	NSF	High Field Ultrasound Probe Development
Kim, Kee-Hoon + Marcelo, Jaime Betts, Jon Boebinger, Greg Hur, Namjung* Cheong, S-W	NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos Rutgers U. Rutgers U.	DOE	Magnetotransport Study of Pyrochlore Ruthenate $PrBiRu_2O_7$
Kim, Yongmin Shon, Y. Kwon, Y.H. Kang, T.W. Crooker, Scott	Dongguk U. - South Korea Dongguk U. Dongguk U. Dongguk U. NHMFL - Los Alamos	University	Magneto-Photoluminescence Transitions of Mn-Implanted GaN Epilayer

Kim, Keen-Hoon + Betts, Jon Balakirev, Fedor Boebinger, Greg Komiya, S. Ono, S.+ Ando, Y.	NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos CRIEPI - Japan CRIEPI - Japan CRIEPI - Japan	DOE	Search for Quantum Critical Point in High Tc Cuprates
Kim, Yongmin Crooker, Scott Park, Y.	Dongguk U. - Seoul, Korea NHMFL - Los Alamos Dongguk U.	University	Magneto-PL Transitions of a GaN/AlGaN Heterostructure
Klimov, Victor Achermann, Marc+ Hollingsworth, J. (f) Crooker, Scott	LANL - PCS LANL - PCS LANL - PCS NHMFL - Los Alamos	DOE	Time-Resolved Energy Transfer in Coupled Nanostructures
Klimov, Victor Crooker, Scott Preiner, Michael* Hollingsworth, J. (f) Petruska, Melissa (f)+	LANL - C NHMFL - Los Alamos MIT LANL - C LANL - C	DOE	Spectroscopy of Single Quantum Dots in High Magnetic Fields
Lacerda, Alex Christianson, Andy* Pagliuso, Pascoal+ Sarrao, John Kern, Sandy	NHMFL - Los Alamos Colorado State U. LANL - MST10 LANL - MST10 Colorado State U.	DOE	^{3}He System Development
Lacerda, Alex Christianson, Andy* Sarrao, John Hundley, Mike Kern, Sandy	NHMFL - Los Alamos Col. State U. LANL - MST10 LANL - MST10 Colorado State U.	DOE	Low Temperature, High Magnetic Fields Power Laws in $CeIrIn_5$ and $CeCoIn_5$
Lander, Gerry Kern, Sandy Christianson, Andy* Harrison, Neil	Intitut Laue-Langevin (ILL), Grenoble Colorado State U. Colorado State U. NHMFL - Los Alamos	Other	Magnetization Study of US
Larbalestier, David Kim, Kee-Hoon+ Patnaik, Satyabrata+ Eom, Chang-Beom	U. of Wisconsin-Madison NHMFL - Los Alamos UW -Madison UW - Madison	NSF	High Field Hc_2 Investigation of MgB_2 Films and Bulks
Lashley, Jason Migliori, Albert Kim, Kee-Hoon+ Kim, Dongyun+	LANL - MST8 NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos	DOE	High Field Heat Capacity of Pu
Lawrence, Jon Cornelius, Andrew Ebihara, Takao Harrison, Neil	UC, Irvine U. of Nevada, Las Vegas Shizuoka U. NHMFL - Los Alamos	NSF	High Field de Haas van Alphen in $YbAl_3$
Lee, Sung-IK Crooker, Scott Kim, Kee-Hoon+	Seoul U. - Korea NHMFL - Los Alamos NHMFL - Los Alamos	University	High Field THz of MgB_2 Thin Films
Limov, Victor Crooker, Scott Achermann, Marc+ Petruska, Melissa (f)+	LANL - C NHMFL - Los Alamos LANL - C LANL - C	DOE	Exciton Dynamics in Langumir-Blodgett Films of Semiconductor Nanocrystals
Maple, Brian Jung, Myung-Hwa (f)+ Ho, Pei-Chum+ Zapf, Vivien (f)* Lacerda, Alex	UC, San Diego New Mexico State U. UC, San Diego UC, San Diego NHMFL - Los Alamos	NSF	High Magnetic Field Phases of $PrOs_4Sb_{12}$

Mielke, Chuck Rickel, Dwight Migliori, Albert Montgomery, Mike	NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos Indiana U.	DOE	Thermodynamic Investigation of X-$BETS_2MC_{l4}$ Salts
Mielke, Chuck Singleton, John McDonald, Ross+ Chen, C. Ryan, J.-F.	NHMFL- Los Alamos Oxford U. NHMFL - Los Alamos Oxford U. Oxford U.	DOE	Upper Critical Field Phase Diagram by Penetration Depth Measurements in LSCO
Migliori, Albert Mydosh, John Galli, Federica (f)* Betts, Jon	NHMFL - Los Alamos Leiden U. - The Netherlands Leiden U. NHMFL - Los Alamos	DOE	Sound Velocity on $Lu_5Ir_4Si_1$
Migliori, Albert Lashley, Jason Kim, Kee-Hoon+ Kim, Don+ Boebinger, Greg Balakirev, Fedor	NHMFL - Los Alamos LANL - MISL NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Specific Heat of Pu
Movshovich, Roman Bianchi, Andreas+ Sarrao, John Thompson, Joe Fisk, Zach Lacerda, Alex	LANL - MST10 LANL-MST10 LANL-MST10 LANL-MST10 Florida State U. NHMFL- Los Alamos	DOE	Specific Heat of $CeCoIn_5$ in Magnetic Fields to 18 T for B//ab Plane
Murata, Keizo Harrison, Neil Konoike, Takako* Brooks, James Papavassiliou, G.	Osaka City U. - Japan NHMFL - Los Alamos Osaka City U. - Japan NHMFL - Florida State U. Natl. Tech. U. of Athens - Greece	Other	High Magnetic Field Behavior of the Tau-Phase Materials
Mydosh, John Guillermo, Jorge* Hellman, Frances Cheong, Sang Wok Kim, Kee-Hoon+ Jaime, Marcelo	Leiden U. - The Netherlands U. of Buenos Aires UC, San Diego Rutgers U. NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Specific Heat of URu_2Si_2 in High Magnetic Fields
Mydosh, John Harrison, Neil Jaime, Marcelo	Leiden U. - The Netherlands NHMFL - Los Alamos NHMFL - Los Alamos	University	QCPs via High Field Magnetization Measurements in URu_2Si_2
Mydosh, John Kim, Kee-Hoon+ Jaime, Marcelo	Leiden U. - The Netherlands NHMFL - Los Alamos NHMFL - Los Alamos	Other	High Field Sensor Calibration
Nakotte, Heinz Jung, Myung-Hwa (f)+ Alsmadi, Abdel* Lacerda, Alex Kamarad, Jiri Sechovsky, Vladimir	New Mexico State U. New Mexico State U. New Mexico State U. NHMFL - Los Alamos Czech Acd. of Sciences Charles U. - Prague	NSF	Magnetoresistance of UIrGe Under High Pressures and High Magnetic Fields
Nakotte, Heinz El-Khatib, Sami* Alsmadi, Abdel* Jung, Myung-Hwa (f)+ Lacerda, Alex	New Mexico State U. New Mexico State U. New Mexico State U. New Mexico State U. NHMFL - Los Alamos	NSF	High Fields Magnetic Properties of $UNi_{1-x}T_xAl$ (T = Rh, Ru, Fe) Compounds

Nieva, Gladys (f) Jaime, Marcelo de la Cruz, F. Correa, Victor* Kim, Kee-Hoon+ Jorge, Guillermo*	CEB - Argentina NHMFL - Los Alamos CEB - Argentina CEB - Argentina NHMFL - Los Alamos U. of Buenos Aires	Other	High Field Magnetization of $Bi_2Sr_2CaCu_2O_{8+\delta}$ Superconductors
Perez, Florent Jusserand, Bernard Etienne, Bernard Crooker, Scott Negre, Nicolas+	CNRS-INSA, Toulouse-France Lab. de Photonique et Nano-France Lab. de Photonique et Nano-France NHMFL - Los Alamos NHMFL - Los Alamos	Other	Photoluminescence of Quantum Wires Array
Ramirez, Art Chi, Xiaoliu+ McDonald, Ross+ Mielke, Chuck Harrison, Neil	LANL - MISL LANL - MISL NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Magnetic Field Suppression of CDW Phase in $(Per)_2Pt(mnt)_2$
Reitze, David Crooker, Scott Jho, Young-Dahl+ Kono, Junichiro Stanton, Chris	U. of Florida NHMFL - Los Alamos U. of Florida Rice U. U. of Florida	NSF	Pulsed-Field Photoluminescence Study on Magneto-Excitons in Wide-Gap Semiconductors
Rickel, Dwight	NHMFL - Los Alamos	DOE	Magnet Noise Measurements
Rosenbaum, T. Husmann, A.* Betts, Jon Boebinger, Greg Migliori, Albert Saboungi, M.	U. of Chicago U. of Chicago NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos Argonne Natl. Lab	NSF	High Field Universality Scaling in AgSe
Rullier-Albenque, F.(f) Balakirev, Fedor Alloul, Henri	CEA-Saclay-France NHMFL - Los Alamos CEA-Saclay-France	University	Transport in Irradiated Cuprates
Sarma, Bimal Ketterson, John Jaime, Marcelo Balakirev, Fedor Migliori, Albert Lacerda, Alex Souslov, Alexei+ Mielke, Chuck	U. of Wisconsin-Milwaukee Northwestern U. NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos NHMFL - Los Alamos UW - Milwaukee NHMFL - Los Alamos	NSF	Ultrasonic Measurements of URu_2Si_2 in Pulsed Fields
Schlueter, John Jorge, Guillermo* Kim, Kee-Hoon+ Jaime, Marcelo	Argonne Natl. Lab U. of Buenos Aires NHMFL - Los Alamos NHMFL - Los Alamos	DOE	Specific Heat of Spin Frustrated $(ET)_3Mn(DCA)_3$
Schmiedeshoff, George Lashley, Jason Quan, Jennifer (f)* Lacerda, Alex	Occidental College LANL Occidental College NHMFL - Los Alamos	NSF	Magnetotransport of Uranium Compounds: Single-Crystal U and UNb
Schulmann, Joel Crooker, Scott Rickel, Dwight Smith, Darryl Martin, Ivar Crone, Brian Zinck, Jenna	Hughes Research Laboratory NHMFL - Los Alamos NHMFL - Los Alamos LANL - T11 LANL - T11 LANL-MST11 Hughes Research Laboratory	Industry	Spin Currents in Semiconductors

Sechovsky, Vladimir Honda, Fumi+ Alsmadi, A.* Chang, Sang* Nakotte, Heinz Janousova, Blanka*	Charles U. - Czech Republic Charles U. NMSU - Las Cruces NMSU - Las Cruces NMSU - Las Cruces Charles U.	NSF	High Pressure - High Field Magnetotransport of UPdSn
Steglich, Frank Geibel, C. Gegenwart, Philipp Jaime, Marcelo Harrison, Neil	MPI - Dresden, Germany MPI - Dresden, Germany MPI - Dresden, Germany NHMFL - Los Alamos NHMFL - Los Alamos	University	High-Field Behavior of Yb- and Ce-based Heavy Fermion Materials: $YbFe_2Ge_2$, $CeNi_2Ge_2$
Swenson, C. Migliori, Albert Fisher, Ian	Ames Lab NHMFL - Los Alamos Stanford U.	DOE	Sound Velocity Investigation of Icosahedral Quasicrystal $Al_{71}Pd_{21}MnO_8$
Takabatake, Toshiro Jung, Myung-Hwa (f)+ Kim, Moo-Sung* Lacerda, Alex	Hiroshima U.- Japan New Mexico State U. Hiroshima U.- Japan NHMFL - Los Alamos	Other	Magnetoresistance of NFL Compounds
Takabatake, Toshiro Jung, Myung-Hwa (f)+ Kim, Moo-Sung* Harrison, Neil Lacerda, Alex	Hiroshima U. - Japan New Mexico State U. Hiroshima U. - Japan NHMFL - Los Alamos NHMFL - Los Alamos	Other	Magnetization of CeRhSn
Tozer, Stan Mielke, Chuck Agosta, Chuck Martan, Catlen* Izabela, Mihut (f)*	NHMFL - Tallahassee NHMFL - Los Alamos Clark U. Clark U. Clark U.	NSF	Field Induced Reentrant Behavior in $(TMTSF)_2PF_6$
Tyson, Trevor Jaime, Marcelo Qin, Yuhai*	New Jersey Institute of Technology NHMFL - Los Alamos New Jersey Institute of Technology	NSF	High Magnetic Field Studies of Ca Doped $BiMnO_3$
von Molnar, Steven Watts, Steven* Jaime, Marcelo	Florida State U. Florida State U. NHMFL - Los Alamos	NSF	High-Field Effect in CrO_2 Films
Yakovlev, Dmitrii Astakov, Gregory+ Crooker, Scott	U. of Wuerzburg - Germany U. of Wuerzburg NHMFL - Los Alamos	University	Trions in Magnetically - Doped ZnSe Heterostructures
Yakovlev, Dmitrii Astakhov, Georgy Keller, Dirk* Barrick, Scott* Preiner, Michael*	U. of Wuerzburg - Germany U. of Wuerzburg U. of Wuerzburg U. of New Mexico MIT	University	Single-Triplet Charged Exciton Anticrossing in High Magnetic Fields
Yakovlev, Dmitrii Astakhov, Georgy+ Crooker, Scott	U. of Wuerzburg - Germany U. of Wuerzburg NHMFL - Los Alamos	Other	High-Field Spin Polarized Spectroscopy of Graded-Density 2DEGs

Number of Pulsed Field Facility Projects: 71

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

Users	Institutions	Funding	Project
Halperin, W.B. Gervais, G. Lee, Yoon Choi, H.C. Gray, Aaron Vicente, C. Xia, J.S.	Northwestern U. Northwestern U. UF & NHMFL UF UF UF & NHMFL UF & NHMFL	NHMFL	Effect of Strong Magnetic Fields on Superfluid ^{3}He
Stewart, G. Kim, J.S. Ihas, G.G. Xia, J.S. Adams, E.D. Sullivan, N.S.	UF & NHMFL UF UF & NHMFL UF & NHMFL UF & NHMFL UF & NHMFL	NSF	$CeNi_2Ge_2$ at Ultra Low Temperatures
Stormer, H.L. Tsui, D.C. Pan, Wei Adams, E.D. Sullivan, N.S. Xia, J.S. Vicente, C.	Bell Lab & Columbia U. Princeton U. Princeton U. & NHMFL UF & NHMFL UF & NHMFL UF & NHMFL UF & NHMFL	Other	FQHE at ν =5/2

Number of High B/T Projects: 3

USERS & PROJECTS: NMR SPECTROSCOPY AND IMAGING FACILITIES

Users	Institutions	Funding	Project
Alam, T. Cherry, B. Gan, Z.	Sandia National Labs Sandia National Labs NHMFL	DOE	High Field ^{17}O STMAS of h-P2O5
Alama, R.G. Blanco, J.A. Carrilero, I. Mowery, D.	FSU, College of Engineering, NHMFL FSU, CoE, NHMFL FSU, CoE, NHMFL FSU, CoE, NHMFL	NSF	Study of Ethylene Copolymers
Barber, Elisar Edison, Arthur	Ohio U. U. of Florida, NHMFL		Triple Resonance Protein
Beck, B. Blackband, S.J. Fitzsimmons, J. Crozier, S. Smith, Mike Collins, Chris	McKnight Brain Institute, U of Florida, NHMFL McKnight Brain Institute, U. of Florida, NHMFL McKnight Brain Institute, U. of Florida U. of Queensland, Australia Pennsylvania State U. Pennsylvania State U.	NHMFL, UFBI	Development of Large Volume High Frequency RF Coils
Beck, B. Duensing, R. Fitzsimmons, J. Blackband, S. Smith, Mike Collins, Chris	U. of Florida, NHMFL, McKnight Brain Institute Applied Resonance Technology McKnight Brain Institute, U. of Florida McKnight Brain Institute, U. of Florida, NHMFL Pennsylvania State U. Pennsylvania State U.	NHMFL, UFBI	Development of High Frequency Phased Array Rf Coils
Benveniste, H. Grant, Sam Blackband, S.	Brookhaven Natl. Lab U. of Florida McKnight Brain Institute, U. of Florida, NHMFL	NIH, NHMFL, UFBI	MR Microimaging Studies of Mouse Brains for Generation of a Web-Based Atlas
Blackband, S.J. Grant, S. Thelwall, P. Shepard, T. Roper, S. Phillips, I. Stanisz, G. Webb, A. Buckley, D.	McKnight Brain Institute, U. of Florida, NHMFL U. of Florida McKnight Brain Institute, U. of Florida McKnight Brain Institute, U. of Florida U. of Florida McKnight Brain Institute, U. of Florida U. of Toronto, Canada U. of Illinois U. of Manchester, England	IHRP, NIH, UFBI	NMR Microscopy and Spectroscopy of Single Cells, Blood Cell Ghosts and Brain Slices
Blackband, S.J. Padgett Mareci, T.	McKnight Brain Institute, U. of Florida, NHMFL U. of Florida U. of Florida, NHMFL		Diffusion Tensor MRI in Developmentally Challenged Children
Bowtell, R. Blackband, S.J. Grant, S.	U. of Florida McKnight Brain Institute, U. of Florida, NHMFL U. of Florida		Dipolar Demagnetization Effects at 750 MHz

Bowtell, R. Crozier, S. Beck, B. Blackband, S.J.	U. of Nottingham, England U. of Queensland, Australia McKnight Brain Institute, NHMFL, U. of Florida McKnight Brain Institute, U. of Florida, NHMFL	NIH	Development of Novel Multi-Layer Transverse Gradient Coils
Brey, W. Gor'kov, P. Fu, R. Tian, C.	NHMFL NHMFL NHMFL NHMFL	NHMFL, IHRP	RF Homogeneity of Large Sample Solenoids Due to Wavelength Effects, and Its Improvement Based on Balanced Tuning Circuit
Brey, W. Gor'kov, P. Fu, R. Cross, T.	NHMFL NHMFL NHMFL NHMFL	NHMFL, IHRP	$^{1}H/^{15}N$ Solid State NMR Probes for Membrane Protein Studies, 600 and 400 MHz Superconducting Magnets at the NHMFL
Bryant, P. Butler, L. Gan, Z.	Louisiana State U. Louisiana State U. NHMFL	NSF	^{93}Nb High Field MAS NMR of $[NH_4]_5 [NbF_4O][NbF_7]_2$
Cioffi, E.A.	U. of South Alabama	U. of South Alabama	*In vivo* ^{31}P NMR Spectroscopy of Microvascular Endothelial Cells
Cioffi, E.A.	U. of South Alabama	Pfizer, Incorporated	Ultrasonically-Promoted C-H Bond Activation and Isotopic Exchange in Glycoconjugates
Constantinidis, Ioannis Simpson, Nicholas Blackband, S.J. Rocca, James	U. of Florida, NHMFL, McKnight Brain Institute U. of Florida McKnight Brain Institute, U. of Florida, NHMFL U. of Florida	NSF-NHMFL External Users Program	Study of Insulin Production in Various Cell Lines
Cross, T.A. Tian, T. Kim, S.	NHMFL, FSU NHMFL NHMFL	NSF	Continuing Development of PISA Wheel Analysis
Cross, T.A. Gao, F. Korepanova, A. Mo, Y. Nakamoto, R.	NHMFL, FSU NHMFL, FSU NHMFL, FSU NHMFL, FSU U. of Virginia	NIH	Membrane Protein Genomics
Cross, T.A. Mo, Y. Nerdal, W.	NHMFL, FSU NHMFL, FSU U. of Bergen	NSF, U. of Bergen	Structural Studies of Gramicidin in Long Chain Lipids by Solid State NMR
Cross, T.A. Tian, C. Tobbler, J. Lamb, R.A. Pinto, L.	NHMFL, FSU NHMFL Northwestern U. Northwestern U. Northwestern U.	NSF, NIH	Solid State NMR Spectroscopy of the M2 Protein from Influenza A Virus
Cross, T.A. Nishimura, K. Kim, S.	NHMFL, FSU Yokohama Natl. U. NHMFL, FSU	NSF	Tetrameric Structure of the M2 Transmembrane Peptide
Cross, T.A. Tian, C. Hu, J.	NHMFL, FSU NHMFL NHMFL	NIH	Binding of Amantadine to the M2 Transmembrane Peptide

Edison, A.S. Thomas, Steve Zachariah, Cherian Cottrell, Glen Price, David Price, Becky	U. of Florida, NHMFL U. of Florida U. of Florida St. Andrews U., Whitney Laboratory U. of Florida U. of Florida	NSF	NMR Structure of FMRFamide Bound to FaNaCh
Fonollosa, P. d'Espinose, J.B. Gan, Z.	ESPCI, CNRS ESPCI, CNRS NHMFL	CNRS	High Field Solid State NMR of Cement Materials
Forder, J. Hsu, E. Buckley, D.L. Blackband, S.	U. of Alabama at Birmingham Duke U. U. of Manchester, England McKnight Brain Institute, U. of Florida, NHMFL	NIH, UFBI, NHMFL	MR Biexponential Diffusion Tensor Imaging of Isolated Rat Hearts
Fu, R. Tian, C. Kim, H. Smith, S.A. Cross, T.A.	NHMFL NHMFL NHMFL NHMFL NHMFL, FSU	NSF	Development of PISEMA
Fu, R. Nishimura, K. Gao, F. Kim, S. Hu, J. Cross, T.A. Ulrich, A.	NHMFL Yokohama National U. NHMFL, FSU NHMFL NHMFL NHMFL, FSU Friedrich-Schiller-Universitaet Jena, Institut für Molekularbiologie	NIH	^{19}F NMR of Membrane Proteins
Fu, R. Ma, Z. Zheng, J.P. Moss, O.P. Au, G. Plichta	NHMFL FSU FSU, CoE FSU, CoE U.S. Army Communications - Electronics Command U.S. Army Communications - Electronics Command	FSU-FSURF, U.S. Army Communications-Electronics Command	Lu NMR Study of Li_xV_{205} Battery Material
Fu, R. Hu, J. Cross, T.A.	NHMFL NHMFL NHMFL, FSU	NIH	High Resolution ^{13}C MAS NMR of Gramicidin A
Fu, R. Li, C. Kim, H. Cross, T.A.	NHMFL NHMFL NHMFL NHMFL, FSU	NSF	Cross Polarization Schemes for Peptide Samples in Hydrated Lipid Environment
Gamscik, M. McDonald, Jeffrey Grant, S. Blackband, S.	Duke U. U. of North Carolina U. of Florida McKnight Brain Institute, U. of Florida, NHMFL	NSF-NHMFL External Users Program	Decoupled and Spatially Localized ^{13}C Spectroscopy of Glutathione in Tumors
Gan, Z. King, B.F. Cross, T.A.	NHMFL Spelman College NHMFL	NSF	^{17}0 NMR of Humic Acids
Gan, Z. Gor'kov, P. Brey, W. Prestegrad, J.	NHMFL NHMFL NHMFL U. of Georgia	NHMFL	High Resolution NMR Above 1 GHz Using Keck Magnet

Gan, Z. Steuernagel, S.	NHMFL Bruker Instruments	NHMFL, Bruker Instruments	Ultra Precise Magic-Angle Calibration
Gan, Z. Gor'kov, P. Glauner, H.	NHMFL NHMFL Bruker Instruments	NHMFL, IHRP	1 GHz High Resolution MAS Probe for 25 T Keck Resistive Magnet at NHMFL
Gilboa, Joseph K. Edison, Arthur S. Rocca, James Zachariah, Cherian	Weizmann Institute of Science U. of Florida, McKnight Brain Institute NHMFL U. of Florida U. of Florida	NSF-NHMFL External Users Program	Conformational Studies of Furanosides
Gor'kov, P. Gan, Z.	NHMFL NHMFL	NHMFL	Static Solid-State NMR Probe with Variable Temperature Capability for 19.6 T Magnet at NHMFL
Gor'kov, P. Fu, R. Samoson, A.	NHMFL NHMFL NICBP, Estonia	NHMFL	7 mm MAS Low-Gamma Probe for 19.6 T Magnet at NHMFL
Gor'kov, P. Gan, Z. Samoson, A.	NHMFL NHMFL NICBP, Estonia	NHMFL	2 mm Fast High Frequency MAS Probe for 19.6 T Magnet at NHMFL
Gor'kov, P. Wu, A. Opella, S.	NHMFL U. of California, San Diego U. of California, San Diego	U. of California, San Diego	Variable Temperature Insert for Membrane Protein Probes at 700 MHz Superconducting Magnet at UCSD
Gowen, Joseph A. Markham, Jeffery Morrison, Sara E. Cross, Timothy A. Busath, David D.	Brigham Young U. Brigham Young U. Brigham Young U. NHMFL, FSU Brigham Young U.	NSF, NIH	The Role of Trp Side Chains in Tuning Single Proton Conduction Through Gramicidin Channels
Grandinetti, P. Gan, Z.	Ohio State U. NHMFL	NSF, NHMFL	Theory for Rotary Resonance in MQMAS Experiment
Grandinetti, P. Clark, T. Gan, Z.	Ohio State U. Ohio State U. NHMFL	NSF	High Field ^{17}O NMR of Carbohydrate
Greenbaum, Nancy Mundoma, Claudius	FSU, NHMFL FSU	FSU CRC, Pfizer Fellowship	Probing the Binding of Paramagnetic Metal Ions to a GAAA RNA Tetraloop
Greenbaum, Nancy Porges, Alex Schroeder, Kersten	FSU, NHMFL FSU FSU	NIH	Structural Features of Domains 5 and 6 of the Group II Intron
Greenbaum, Nancy Schroeder, Kersten Aquino, Theo	FSU, NHMFL FSU FSU	NIH	Interaction of the Spliceosomal Pre-mRNA Branch Site Duplex with the SF3b p14 Protein
Han, O. Gan, Z.	Korean Institute of Basic Science NHMFL	Korean Government	^{109}Ag NMR of Electric Materials Using High Fields
Hargrave, Paul Smith, Clay McDowell, Hugh Rocca, Jim Edison, A.S. Shilton, Brian	U. of Florida McKnight Brain Institute, NHMFL U. of Western Ontario U. of Florida U. of Florida U. of Florida U. of Florida, NHMFL	NSF-NHMFL External Users Program	NMR Studies of the Arrestin/Rhodopsin Complex

Hedges, K. Blackband, S. Rodier, P.	U. of Rochester McKnight Brain Institute, U. of Florida, NHMFL U. of Rochester	NIH	High Resolution MRI of Isolated Fixed Autistic Human Brains
Hilbelind, Don Mareci, Tom	U. of South Florida U. of Florida	NIH	MRI of Fetal Pig
Hoatson, Gina L. Zhou, Donghua	College of William & Mary College of William & Mary	NHMFL, College of William & Mary	^{93}Nb, ^{45}Sc NMR of PMN Using 830 MHz NMR
Houpt, T.A. Smith, J.C. Cason, A.	FSU FSU FSU	NIH, FSURF	Behavioral and Neural Effects of Static High Magnetic Fields
Hu, J. Mo, Y. Li, C. Gao, F. Cross, T.A. Opella, S.J. Marassi, F. Veglia, G.	NHMFL NHMFL NHMFL NHMFL NHMFL, FSU U. of California – San Diego Burnham Institute, U. of Minnesota U. of Minnesota	NIH	Development of Membrane Protein Sample Preparation
Hu, J. Nishumura, K. Zhang, L. Cross, T.A.	NHMFL Yokohama Natl. U. Yokohama Natl. U. NHMFL, FSU	NIH	Histidine pH Titration of M2 TMP
Kwak, H. Gan, Z.	NHMFL NHMFL	NHMFL, IHRP	Solid State NMR Method Development for Quadrupolar Nuclei
Lin, Y.Y. Warren, W. Brey, W.	UCLA Princeton U. NHMFL	NHMFL	IZQC Technique (Intermolecular Zero Quantum Coherence), 25 T Keck Magnet
Lockett, Elizabeth Noe, Adrianne Mareci, Tom	National Museum of Health & Medicine of the Armed Forces Institute of Pathology National Museum of Health & Medicine of the Armed Forces Institute of Pathology U. of Florida	NIH	MRI of Human Fetal Development
Logan, T.M. Edison, A. Dunn, B.	NHMFL, FSU U. of Florida U. of Florida	NIH	Structure of IA3 Peptide
Logan, T.M. Wylie, G. Murphy, J. Caspar, D.	NHMFL, FSU FSU Boston U. School of Medicine FSU	AHA	Structure of an Intramolecular Complex that Regulates the Diphtheria Toxin Repressor Protein
Logan, T.M. Murphy, J. Caspar, D. Marin, V.	NHMFL, FSU Boston U. School of Medicine FSU FSU	NIH	Disorder - to - Order Transition in Diphtheria Toxin Repressor and Its Mutants
Logan, T.M. Vijayaraghavan, R. Zhou, H.X.	NHMFL, FSU Brigham Young U. Brigham Young U.	FSU	Entropy of Intramolecular Ligand Binding Reactions in Biochemistry

Logan, T.M. Vijayaraghavan, R. Marin, V. Caspar, D. Murphy, J.	NHMFL, FSU FSU FSU FSU Boston U. School of Medicine	AHA, FSU	Domain-Domain Interactions in Diphtheria Toxin Repressor Protein
Logan, T.M. Mehndiratta, P. Walton, W.J.	NHMFL, FSU FSU FSU	NIH, FSU, NSF	Structural Studies on Recombinant Thy-1 Glycoprotein
Luck, Linda Salopek-Sondi, Branka Swartz, Derrick Carmon, Kendra	Clarkson U. Clarkson U. Clarkson U. Clarkson U.	NIH, ACS, NSF	^{19}F NMR of Periplasmic Binding Proteins and the Estrogen Receptor
Lukasik, Stephen Zhang, Lina Corpora, Takeshi Tomanicek, Sarah Li, Yuanhong Kundu, Mondira Hartman, Kari Liu, Paul Laue, Thomas Biltonen, Rodney Speck, Nancy Bushweller, John	U. of Virginia Dartmouth Medical School U. of Virginia U. of Virginia U. of Virginia School, National Human Genome Research Institute NIH U. of New Hampshire School, National Human Genome Research Institute NIH U. of New Hampshire U. of Virginia Dartmouth Medical School U. of Virginia	NIH, NSF, Damon Runyon Cancer Research Foundation	Altered Affinity of CBFbSMMHC for Runx1 Explains Its Role in Leukemogenesis
Massiot, D. Gan, Z.	CRMHT, CNRS NHMFL	CNRS	High Field Solid State NMR of Materials
Morrison, Paul Sarntinoranont, Malisa Mareci, Tom	National Institutes of Health NIH U. of Florida	NIH	MRI of Excised Spinal Cords
Mrse, A.A. Emery, E.F. Gan, Z. Caldwell, T. Reyes, A.P. Kuhns, P. Hoyt, D.W. Simeral, L.S. Hall, L.G. Butler, L.G.	Louisiana State U. Louisiana State U. NHMFL NHMFL NHMFL NHMFL Environmental Molecular Science Laboratory Albermarle Corporation Louisiana State U. Louisiana State U.	NSF	Structural Characterization of MO and Related Aluminum Complexes. I. Solid-State ^{27}A1 NMR with Comparison to EFG Tensors from *ab initio* Molecular Orbital Calculations
Pikov, Victor Mareci, Tom	Huntington Medical Research Institute U. of Florida	NIH	MRI of Spinal Cords
Quine, J. Bertram, R. Chapman, M Cross, T.A.	FSU FSU FSU NHMFL, FSU	NSF	Mathematical Aspects of Protein Structure Determination with NMR Orientational Restraints
Samoson, A. Gan, Z. Cross, T.A.	NICBP, Estonia NHMFL NHMFL	NICBP, Estonia	DOR NMR at 720 MHz

Schiano, J. Brey, W. Gor'kov, P.	Pennsylvania State U. NHMFL NHMFL	NHMFL	Feedback Stabilization of the 25 T Keck Resistive Magnet at NHMFL, Control Theory and Hardware
Skalicky, J.J. Clark, S. Chapman, M.S.	NHMFL FSU FSU	NIH, NHMFL	Functional Dynamics of Arginine Kinase: Development of TROSY-Based Methods
Srinivasan, P. Quine, J. Gan, Z.	FSU FSU NHMFL	NHMFL	Mathematical Tools in NMR Spectroscopy
Stemmler, Timothy Hu, Jun Bencze, Krisztina Skalicky, J.J.	Wayne State U. NHMFL, FSU Wayne State U. NHMFL	American Heart Association Scientist Development Grant	The Solution Structure of the 123 Amino Acid Yeast Frataxin Homologue Protein "Yfhlp"
Stemmler, Timothy Bencze, Krisztina Skalicky, J.J.	Wayne State U. Wayne State U. NHMFL	Wayne State U.	Active Site Characterization and Solution Dynamic Study of TEM-1 Beta-Lactamase
Sven, Ferdinand Edison, Arthur	Mt. Sinai School of Medicine U. of Florida, NHMFL	NSF-NHMFL External Users Program	Conformation and Dynamics of a New Group of Neuropeptides
Taulelle, Francis Gan, Zhehong	U. of Strasbourg NHMFL	CNRS, France	Optimizing STMAS
Tian, C. Hu, J. Cross, T.A. Busath, D.D.	NHMFL NHMFL NHMFL, FSU Brigham Young U.	NIH	Ion Conduction of the M2 Protein
Tian, C. Cross, T.A.	NHMFL NHMFL, FSU	NIH	Solution NMR of the Transmembrane M2 Protein
Tzou, Der-Lii Zujovic, Z. Gan, Z.	Institute of Chemistry, Taipei Institute of Chemistry, Taipei NHMFL	Academia Sinica	^{27}Al Solid State NMR of Catalytic Materials
Walkenhorstt, William Edison, Arthur Thirumoorthy, Ramanan	Loyola U. U. of Florida, NHMFL U. of Florida	NSF-NHMFL External Users Program	NMR Structure and Stability of Modified Ovomucoid
Waschek, James Grant, S. Blackband, S.	U. of California, Los Angeles U. of Florida McKnight Brain Institute, U. of Florida, NHMFL	NSF-NHMFL External Users Program	MR Microimaging of Genetically Modified Mice
Williams, David F. Koehler, Philip G. Silver, Xeve	U.S. Department of Agriculture U. of Florida U. of Florida Advanced Magnetic Resonance Imaging Spectroscopy	NSF-NHMFL External Users Program	MRI Elucidation of the 3-D Structure of Subterranean Termite Habitats
Withers, S. Brey, W.	Bruker Instruments NHMFL	NIH	Design of Superconductive Coils for ^{15}N NMR Applications
Wolf, Martin Wolf, Ursula Baumgartner, Stephan	U. of Berne U. of Berne U. of Berne	Software AG Foundation, U. of Berne, Wala Heilmittel GmbH, Dr. Reckeweg & Co GmbH	Investigation of Homeopathic Potencies with Nuclear Magnetic Resonance Spectroscopy
Wu, G. Gan, Z.	Queen's U. NHMFL	NERSC	High-Field Solid State ^{17}O, ^{39}K, ^{23}Na NMR

Yue, Wu Gan, Z.	U. of North Carolina, Chapel Hill NHMFL	NSF	Ti Solid State NMR of Nanosheet
Zujovic, Z. Gan, Z.	U. of Belgrade NHMFL	NHMFL	Development of New PISEMA Sequence

Number of NMR Spectroscopy and Imaging Projects: 89

USERS & PROJECTS: ICR FACILITY

v.P.I. = Principal investigator who came to the facility
v.g.s. = Graduate student who came to the facility
v.p.d. = Postdoc who came to the facility
User = Researcher who sent samples to the facility
Collaborator = Researcher who has either active or in progress grants for these projects

Users	Institutions	Funding	Project
Blair, Ian (User)	U. of Pennsylvania		Lipoxidation of Peptides
Conrad, Charles (collaborator)	M.D. Anderson Cancer Center-Houston		Cytokines Associated with Gliablastoma Brain Tumors
Cooper, Bill (P.I.)	Florida State U.		ESI of Humic Substances
Cross, Tim (User)	Florida State U.		Peptide Sequence Analysis
Denison, Carilee (v.g.s.)	U.T. Medical School at Dallas		Cross-Linking of Peptides
Drader, Jarod (v.P.I.)	Ibis Pharmaceuticals		Evaluation of Q-ICR
Eng-Wilmot, Larry (User)	Rollins College		ESI of Siderophore Compounds
Eyler, John (v.P.I.)	U. of Florida		ICP/ICR, Ion Solvation
Fagerquist, Keith (v.P.I.)	U.S. Department of Agriculture		ECD of Protein Antibiotic Complex
Freitas, Michael (P.I.)	Ohio State U.		H/D Exchange of Peptide/Protein
Gapeev, Alexei (v.g.s.)	Case Western Reserve U.		Transition Metals rxns with Benzene
Georganopoulou, Dimetra (User)	U. of North Carolina		Micro-Emitter Fabrication
Goli, Omesh (User)	Florida State U.		Peptide Lab, Verification of Peptide Structure
Greenbaum, Nancy (User)	Florida State U.		FT-ICR of RNA
Grubbs, Robert (User)	California Institute of Technology		ESI of Noncovalent Daisychain Polymers
Gustafsson, Elizabet (v.g.s.)	U. of Göteborg-Sweden		LC micro-ESI FT-ICR
Hare, Joan (collaborator)	Florida State U.		Magnetic Assisted Transformation, Gliablastoma and Microglia
Hatcher, Pat (v.P.I.)	Ohio State U.		ESI of Humics
Hendricks, Hank (User)	Florida State U.		Peptide Lab, Verification of peptide Structure
Heptinstall, John (User)	Coventry U.		ESI of Nitrated Peptides
Herron, Ron (v.P.I.)	FOM Institute-Amsterdam		MIDAS
Hurst, Jeff (User)	Hershey's		ESI of Cocoa Extract
Jessop, Mike (v.P.I.)	Syngenta Pharmaceuticals U.K.		High Sensitivity CZE

Johnson, Bob (User)	Abbot Laboratories		Phosphorylated Peptides
Kaifer, Angel (User)	U. of Miami		ESI of Calixarene Dimers
Kim, Sunghuan (v.g.s.)	Ohio State U.		ESI of Humics
Kodakek, Thomas (User)	U.T. Medical School at Dallas		Cross-Linking of Peptides
Langridge-Smith, Pat (v.P.I.)	U. of Edinburgh		Metal Complexes
Lanman, Jason (User)	U. of Alabama		HD Exchange of HIV Protein
Li, Hong (User)	Florida State U.		Verification of Protein RNA Complex
Lifshiz, Chava (User)	U. of Jerusalem		HDX of Sr_8
Little, Reginald (v.P.I.)	Florida A&M U.		ESI of Fe Cluster
Liu, Yan (User)	Duke U.		ESI of Melanins
Llewellyn, Jennifer (User)	Florida State U.		ESI of Humic Substances
Marzluff, William (User)	U. of North Carolina		ESI of RNA Binding Protein
Logan, Tim (User)	Florida State U.		Di-Sulfide Bonding and Verification of Peptide Sequence
McIntosh, Michael (User)	U. of Utah		MS/MS of Unique Conotoxin
McKay, Logan (v.g.s.)	U. of Edinburgh		CE-FT-ICR
McLendon, George (User)	Princeton U.		ESI of Coiled-Coil Dynamic Libraries
Moffett, Frank (v.P.I.)	Syngenta Pharmaceuticals U.K.		High Sensitivity CZE
Mehdiratta, Promod (v.g.s.)	Florida State U.		Glycosylation of Thy1 Protein
Moore, Eugene (User)	U. of California at Riverside		ESI of Wasp Venom
Murray, Royce (v.P.I.)	U. of North Carolina		Micro-Emitter Fabrication
Nelsestuen, Gary (User)	U. of Minnesota		MS/MS of OMP C Proteins
Nilsson, Carol (v.P.I.)	U. of Göteborg-Sweden		MS/MS of Glycosylated Peptides
Patrie, Steve (v.g.s.)	U. of Illinois		Construction of High Performance ESI 9.4 T FT-ICR
Polfer, Nick (v.g.s.)	U. of Edinburgh		ECD of Zn-Binding Protein
Powell, David (v.P.I.)	U. of Florida		High Sensitivity FT-ICR MS
Qian, Kuangnan (v.P.I.)	Exxon/Mobil Inc.		ESI of Crude Oil
Sang, Amy (User)	Florida State U.		Human Endometase
Saunders, Martin (User)	Yale U.		Endohedral Fullerenes
Schafer, Matias (v.P.I.)	U. of Cologne		IRMPD of Non-Covalent Complexes

Seavy, Margaret (User)	Florida State U.		MALDI of Proteins
Speake, Diane (User)	Florida State U.		ESI of Tupelo Extract
Stenson, Alexandra (User)	Florida State U.		ESI of Humic Substances
Svek, Frank (v.P.I.)	U. of California at Berkley		CEC on a Chip
Taylor, Alan (User)	Oregon State U.		ESI of Hoptannie
Wood, Paul (collaborator)	Centaur Pharmaceuticals		Effects of Gliablastoma on Growth of Microglia
Zhang, Liwen (v.g.s.)	Ohio State U.		ESI of Humics

Number of ICR Projects: 59

USERS & PROJECTS: EMR FACILITIES

Users	Institutions	Funding	Project
Angerhofer, A. Walker. L. Van Tol, J.	NHMFL, U. of Florida U. of Florida NHMFL	NHMFL	High Field ENDOR of Chlorophyl and Pheophytin Anions
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
Arieli, D. Goldfarb, D. Saylor, C.	Weizmann Institute Rehovot, Israel Weizmann Institute NHMFL	Other	High Field EMR of Ni-SAPO-34
Brunel, L.C. Van Tol, J. Bortolus, M.	NHMFL NHMFL NHMFL	NHMFL	Multifrequency EPR/ENDOR Investigation of Phosphor-Doped Silicon
Budil, D. Zeng, R. Van Tol, J.	Northeastern U. NHMFL/Northeastern U. NHMFL	NSF	EPR of Triplet States in Photosynthetic Reaction Centers
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. Smith, S. Khairy, K. Fajer, P.	Northeastern U. NHMFL Northeastern U. NHMFL, FSU	NSF	The Stochastic Liouville Equation in Magnetic Resonance. An Object Oriented Implementation
Cotton, F.A. Dalal, N. Huang, P. Murillo, C.A. Stowe, A.C. Wang, X.	Texas A&M U. FSU Texas A&M U. U. of Costa Rica FSU Texas A&M U.	NSF	The First Structurally Confirmed Paddlewheel Compound with an M_2^{7+} Core: $[Os_2(hpp)_4Cl_2](PF_6)$
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. Berlinguette, C. Dunbar, K.	FSU FSU Texas A&M U. Texas A&M U.	NSF	Multifrequency EPR of $[Ni(tmphen)_2]_3[Fe(CN)_6]_2$
Dalal, N. Stowe, A. Van Tol, J.	FSU FSU NHMFL	FSU, NHMFL	Exchange Coupled Transition Ion Clusters Studied by HF EPR
Fajer, P. Song, Likai Li, Hui	NHMFL/FSU NHMFL Taichi U., Taiwan	American Heart Association	Domain Dynamics of Smooth Muscle Myosin
Fajer, P. Song, Likai Brown, L.	NHMFL/FSU FSU U. New South Wales, Australia	Muscular Dystrophy Association	Binding of Metal Ions to Troponin Complex
Fajer, P. Zhang, Xiaojun Brown, L.	NHMFL/FSU FSU U. New South Wales, Australia	Muscular Dystrophy Association	Orientation of Troponin in Muscle

Fajer, P. Zhang, Xiaojun Rouviere, C. Brown, L.	NHMFL/FSU FSU NHMFL U. New South Wales, Australia	Muscular Dystrophy Association	Structure of Troponin Complex in Muscle
Fajer, P. Rouviere, C. Miki, M. Wakabayashi, T.	NHMFL/FSU FSU Kyoto U. Tokyo U., Japan	Muscular Dystrophy Association	Structure of Tropomyosin
Fajer, P. Liang, Hua	NHMFL/FSU FSU	NSF	Orientation and Dynamics of Regulatory Light Chain
Fajer, P. Stallworth, R. Khairy, K. Budil, D Sale, K.	NHMFL/FSU NHMFL MPI Dresden, Germany Northeastern U. Sandia Natl. Labs	NSF	Sidechain Mobility and Simulation in Staph. Nuclease
Fajer, P. Hambly, B. Baumann, B. Hideg, K.	NHMFL/FSU U. Sydney, Australia NHMFL/FSU U. Pecs, Hungary	NSF	The Regulatory Domain of the Myosin Head Behaves as a Rigid Lever
Fajer, P. Sienkiewicz, A. Logan, T. Sen, I.	FSU/NHMFL Polish Academy of Sciences FSU FSU	PEG	Stop-Flow of Protein Folding
Fattibene, P. Onori, S. Maniero, A. Van Tol, J. Bortolus, M.	Instituto Superioro di Sanita, Rome, Italy Inst. Sup. di Sanita U. Padova, Italy NHMFL NHMFL	Instituto Superioro di Sanita, Rome, Italy, NHMFL	HF-EPR of Free Radicals in Tooth Enamel
Furdyna, J. Colesniuc C. Van Tol, J.	Notre Dame U. FSU/NHMFL NHMFL	NSF	High-Field EPR on GaAs:Mn Films
Gannett, P. Darian, E. Greenbaum, N.L. Mundoma, C. Dalal, N. Ramsey, C. Van Tol, J.	West Virginia U. West Virginia U. FSU FSU FSU FSU NHMFL	NIH/NHMFL	HF-EPR of Unconstrained and Constrained Spin-Labeled DNAs
Goldberg, D.P. Telser, J. Krzystek, J.	Johns Hopkins U. Roosevelt U. NHMFL	NIH/NSF	EPR Investigation of Corrolazines
Greenbaum, N.L. Mundoma, C. Van Tol, J.	FSU FSU NHMFL	FSU	Gadollinium Complexes with RNA
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
Kennedy, R. Stampe, P. Van Tol, J.	Florida A&M U. Florida A&M U. NHMFL	DARPA	EMR of Co-Doped TiO_2 Films
Kispert, L. Konovalova, T. Van Tol, J. Brunel, L.C.	U. of Alabama U. of Alabama NHMFL NHMFL	DOE	HF EPR Study of the Structure and Redox Properties of Heterogeneous Catalysts

Konovalov, V. Zvanut, M. 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 ^{4}H SiC
Krzystek, J. Ziegler, C.	NHMFL Akron U.	NSF	N-Confused Porphyrins Containing Mn(II): Influence of Unusual Ring Structure on Spectroscopic Properties
Krzystek, J. Telser, J.	NHMFL Roosevelt U.	NHMFL	High Frequency and Field EPR Spectroscopy of High-Spin Ferrous Complexes
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)
Landee, C.P. Turnbull, M.M. Zvyagin, S. Van Tol, J.	Clark U. Clark U. NHMFL NHMFL	NHMFL/FSU	Temperature Dependence of 240 GHz EPR Transition of Spin-Ladder Compounds
Lenahan, P. Saylor, C.	Pennsylvania State U. NHMFL	NSF	High Field Spin Dependent Recombination Measurements in Si
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
Long, J. Sokol, J. Van Tol, J.	U. of California at Berkeley U. of California at Berkeley NHMFL	NSF	High-Spin Metal-Cyanide Clusters
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
Punnoose, A. Seehra, M.C. Van Tol, J. Brunel, L.C.	West Virginia U. West Virginia U. NHMFL NHMFL	NHMFL	EMR Studies of CuO Nanoparticles
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	HF EPR of Rubredoxin
Reyerse, E. Van Tol, J. Brunel, L.C.	Nijmegen NHMFL NHMFL	NHMFL	Study of Specific and Non-Specific Protein-Metal Binding by HF-EPR

Sharma, V. Burnett, C. Smith, T. Saylor, C. Van Tol, J.	Florida Institute of Technology FL Inst. of Technology FL Inst. of Technology NHMFL NHMFL	NHMFL	High Frequency and High Field Electron Paramagnetic Resonance Studies of Ferrate Species
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. Saylor, C.	North Carolina State U. NHMFL	NSF	HF EPR of Spin Labels
Smirnova, T. Van Tol, J.	North Carolina State U. NHMFL	NIH	HF EPR of Gd(III) Complexes
Telser, J. Krzystek, J. Brunel, L.C.	Roosevelt U. NHMFL NHMFL	NHMFL	EPR from "EPR-Silent" Species: High Frequency and Field EPR Spectroscopy of a Catalytically Relevant Cobalt (I) Molecular Complex
Telser, J. Krzystek, J. Brunel, L.C.	Roosevelt U. NHMFL NHMFL	NHMFL	High-Frequency and -Field EPR Spec-troscopy of Tris(2,4-pentanedionato) manganese(III): Investigation of Solid-State Versus Solution Jahn-Teller Effects
Telser, J. Krzystek, J.	Roosevelt U. NHMFL	NHMFL	EPR from "EPR-Silent" Species: High-Frequency and -Field EPR of Ionic Complexes of Nickel(II)
Thurnauer, M. Poluektov, O. Brunel, L.C. Zvyagin, S. Boyce, C. Walker, L. Angerhofer, A.	Argonne Natl. Lab. Argonne Natl. Lab. NHMFL NHMFL U. of South Carolina NHMFL/UF NHMFL/UF	DOE	The *G*-Factor Anisotropy of Bacteriochlorophyll $a^{\bullet+}$
Tondello, E. Maniero, A. Armelao, L Van Tol, J. Brunel, L.C.	U. of Padova, Italy U. of Padova, Italy CNR-CSSRCC, Padova NHMFL NHMFL	NHMFL, CNR, Italy	HF-EPR of Cu(II) Thin Films Deposited by Sol-Gel Process on SiO_2 Glasses
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
Van Tol, J. Colesniuc, C. Damen, F.D.	NHMFL NHMFL Martech, FSU	NHMFL	Multifrequency Paramagnetic and Ferromagnetic Resonance on $La_{1-x}Ca_xMnO_3$ and $La_{1-x}Sr_xMnO_3$ Films

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
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
Zvyagin, S. Landee, C.P. Turnbull, M.M. Galeriu, C. Brunel, L.C. Saylor, C.	NHMFL/UF-FSU 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: 57

USERS & PROJECTS: GEOCHEMISTRY FACILITIES

Users	Institutions	Funding	Project
Furbish, D. Hussaini, Y. Wang, Y. Schmeeckle, M.	Florida State U. Florida State U. NHMFL/Florida State U. Florida State U.	FSU/CoE	Earth Surface Processes
Furbish, D. Wang, Y. Hsieh, P.	Florida State U. NHMFL/Florida State U. Florida A&M U.	NSF	Biocomplexity Incubation: An Integrated Approach Towards a Quantitative Model of Salt Marsh Biocomplexity and Morphodynamics
Hames, W.E.	Auburn U.	NSF	Trace Clement Characteristics of Clubhouse Crossroads Basalts
Hickey, R.	Florida International U.	NSF	Isotopic Investigation of Island-Arc Basalts
Jacob, D.	U. Greifswald, Germany	DFG	Nd and Hf-Isotopes in Ecogites
Landing, W.M.	Florida State U.		Trace Elements in Atmospheric Dust
Landing, W.M.	Florida State U.	NSF	Fe by Isotope Dilution ICP-MS
Marcantonio, F.	Louisiana State U.	LSU	Sr-Isotopes in Salt-Marshes
Salters, V. Dick, H.	NHMFL WHOI	NSF	Determining the Mineralogy of the Source of Mid-Ocean Ridge Basalts Through Nd-Isotopes in Abyssal Peridotites
Odom, A.L. Salters, V. Landing, W.M.	NHMFL/Florida State U. NHMFL Florida State U.	NSF	Mercury Isotope Investigations of Pre-and Post-Industrial Atmospheric Deposition
Odom, A.L. Salters, V. Landing, W.M.	NHMFL/Florida State U. NHMFL Florida State U.	EPA	Constraining the Sources and Cycling of Mercury Through Use of Natural Variations in Mercury Isotopic Composition
Salters, V. Blichert-Toft, J. Patchett, P.J.	NHMFL ENS-Lyon U. Arizona	NSF	The Composition of Bulk Earth Inferred from Primitive Chondrites
Salters, V. Longhi, J.	NHMFL LDEO-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. Marshall, A.	NHMFL Florida State U. Florida State U. NHMFL	FSU/PEG	The Speciation of Metals and Nutrients with Dissolved Organic Matter
Sen, G.	Florida International U.	NSF	Isotopic Investigations of Hawaiian Xenoliths
Wang, Y.	NHMFL/Florida State U.	NSF	Tracing the Source of Phosphorus Using Oxygen Isotopic Ratios
Wang, Y.	NHMFL/Florida State U.	NSF	Isotopic Evidence for Late Cenozoic Ecosystem and Climate Changes in Southwest China
Wang, Y.	NHMFL/Florida State U.		Coastal Wetland Formation and Its Significance to Carbon Sequestration
Wolf, M. Wolf, U. Baumgartner, St. Thurneysen, A. Heusser, P.	U. of Bern	Swiss NIH	Investigation of Homeopathic Potencies with Physical Methods: Nuclear Magnetic Resonance Spectroscopy, Ultraviolet Spectroscopy and Inductive Coupled Plasma Mass Spectroscopy

Number of Geochemistry Projects: 20

APPENDIX B: SEMINARS

NHMFL SEMINARS AT THE NHMFL IN TALLAHASSEE

SEE PAGE 127 FOR SEMINARS AT LOS ALAMOS; PAGE 130 FOR SEMINARS AT THE UNIVERSITY OF FLORIDA

January 29, 2002
T. W. Noh
Seoul National University
Effects of Spin/Orbital Orderings and Their Fluctuations on the Optical Properties of Perovskite Manganites

February 1, 2002
Mark Jarrell
University of Cincinnati
How Do Zn Impurities Suppress High Tc Superconductivity

February 4, 2002
Chuck Swenson
NHMFL-MS&T
Risk Assessment & Evaluation in Pulse Magnet Coils

February 8, 2002
V.G. Kadyshevsky, A. N. Sissakian
Russian Academy of Sciences
The Science Program of the Joint Institute for Nuclear Research

February 8, 2002
Ned S. Wingreen
NEC
Designability of Protein Structures

February 15, 2002
Kyozi Kawasaki
Los Alamos National Laboratory
Models of Glassy Behavior that Attempt to Understand Mode Coupling Theories

February 19, 2002
David Hilton
NHMFL-MS&T
The Direct Measurement of Transient Induced Quantum Turbulence in He II

2/21/2002
Nobuki Maeda
Hokkaido University, Japan
Energy Spectrum of Neutral Collective Excitations in Striped Hall States

February 22, 2002
Michael B. Weissman
University of Illinois - Urbana Champaign
Mesoscopic Fluctuation in Colossal Magnetoresistance

February 26, 2002
Harold Weinstock
AFRL/AFOSR
SQUID Nondestructive Evaluation (NDE) of Aircraft, Wires and People

March 5, 2002
Michael T. Lanagan
Pennsylvania State University
An Overview of the Center for Dielectric Studies

March 6, 2002
Geert Rikken
Toulouse Pulsed Magnet Laboratory
Recent Advances in Magneto-Optics

March 6, 2002
Peter M Gannett
West Virginia University
Free Radicals and Spin-Labels in DNA Structural Studies

March 14, 2002
Takashi Hotta
Adv. Science Res. Center, Japan Atomic Energy Research Institute
Key Role of Orbital Degrees of Freedom for Superconductivity in Ce-Based Heavy Fermion Compounds

March 15, 2002
Alexander Smirnov
P. Kapitza Institute for Physical Problems, Moscow
Antiferromagnetic Resonance in Doped Haldane Magnet $PbNi_2V_2O_8$

March 18, 2002
Ho-Myung Chang
NHMFL-MS&T
Magnet-Cryocooler Integration for Thermal Stability in Conduction-Cooled Systems

October 29, 2002
Fabien Aussenac
European Institute of Chemistry and Biology
Bicelles and Rafts: New Biomimetic Models for Membrane Proteins Study by Solid-State NMR

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Wolfgang Sigmund
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Self-Aligning, Modifying and Manipulating Multiwall Carbon Nanotubes

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Time Resolved X-Ray Scattering

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Ziya Aslanoglu
NHMFL-MS&T
YBCO ($YBa_2Cu_3O_{7-x}$) Coated Conductor Development by Sol-Gel Dip Coating Process

November 13, 2002
Marcelo Jaime
Los Alamos National Laboratory
High Magnetic Field Studies of the Hidden-Order Phase in URu_2Si_2

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Robert Willet
Lucent Technologies
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Textured Buffer Layers Development by Chemical Solution Deposition Technique for YBCO Coated Conductors

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Indian Institute of Technology
Magnetotransport Studies on Doped CMR Manganites and Fabrication of Magnetic Tunnel Junctions (MTJ) Using Novel Insulating Layers

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Jens Mueller
Max-Planck Institute for the Chemical Physics of Solids
Exploring the Phase Diagram of Quasi-Two Dimensional Organic Superconductors

November 21, 2002
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Varian Vacuum Technologies
High and Ultra-High Vacuum Techniques

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Bertrand I. Halperin
Harvard University
Tunneling Between Parallel 1-D Wires: Theory and Experiment

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Lawrence Pinto
Northwestern University
The M2 Ion Channel of Influenza Virus: Its Role in the Life Cycle of the Virus and Its Mechanism for Proton Transport

December 6, 2002
Sergey Kravchenko
Northeastern University
Metal-Insulator Transition and Possible Ferromagnetic Instability in 2D

December 9, 2002
Hubertus Weijers
NHMFL-MS&T
The Effects of Conductor Anisotropy on the Design of BSCCO Inserts

December 10, 2002
Makariy A. Tanatar
University of Toronto
Probing the Superconducting State with Measurements of Thermal Conductivity in Oriented Magnetic Field

NHMFL Seminars at Los Alamos National Laboratory

January 11, 2002
Paul Crowell
University of Minnesota
Ferromagnet-Semiconductor Spin-Injection Devices

January 18, 2002
Roy Goodrich
Louisiana State University
de Haas - van Alphen Measurements on $La_{1-x}Ce_xM_yN_{1-y}In_5$ (M, N = Rh, Ir, Co)

February 1, 2002
Wei Bao
Los Alamos National Laboratory
New Insight on Pseudo-Spin-Gap from Inelastic Neutron Scattering

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Barbara Simovic
Los Alamos National Laboratory
An NMR Study of the Electronic Properties of the Non-Superconducting State of LaEuSrCuO

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$CeMIn_5$: Experiment vs. Theory: Quantum Criticality and Pseudogap in the Two Band Model

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Sergei Stishov
Institute for High Pressure Physics, Russia
Modest Introduction to Physics of Classical Many-Particle Systems: an Experimentalist's Approach

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Low-Temperature Hall Effect in the Normal State of the $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ High-Tc Superconductor

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Brian Gamble
Clemson University
Thermodynamic Properties in the Light Rare-Earth Diantimonide ($RESb_2$) Compounds

April 5, 2002
George Schmiedeshoff
Occidental College
The Electrical Resistivity of UBe_{13} in High Magnetic Fields: Evolution of the Fermi Liquid Ground State and Aging Effects

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Los Alamos National Laboratory
First Order Superconducting Phase Transition in $CeCoIn_5$

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Specific Heat of URu_2Si_2 in Very High Magnetic Fields: Conventional Metamagnetism vs. Hidden Order Parameter

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Kee-Hoon Kim
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Charge Ordering Fluctuation and Optical Pseudogap in $La_{1-x}Ca_xMnO_3$

May 3, 2002
John Schlueter
Argonne National Laboratory
Interlayer Interactions in Molecular Superconductors

May 10, 2002
James Brooks
Florida State University
The Tau-Phase Organic Conductors: And Now for Something Completely Different

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Seamus Davis
University of California, Berkeley
Angle Resolved Tunneling Spectroscopy (ARTS): A New Window on the Cuprates

May 31, 2002
Heinrich Boenig
NHMFL – Los Alamos
The Los Alamos 1.43 GigaWatt Generator Story

June 7, 2002
Myung-Hwa Jung
New Mexico State University, Las Cruces
Coexistence of Ferromagnetism and Superconductivity in $CeTe_{1.82}$

June 14, 2002
Michael Nicklas
Los Alamos National Laboratory
Relationship of Magnetism and Superconductivity in Heavy-Fermion Systems: Pressure Studies on $CeMIn_5$ *and* Ce_2MIn_8 *(M=Rh, In)*

June 21, 2002
Lev Boulaevskii
Los Alamos National Laboratory
Possible Direct Probe of Non-uniform Superconductivity LOFF State in Anisotropic Crystals

June 28, 2002
Tae Won Noh
Seoul National University, South Korea
Non-Fermi Liquid Behavior and Scaling of Low-Frequency Suppression in Optical Conductivity Spectra of Perovskite Ruthernates

July 12, 2002
Antonio Casro-Neto
Boston University
Anomalous Metallic and Superconducting Behavior in Metallic Dichalcogenides

July 19, 2002
Jason Lashley
Los Alamos National Laboratory
Charge Density Waves in U and Pu

July 26, 2002
Albert Migliori
NHMFL – Los Alamos
Ag_2Se*, Pu and* $Lu_5Ir_4Si_{10}$*: A Potpourri of Recent Results Out of the 100 T*

August 2, 2002
James L. Smith
Los Alamos National Laboratory
Good Samples and/or dHvA

August 9, 2002
Heinz Nakotte
New Mexico State University, Las Cruces
Unusual Magnetic Ordering in CeTSn Compounds (T=Cu, Pt)

August 23, 2002
Andrew Cornelius
University of Nevada, Las Vegas
Magnetic Measurements on $YbAl_3$ in Pulsed
Magnetic Fields to 60 T: The Observation of Two Energy Scales and Slow Crossover

August 30, 2002
Ross McDonald
NHMFL – Los Alamos
The Pressure Dependence of Many-Body Interactions in the Organic Superconductor κ*-(BEDT-TTF)*$_2$*Cu(SCN)*$_2$*: A Comparison of High Pressure Infrared Reflectivity and Raman Scattering Experiments*

September 6, 2002
Amalia Coldea
Oxford University
Spin Freezing and Phase Separation in Bilayer Manganites

September 13, 2002
Donovan Hall
NHMFL – Tallahassee
De Haas - van Alphen Measurements on $CeRhIn_5$ *Under Pressure*

September 20, 2002
Qimiao Si
Rice University
Quantum Phase Transitions and Non-Fermi Liquid Properties: A Locally Critical Picture

September 27, 2002
John Sarrao
Los Alamos National Laboratory
Unconventional Superconductivity in $PuCoGa_5$ *at 18.5 K?*

October 11, 2002
Ying Chen
Los Alamos National Laboratory
Investigation of Quasi-one Dimensional Antiferromagnets by Neutron Scattering

October 18, 2002
Vladimir Kogan
Ames National Laboratory
Anisotropy of Superconducting MgB_2

October 25, 2002
Gabriel Kotliar
Rutgers University
Electronic Structure of Correlated Electrons: A Dynamical Mean Field Perspective

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Mike Montgomery
Indiana University
A Chemist's Views on Organic Superconductor Design

November 8, 2002
John Singleton
NHMFL – Los Alamos
Evidence for Non Fermi-Liquid Behavior in the Quasiparticle Scattering Rates of Two-Dimensional Superconductors

November 15, 2002
Scott Crooker
NHMFL – Los Alamos
Towards Engineered Energy Flows in Quantum Dot Nanocrystal Assemblies

November 22, 2002
Jens Mueller
Max Plank Institute, Dresden
Exploring the Phase Diagram of Quasi-Two-Dimensional Organic Superconductors

December 13, 2002
Jon Lawrence
University of California, Irvine
Suppression of Low Temperature Anomalies in $YbAl_3$ *in High Magnetic Field*

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. President D'Alemberte had announced that he would be stepping down and decided not to appoint a new committee in the last few months of his tenure as Chair of the Oversight Committee. Florida State University's new president, Dr. T. K. Wetherell, will appoint a new External Advisory Committee in 2003. As in the past, its members will represent academic, government, and industrial organizations, as well as the NHMFL user community.

Research Program Committee

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
Dragana Popovic
Mark Meisel
Greg Stewart
Neil Harrison
Arthur Ramirez
*Meigan Aronson, University of Michigan
*Dimitri Basov, University of California, San Diego
*Don Candela, University of Massachusetts

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Anthony Brennan
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Louis-Claude Brunel
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Steve Blackband
Nigel Richards
Tom Terwilliger
William Woodruff
*Les Butler, Louisiana State University
*Sandra Eaton, University of Denver
*Linda Luck, Clarkson University

*External Committee Members

Executive Committee

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.

Jack E. Crow, Director and Co-Principal Investigator, FSU
Greg Boebinger, Co-Principal Investigator, LANL
Alan Marshall, Co-Principal Investigator, FSU, and Director, ICR Program
J. Robert Schrieffer, Co-Principal Investigator, FSU, and Chief Scientist
Neil Sullivan, Co-Principal Investigator, UF

Reza Abbaschian, NHMFL-University of Florida Representative
Bruce Brandt, Director, Continuous Fields Facility
Tim Cross, Center for Interdisciplinary Magnetic Resonance Representative
John Eyler, Chair, Research Program Committee
Brian Fairhurst, Interim Deputy Director for Management & Administration
Alex Lacerda, Director, Pulsed Field User Programs
William G. Luttge, Director, University of Florida McKnight Brain Institute
Janet Patten, Director, Public and Governmental Relations
Dwight Rickel, NHMFL-Los Alamos National Laboratory Representative
Hans Schneider-Muntau, Chief Technology Officer
Steven Van Sciver, Director, Magnet Science and Technology

2002 NHMFL ANNUAL PROGRAMS REPORT

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