NATIONAL HIGH MAGNETIC FIELD LABORATORY

1999 ANNUAL PROGRAMS REPORT

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

SUPPORTED BY:
NATIONAL SCIENCE FOUNDATION
STATE OF FLORIDA

1999 Annual Programs Report

of the

National High Magnetic Field Laboratory

	Introduction	1
1	User Facilities & Services	3
2	Magnet Science & Technology Program	7
3	In-House Research Program	28
4	Education	29
5	Outreach Activities	31
6	Budget	35
	Appendix: Users & Projects	40

INTRODUCTION — YEAR 1999

The National High Magnetic Field Laboratory (NHMFL) Annual Research Report announced a significant increase in both the number and quality of research reports from the previous year. These 310 reports span fifteen scientific disciplines, including biology, chemistry. geochemistry, materials engineering, magnet technology, cryogenics, and all aspects of condensed matter physics. The quality and interdisciplinary nature of these research reports signify the strength and maturity of the scientific programs of the laboratory. User statistics show that about 461 Senior Investigators, 98 Postdocs, 185 Graduate Students, and 17 Undergraduates conducted research at one of the NHMFL facilities.

One of the effective means of expanding the NHMFL user base is to host workshops and international conferences, and 1999 was definitely the year for major conferences with roughly 1000 individuals participating. Early in the year over 70 NMR directors and managers of major chemical companies, pharmaceuticals, and the automobile industry held their winter meeting at the NHMFL so they could tour the facility and be briefed on the laboratory's magnetic resonance capabilities. The Second North American FT-ICR Mass Spectrometry Conference was held on the West Coast to make it more accessible to that part of the country. This biennial conference has been very successful and has attracted an international audience. In the fall, the NHMFL hosted the 16th International Conference on Magnet Technology that attached over 550 participants and 21 international companies. This was the first time that this conference had been held in the United States in twelve years and two-thirds of the attendees came from countries outside of the United States. The 30th Southeastern Magnetic Resonance Conference was also held at the NHMFL, attracting more national attention rather than just being regional. The NHMFL High B/T Facility at the University of Florida held a very successful International Workshop on Latest Developments in Low-Density and Low-Dimensional Electronic Systems, which featured over twenty invited speakers. In conjunction with the Office of Naval Research, the NHMFL hosted a workshop to assess the state-of-the-art in power distribution and management for the next generation of the all-electric ship for the Navy.

The National Science Foundation renewed its support for the NHMFL's National High-Field Fourier Transform Ion Cyclotron Resonance Mass Spectrometry (FT-ICR MS) Facility for a second five-year period, 2000-2004. The NSF chose to fund the proposal at its full requested budget of $5.76 million. The ICR program has been one of the shining successes of the NHMFL both in terms of instrumentation and technique development and in applications for a worldwide user base.

The NHMFL's Center for Integrating Research & Learning unveiled its second curriculum product throughout the State of Florida, *Science, Tobacco & You*. This product is aimed at 4th and 5th graders and includes an interactive compact disc that allows students to create a "virtual you," hands-on activities for the classroom, access to a specially-designed web site, and other materials. The program encourages students to use science to ask and answer questions; in this case, the medium used to promote scientific literacy is the issue of tobacco use and prevention. The Center conducted workshops around Florida to train teachers to use the new curriculum product and it was extremely well received. The Center was one of eight organizations showcased in an exhibit sponsored by the Science Coalition in the United States

Senate Hart Office Building. The Center's outreach program was highlighted as an invited program for the 1999 Centennial Meeting of the American Physical Society. The NHMFL hosted 26 middle school students for a semester. The students worked alongside researchers at the NHMFL conducting experiments, engaging in research, and experiencing the excitement of doing science. At the end of their mentorship, the students presented their research findings at a public symposium. The Center organized the 7th "Research Experience for Undergraduates" program that enabled 18 students (at all three sites) to participate in a summer internship. For the first time, the NHMFL hosted 10 K-12 science teachers in a "Research Experience for Teachers" funded by the NSF in a separate grant.

Dr. Don Parkin, one of the original NHMFL co-principal investigators at Los Alamos National Laboratory (LANL), stepped down to assume additional responsibilities at LANL. His leadership was pivotal during the initial stages of the NHMFL program design and proposal drafting, and continued throughout the decade as the NHMFL Pulsed Field Facility at LANL established and developed an important new user community. Dr. Greg Boebinger was named as Dr. Parkin's successor and director of the Pulsed Field Facility. Dr. Boebinger is a leading scientist in high magnetic field research who has contributed in many significant ways to the advancement of magnet and magnet materials technology. The NHMFL Pulsed Field Facility moved into a new experimental hall that allowed an extensive and improved redesign of the user support infrastructure. The new building is configured for future growth by fully exploiting the freedom to time-multiplex pulsed magnet experiments.

The first phase of commissioning of the 45 tesla Hybrid Magnet was conducted in December 1999, with the magnet achieving 44 tesla and experiments conducted at field to 45 tesla. The first Hybrid experiment consisted of four samples of materials representing many aspects of condensed matter physics: an exotic organic metal, a curious magnetic "bad-metal," a thin-layered semiconductor, and a semiconductor device. Although the data from the experiment is still being carefully analyzed, the initial findings show some interesting new physics. At high magnetic fields between 35 and 45 tesla the exotic metal "morphs" from one state to another. Above 38 tesla the "bad metal" becomes a "good metal." Finally, the semiconductor systems, which show something called the quantum Hall effect (which has yielded two Nobel prizes in the 1990's), showed beautifully complex behavior, switching between conducting and quantum non-conducting states as the field was increased. Researchers were intrigued as they watched the evolution of a "fractional 1/3 quantum Hall state" in fields between 32 and 40 tesla.

1 USER FACILITIES & SERVICES

1999 again showed a significant increase in the scope and strength of the research projects conducted at the NHMFL. The number of projects increased to 310 from 293, 255, and 239 in previous years. There continues to be increased collaborative research between in-house research staff and external users, some of which is supported by the NHMFL In-House Research Program. These facts are good indicators of the success of the NHMFL in supplying not only the highest fields in the world but also in responding to researchers' needs with unique instrumentation and supportive services. Certainly, the growth of the pulsed field facility and users is most dramatic since the United States had not offered broad user access to pulsed fields in the past and did not have an established user community.

The research of the laboratory is broadly distributed across fifteen disciplines, with the largest number of projects being superconductivity (43), semiconductors (37), magnetism and magnetic materials (36), magnetic resonance techniques (35), biology (34), chemistry (24), molecular conductors (24), and heavy fermions (22).

Some of the scientific highlights and collaborations from each of the user facilities are highlighted below.

DC Magnets – Tallahassee & Los Alamos

- NMR Under Pressure (*Brown, Clark et al., UCLA*)
- Calorimetric Study of Flux-Lattice Melting: High Tc Superconductors (*Schilling et al., Zurich*)
- On the Mixed State of High Tc Superconductors (*Safar et al. Bell Labs, Lucent Technologies*)
- Anisotropy Direction in Multiple Quantum Wells (*Tsui et al., Princeton*)
- High Pressure Optical Properties of InGaAsN (*Jones, Tozer, Sandia & NHMFL*)
- Superconducting Vortex Dynamic, Magnetic Phase Diagram via NMR at Fields to 30 T (*Halperin, Clark et al., Northwestern & UCLA*)

Short-Pulse Magnets – Los Alamos

- Development of High-Field Heavy-Fermion Ground State in Intermetallics (*Goodrich et al., LSU*)
- Fermi-Surface Topology of Molecular Conductors (*Harrison, Mielke et al., NHMFL*)
- High Field Normal State Properties of High Tc Superconductors (*Ono, Anko et al., Tokyo*)

Long-Pulse Magnets – Los Alamos

- Heat Capacity Measurements to 60 T in Kondo Insulators (*Jaime, Movshovich et al., LANL*)
- High Field Quasiparticle Tunneling in High Tc Superconductors (*Morozov , Krusin-Elbaum et al., LANL & IBM*)
- Topological Phase Diagram in High Magnetic Fields of Electron Gases (*Jiang, Schaff et al., UCLA & Cornell*)

High B/T – Gainesville

- FQHE at Ultra-Low Temperatures (*Störmer, Tsui et al., Columbia & Princeton*)
- Field-Induced Relaxation of Spin Currents (*Candela, Mullin et al., Univ. of Mass.*)

CIMAR – Tallahassee

- Digital Quadrature Heterodyne Detection for High Resolution FT-ICR MS (*Marshall et al., NHMFL, Blakney & Laude, Univ. of Texas*)
- NMR Microscopy and Spectroscopy of Single Cells (*Blackband et al., UF, Grant, Univ. of Chicago & Webb, Univ. of Illinois*)
- 330 to 670 GHz EPR Studies of Canthaxanthin Radical Cation Stabilized on a Silica-Alumina Surface (*Kispert et al., Univ. of Alabama, Brunel et al., NHMFL*)

The NHMFL consults regularly with its Users' Committee for guidance on the equipment and policies needed for the development and utilization of the laboratory's facilities. Members of the committee are nominated and elected by the user community and serve staggered terms. The committee comprises 14 members: nine condensed matter physics users and five representing chemistry and biology. The chemistry and biology representative were added to the committee in 1998-1999 to reflect the increased user activities in these disciplines.

The general purpose DC field facility at the NHMFL's headquarters in Tallahassee exists to provide the user community with the strongest, quietest, steady and slowly varying magnetic fields in the world coupled with state-of-the-art instrumentation and experimental expertise. Resistive magnets at 30 and 33 T are in constant demand, and an entirely new user community has grown out of the ability to do magnetic resonance research in high homogeneity resistive magnets of 25 to 30 T. The resistive magnets are used primarily for studies in magnetism and magnetic materials, molecular conductors, heavy fermions, semiconductors, biology, basic superconductivity, and quantum solids. The facility offers extensive support services, including a machine shop, electronic shop, and computer support. A highly qualified staff supports user operations including, nine Ph.D. scientists, one engineer, one technician, five control room operators, three cryogenic systems and hybrid operators, and one administrative coordinator.

Los Alamos National Laboratory (LANL) is home to the NHMFL's Pulsed Field Facility because of that laboratory's unique facilities for the production of pulsed electrical power. The facility provides experimental capabilities for a wide variety of measurements in pulsed field magnets. The newest addition to the facility, the world's only 60 T Long-Pulse magnet, is a significant new user research tool. The Pulsed Field Facility has recently moved to a newly configured experimental hall that will make it more user friendly and productive. An experienced staff interacts and supports this unique user facility with five Ph.D. scientists, four senior engineers, four technical staff, and two long pulse system operators.

The High B/T Facility at the University of Florida (UF) adds an important user dimension to the NHMFL with temperatures down to 0.4 mK and fields at nearly 20 T. Many new phenomena that require the establishment of high spin polarization or high magnetokinetics, polarized quantum fluids, quantum-confined structures, and non-Fermi liquids, may be explored in this research facility. A new quantum Hall state at $\nu=5/2$ was identified and a series of related parameters has been determined.

The Center for Interdisciplinary Magnetic Resonance (CIMAR) supports a broad range of research in the biological, chemical, and physical sciences, as well as cross-disciplinary programs such as environmental science. The NHMFL is the only magnet laboratory with the full complement of magnetic resonance areas—nuclear magnetic resonance (NMR), electron magnetic resonance (EMR), ion cyclotron resonance (ICR), and magnetic resonance imaging and spectroscopy (MRI/S). The NMR program has added five new positions to work with users and do instrumentation development. The focus of this program has been to develop unique capabilities with the 833 MHz and 25 T "Keck": magnets and dividends are beginning to pay off handsomely, The NHMFL has engaged many of the nation's leading NMR spectroscopists to help define the scientific drivers for high field NMR in anticipation of the 900 MHz system. Their report, *High Field NMR: A New Millennium Resource* has received significant international recognition. The MRI/S facility of the NHMFL is housed within the state-of-the-art Brain Institute at UF where a MRI system at 11.7 T with a 40-cm chamber was recently been delivered. This world record MRI will generate highly detailed images of structural, chemical, and electrical processes taking place inside the brain and spinal cord region in living animals.

Both the ICR and EMR programs have received much international recognition and are very productive programs. The ICR Center has added an instrumentation director and a biological applications director to work with users, unparalleled opportunities to identify and characterize large molecules—peptides, proteins, and nucleic acids. The EMR program has a 400 GHz transient machine under development that will be unique and will allow the study of fast phenomena in the sub nanosecond range, which is of paramount interest in photosynthesis.

User Statistics for 1999

The laboratory is quite pleased with the excellent quality of the outside users program and its 25 percent annual growth. External users constitute 60 percent of all users, and domestic users come from three-fourths of the states. In addition, there has been a significant growth in foreign users, with the number approaching 30 percent of all external users.

Category	Total	Female*	Minority*
Sr. Investigators	461	35	20
Postdoctoral Fellows	98	12	1
Graduate Students	185	40	5
Undergraduates	17	4	4

* *Female minorities have been included only in minority numbers*

Goals and Enhancements

The past five years have seen steady improvement in the magnets, instruments, and services offered to users of the NHMFL. The user community has responded by pursuing new lines of research and advancing older problems into new scientific territory. The multidimensional "phase space" of peak magnetic field, magnetic field homogeneity and stability, temperature, pressure, resonant frequency, mass resolution, and sample orientation available at the NHMFL is unique.

The NHMFL User Program has the following four goals:

- **Improve user efficacy and efficiency,** as indicated by the quality and quantity of results from each NHMFL visit as well as each research group's total program.

- **Expand the experimental phase space available for research.** Parameters to improve include temperature, pressure, mechanical stress, sample orientation, resonant frequency, and magnetic field. Expansion of the magnetic field offered is not limited to strength but also includes bore diameter, homogeneity, gradients, orientation, modulation, pulse shaping, stability and ripple.

- **Increase the range, sensitivity, resolution, and variety of experimental techniques adapted for high magnetic field research.**

- **Expand the user community** to include scientists doing interdisciplinary research (e.g. environmental problems); scientists who are unfamiliar with particular techniques (e.g. magnetic resonance spectroscopy or imaging); and those unfamiliar with the ways that high magnet fields might be used to unfold the problems that interest them.

NHMFL users have initiated numerous new experimental capabilities that are summarized below.

DC Magnets – Tallahassee & Los Alamos
- Heat capacity (*UC Riverside & UC Berkeley*)
- Magnetovolume (*Occidental College*)
- Magnetization (*San Diego State Univ.*)
- Pressure (*Czech Republic*)
- High temperature probe (*Washington State Univ.)*
- Millimeter wave spectroscopy (*Oxford Univ. & FSU*)
- Ultrasound at millikelvin temperatures (*Univ. of Wis.)*

Short Pulse Magnets – Los Alamos
- Uniaxial pressure (*Clemson*)
- Optics (*Northeastern & UC Santa Barbara*)
- Magnetization (*Bell Labs & Lucent , USW, Sydney*)
- Transport (*Clark Univ.)*

Long Pulse Magnet – Los Alamos
- Heat capacity (*LANL, Univ. of Florida, UC Riverside*)
- Pressure (*Czech Republic*)

2 MAGNET SCIENCE & TECHNOLOGY PROGRAM

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 in innovative approaches to magnet design and magnet materials
- External activities such as magnet design and development in collaboration with other organizations.

The first and largest of these activities are major magnet development projects, which include both in-house magnet systems and those funded by external organizations. MS&T has developed this dual role to best utilize the human capital developed through the many magnet projects for the NHMFL and responding to the NSF charge to advance magnet design and magnet materials. With the pending completion of major projects such as the Hybrid, 900 MHz and many of the resistive magnets, external activities are expected to increase as a fraction of our workload.

MS&T continues to work on a number of external programs and projects with outside agencies. This is part of the natural evolution of the organization and exemplifies the high regard the MS&T group has worldwide. A few examples of major external project activities are:

- Magnet and cryogenic design for the DuPont ore separation magnet
- Magnet design and construction for the Michigan State University, National Cyclotron Laboratory
- Design and construction of a radiography pulsed magnet system for Sandia National Laboratory
- Magnet design for the Muon collider with Fermi National Laboratory
- Magnet system design for the MECO experiment proposed for the AGS facility at Brookhaven National Laboratory.

A significant amount of work has been accomplished over the past year. Highlights of achievements are listed below:

Major Projects

- The 60 T Long-Pulse (quasi-continuous) magnet at LANL was first operated as a user facility in November 1998. Since then there have been approximately 350 full field pulses produced.

- The 45 T Hybrid magnet system is nearing completion. The resistive insert was tested to 32.4 T in June 1999. The superconducting outsert's first test occurred in December 1999 and the combined system achieved 44.2 T, the world's highest DC magnetic field. Upgrading and improving the performance of the complete system continues.

- The 900 MHz project is progressing toward the ultimate goal of achieving 21 T in a 100 mm bore NMR spectrometer. Most materials and major components are in house and coil

winding is well underway at both the NHMFL and IGC. Testing of model Nb_3Sn coils and other major components are planned for early 2000. The preliminary design of the cryostat is complete and Ability Engineering and Technology has been selected for the final design and construction. A fully assembled test of the magnet system is scheduled for spring 2001.

- The pulsed magnet group continues to deliver capacitively driven magnets for the LANL user facility. A recent development is a 50 T, 15 mm bore, 400 ms long pulse magnet.

- The 100 T project achieved significant progress over the last year. A self-consistent design exists for 100 T on 15 mm bore. Insert test coils are being developed and tested.

Development Programs

- A detailed scoping study has been performed on a new hybrid consisting of a series connection of a resistive insert and superconducting outsert magnet. The goal is production of 35 T with one 10 MW power supply.

- The HTS magnets and materials group, in collaboration with Oxford Superconductor Technologies, completed and tested a 3 T high field insert coil composed of high Tc conductor. The coil was tested in the 20 T, 200 mm bore resistive magnet at the NHMFL.

- The Cryogenics group continues to investigate two-phase He II flow theory and experiment in collaboration with the DESY laboratory in Hamburg.

- The High Strength/Conductivity materials group is investigating strengthening of pure copper by cryogenic deformation. Yield strengths in the range of 500 to 600 MPa have been achieved by this process.

External Activities

- MS&T staff have performed a number of scoping studies for different magnet systems. These include design of a Muon collider for Fermi National Laboratory and the MECO experiment at Brookhaven.

- The MS&T group is working with Sandia National Laboratory to build a Radiography pulsed magnet.

- In collaboration with Michigan State University, MS&T is building a sweeper magnet for particle control at the National Superconducting Cyclotron Laboratory.

- The NHMFL is developing a split pulsed magnet for the Los Alamos Neutron Science Experiment (LANSCE).

More details on these and other MS&T projects are described herein.

Major Projects

Project Title: 45 T Hybrid Magnet

Report Date: December 31, 1999

Objective

The 45 T Hybrid has been designed as a versatile, reliable, user-friendly magnet system capable of producing 45 T in a 32-mm bore. This goal is to be accomplished using:

- a superconducting outsert magnet with a clear, warm bore of 616 mm and capable of 14 T on axis during normal operation,
- a resistive insert magnet contributing at least 31 T while immersed in the background field of the outsert, and
- technology that significantly advances the state of the art for large, high-field superconducting magnets.

The superconducting outsert has been designed for a minimum 10-year life and with capability of safely accepting upgraded, higher field resistive inserts, potentially extending the combined field to 50 T.

Status

The 45 T Hybrid Project includes five major components: (1) the superconducting outsert magnet, (2) the resistive insert magnet, (3) the outsert cryogenic system, (4) the outsert power/protection system, and (5) system integration.

Fabrication and assembly of the set of three subcoils comprising the superconducting outsert is complete, the set has been installed in the outsert magnet vessel, and the vessel installed in the cryostat. After repairing a small leak in the helium gas cooled thermal shields, the magnet was finally cooled to operating temperature in November. After a series of low current tests, the magnet was ramped to full field (14 T) and 10 kA, thus achieving the design goal.

All five coils of the resistive insert magnet have been stacked and installed in the insert housing. The insert housing has been positioned in the outsert cryostat and both the insert and outsert fields have been mapped at low current. Field center alignment has been verified through two independent measurements. The magnet was tested without the superconducting outsert in May. The peak on-axis field was 32.4 ±0.2 T.

The power supply and emergency current interrupters were tested to 11 kA for 4 hours without incident. The magnet control computer is complete and operational with most critical interfaces tested. The quench-detection system, including high-voltage isolation amplifiers and quench-detection computer, is complete and has undergone preliminary tests using inductive signals generated by operating the resistive insert inside the warm outsert with shorted terminals.

The entire magnet system was tested in December achieving 44.2 T. At that time, the performance of the resistive magnet degraded due to increased hydraulic resistance for water

flow. The first experiments in DC magnetic fields above 40 T were performed during this first test of the hybrid.

As a result of the preliminary tests, the resistive magnet has undergone a minor redesign and will be rebuilt in spring, 2000. A new set of full field tests of the hybrid are scheduled to begin in May, 2000.

Milestone Schedule Summary

	7/31/96 Schedule	Actual (A) or Current Schedule (C)
Coil A		
Heat Treatment Complete	11/7/96	2/17/97 (A)
Impregnation Complete	12/31/96	4/24/97 (A)
Manufacture Complete	2/25/97	11/1/97 (A)
Coil B		
Heat Treatment Complete	9/5/96	11/9/96 (A)
Impregnation Complete	11/4/96	5/15/97 (A)
Manufacture Complete	1/1/97	11/1/97 (A)
Coil C		
Complete Pancake Delivery	5/5/97	10/15/97 (A)
Coil C Assembly Complete	5/22/97	7/15/98 (A)
Outsert Magnet Assembled in Vessel	8/7/97	12/10/98 (A)
I&C System Ready for Operation	6/1/97	5/17/99 (A)
Outsert System Ready for Test	9/2/97	10/15/99 (A)
Superconducting Outsert Operational	10/21/97	12/14/99 (A)
Resistive Insert		
Coil Design Complete	10/31/96	1/13/98 (A)
Mechanical Design Complete	2/15/97	5/12/98 (A)
Component Fabrication Complete	7/31/97	3/2/99 (A)
Assembly Complete	8/31/97	5/16/99 (A)
Resistive Insert Tests Complete	7/30/97	5/17/99 (A)
45 T Hybrid System		
System Ready for Combined Tests	10/28/97	12/10/99 (C)
System Operational for Users	11/8/97	6/15/00 (C)

Major Projects

Project Title: **High Field Magnetic Resonance Magnet Systems**

Report Date: **December 31, 1999**

Objective

The 900 MHz magnet is a major part of the long term program to achieve high resolution at 25 T, corresponding to a proton resonance frequency of 1.066 GHz. The future 25 T magnet will consist of a HTS inner coil operating in the field of a large LTS outer magnet. The requirements of this LTS magnet have been formulated as the wide bore 900 MHz program. Activities toward development of the HTS inner coil are carried out in the Delta B program.

The 900 MHz magnet is a very wide bore high resolution NMR magnet, with a central field of 21.1 T, a room temperature bore of 110 mm, and a temporal and spatial homogeneity objective of less than 1 part per billion in a 4 cm DSV. The magnet will operate in the persistent current mode at a reduced temperature of 1.8 K. The magnet employs epoxy impregnated coil technology, with coils fabricated from NbTi and Nb_3Sn metallic superconductors. The magnet system includes magnet, superconducting and room temperature shims, cryostat with JT refrigerator, and power supply.

The program is a collaboration between the NHMFL and the principal industrial partner Intermagnetics General Corporation. Additional industrial suppliers include Supercon, Vacuumschmelze, and Ability Engineering and Technology.

Status

The main components of the 900 MHz project are presently being fabricated at three locations simultaneously. Intermagnetics General Corporation (IGC) is fabricating all of the NbTi coils in Latham, NY. Ability Engineering is fabricating the cryostat in South Holland, IL. The NHMFL is fabricating the Nb_3Sn coils as well as coordinating the overall assembly logistics and final assembly design.

IGC is responsible for the engineering design and fabrication of five NbTi coils (Production Coils 6 through 10) and the superconducting shim set comprising an axial and radial shim assembly. The engineering design of these coils is nearly complete with only a few remaining drawings to be reviewed and approved by NHMFL. Model Coil 6 has been completely fabricated and received at NHMFL. The Model Coil 6 has been used to fully demonstrate the engineering design and qualify the fabrication procedures. Production Coil 6 has been wound and impregnated and is presently undergoing some minor repair before being sent to Oak Ridge Tool and Engineering for final coil form machining. From there, it will be shipped to the NHMFL, scheduled for March 2000. Production Coil 9 is presently being wound followed immediately afterward by the winding of Production Coils 10, 8 and 7 respectively. All of the NbTi Production Coils will be received from IGC by August, 2000. The axial shim assembly has been completely fabricated and the radial shim coils are wound and presently being assembled. The superconducting shim set is expected to arrive at the NHMFL by May 2000. The NbTi coils are not on the critical path.

Ability Engineering is responsible for the engineering design and fabrication of the cryostat. The final engineering design details are presently being completed and fabrication will start after review and approval of the design by NHMFL. Long lead material procurement will be released as early as possible. The fabrication process has been structured so that the cryostat components will arrive in priority order to support assembly of the magnet. The Cryostat is not on the critical path.

The NHMFL is responsible for the overall magnetic design, which has been completed as well as the engineering design and fabrication of the Nb_3Sn coils, and the overall assembly of the magnet including the auxiliary systems. The Nb_3Sn coil set includes one model coil (Model Coil 3) and five Production Coils (Production Coils 1 through 5). The engineering design of the Nb_3Sn coils is complete and work continues on the final assembly design.

The Nb_3Sn coil fabrication process has the following sequence: wind, prepare joints, heat treat, solder joints, vacuum pressure impregnate, and breakout and mandrel removal. Coil winding is 90% complete. Model Coil 3 and Production Coils 1 through 5 have been completely wound. Production Coil 5 winding is in process and will be completed in January 2000. After that, Production Coil 2 will be reinstalled in the winding machine for some repairs to fix a shorted turn. Remaining winding activities are not on the critical path.

The heat treatment process will begin with Model Coil 3 to qualify the process. At the April 1999 review, the committee recommended that the joint fabrication process be fully understood before committing the expensive Production Coils to the irreversible heat treatment process. As of December 1999, the persistent joint fabrication process has been investigated and tested to the point where we can proceed with the Model Coil 3 heat treatment, which is scheduled to start the week of January 10, 2000. Immediately following Model Coil 3, Production Coils 1 through 5 will be heat treated in series at a rate of approximately one per month. The heat treatment process is presently on the critical path. The logistics have been reviewed for proceeding with parallel heat treatment to shorten the process, however, due to equipment limitations and staffing, the series process is the safest way to proceed.

After the heat treatment, each coil must undergo joint soldering, vacuum impregnation and mandrel removal. All of these processes are expected to take approximately 2.5 months to complete after the heat treatment process. As a result, the final individual Nb_3Sn coil assembly is expected to be complete by August 2000. It is anticipated that the completed magnet will be bucket tested in December 2000 and finally assembled in the final cryostat for final testing and commissioning in April 2001.

Cost and Schedule Issues

The major impact in the past year has been in terms of schedule due primarily to difficulties in developing a Nb_3Sn joint process that is reliable and that produces joints of the quality needed to support the persistence requirements of the project. We have successfully completed that development and can now proceed with the balance of the fabrication process.

Milestone Schedule Summary

	7/31/96 Schedule	Actual (A) or Current (C) Schedule
Issue Engineering Design (NHMFL)		
Engineering Design	8/30/96	9/12/96 (A)
Even/Integer Design		3/26/97 (A)
Conductor Procurement (NHMFL)		
Nb_3Sn Specification	8/30/96	8/30/96 (A)
Nb_3Sn Order	10/1/96	10/1/96 (A)
Nb_3Sn Delivery Complete		
Coils 1,2,3	10/1/97	3/30/98 (A)
Coils 4,5		12/30/98 (A)
NbTi Specification		5/6/97 (A)
NbTi Order		6/30/97 (A)
NbTi Delivery		3/30/99 (A)
900 MHz Research & Development (NHMFL)		
Nb_3Sn Jc (B,T) Development	6/30/96	6/30/96 (A)
Nb_3Sn Mechanical Properties	11/30/96	11/30/96 (A)
Epoxy-Fibers Composites Development	1/31/97	1/31/97 (A)
Winding composites	3/31/97	3/31/97 (A)
Persistent Joint Development	5/31/97	12/15/99 (A)
Persistent Switch Development	6/15/97	12/30/99 (A)
Model/Test Coils Fabrication		1/30/99 (A)
Mechanical Configuration and Structural Design (NHMFL)		
Initial Concepts Review		5/15/97 (A)
Design Initial Inputs Complete	8/15/97	9/15/97 (A)
Configuration Design Complete		4/30/99 (A)
IGC Design and Fabrication		
Prepare Manufacturing Drawings		
Start Manufacturing Design	12/16/96	9/22/97(A)
Manufacturing Design Complete	11/15/97	7/31/99(A)
Fabricate NbTi Coils		
Ti Coil Forms and Tooling Delivered	2/2/98	
Coils 6 & 7		2/15/99(A)
Coils 8, 9 & 10		7/15/99(A)
Start Winding of Ti Coils	2/2/98	3/1/99(A)
Ship Ti Coils to NHMFL	9/30/98	8/30/00(C)
Fabricate Shim Coils		
Shim Tooling Received	1/10/98	7/1/99(A)
Complete Winding of Shim Coils	2/15/98	3/15/00(C)
Assemble Shim Coil Set	7/10/98	5/15/00(C)
Ship Shim Coil Set to NHMFL	9/30/98	5/30/00(C)
NHMFL Fabrication Program		
Fabricate Nb_3Sn Coils		
Nb_3Sn Coil forms & Tooling Delivered	11/20/97	9/1/99(A
Start Winding Nb_3Sn Coils	11/21/97	5/1/99(A)
Complete Nb_3Sn Coil Assembly	9/30/98	8/30/00(C)
Cryostat and Cryogenic System		
Start Cryogenic System Design	TBD	3/1/98(A)
Receive Cryostat & Components	4/15/98	8/30/00(C)
Power Supply and Protection Controls		
Start Electronic Components Design	TBD	5/1/99(A)
Complete System Assembly and Test	8/30/98	6/30/00(C)
Magnet Assembly and Test		
Start Final Assembly of Magnet	10/1/98	10/1/99(C)
Installation of Magnet in Bucket Cryostat	12/23/98	11/30/00(C)
Magnet Bucket Testing		12/30/00(C)
Installation of Magnet in Cryostat		2/28/01(C)
Magnet Testing	12/26/98	4/30/01(C)

Major Projects

Project Title: 50 mm Bore Multipurpose Magnet

Report Date: December 31, 1999

Objective

This magnet can be operated in four different configurations for different purposes: (1) standard high field, (2) high field plus moderate uniformity for condensed matter NMR, (3) high field plus high modulation for de Haas van Alphen, (4) high field plus high gradient for force magnetometry.

Status

The magnet was constructed by taking the inner coil of an old 30 T, 32 mm bore magnet and enlarging the inner diameter of the Florida-Bitter disks. In the high field configuration the magnet provides 27 T in a 50 mm bore. In the moderate homogeneity configuration a piece of 1018 steel of rather intricate shape can be installed in the bore to provide uniformity of roughly 50 ppm over 1 cm DSV in a 36 mm bore. In the modulation configuration, the 50 mm bore tube is replaced with a 32 mm version with a small wire-wound coil on the outer diameter. This provides approximately 0.4 T peak to peak of AC modulation (roughly four times what other facilities provide) and can be operated at frequencies varying from 10 to 1000 Hz. The high gradient configuration should provide 0.05 T/cm either AC or DC in a 32 mm bore. An improved version of the modulation system is being developed to reduce the falloff at higher frequencies.

Major Projects

Project Title: 30 T High Homogeneity Magnet

Report Date: December 31, 1999

Objective

This magnet is an upgrade of our old 24.5 T, 32 mm bore, 50 ppm magnet. The new magnet will provide at least 30 T in a 32 mm bore with similar field homogeneity as our existing 24.5 T magnet. It will support the condensed matter NMR activities at the lab and permit the study of magnetically driven phenomenon at high fields.

Status

The coil design work for this project is essentially complete. It will be based upon our 33 T Florida-Bitter magnets but will have a longer "A" coil to reduce the field inhomogeneity and a gap in the "B" coil for compensation. The project is on hold awaiting completion of the 900 MHz and the availability of manpower.

Major Projects

Project Title: Pulsed Magnets for User Facility

Report Date: December 31, 1999

Objective

The objective of this activity is to provide the magnets necessary to sustain the NHMFL Pulsed Field Facility at LANL. Magnet performance is upgraded, as technology becomes available.

Status

24 mm bore, 50 T magnets and 15 mm, 60 T magnets are provided on an as-needed basis for the user facility. The 24 mm, bore 50 T magnet can survive over 1000 full field pulses without destruction. The 15 mm bore magnet running at 60 T has shown a shorter life of less than 240 pulses. A new design has been made to upgrade the life of the 15 mm bore magnet to over 1000 full field shots. The new coil will be wound with a larger cross-section Glidcop Al-15 conductor and internally reinforced by the Zylon fiber composites and the MP35N. The new design reduces both the deformation and the heating in the magnets, which ensures a better performance than the old design. Materials have been ordered. The magnet will be made and tested at the beginning of next year.

A 15 mm bore, 50 T long pulse magnet has been designed on the requirement of the user. The magnet is to be wound with hard copper wire with total 24 layers. The magnet will be energized with the full capacitor bank to generate a magnetic field of 50 T with a pulse duration of 400 ms. The magnet will be provided to the user next March. Due to the size of the magnet, large cooling time after a full field pulse is estimated to be over 1.5 hours. A new design with cooling channels inside the magnet is being considered for the next generation to shorten the cooling time.

Major Projects

Project Title: 60 T Long-Pulse (Quasi-Continuous) Magnet

Report Date: December 31, 1999

Objective

The objective of this now completed project was to provide a generator-driven, controlled-power pulsed magnet capable of sustaining a constant field of 60 T in a cold bore of 32 mm for 100 ms. In addition, the magnet was designed to furnish a variety of pulse shapes including steps, linear ramps, field reversals, and long decays, in response to user needs. With suitable modifications to the power supply, a crowbar decay from full field could be added to the already available user pulse shapes. The system design includes the following:

- Nine mechanically independent coils designed to operate in the elastic strain region for 10,000 pulses.
- Existing 1.4 GVA motor-generator to provide the primary energy from inertial storage.
- New 400 MVA pulsed power supply driven from the generator consisting of five 80 MW power modules (rectifier-transformer units). Two additional 80 MW modules are installed to power the 100 T magnet, which might be able to be used to enhance the performance of the 60 T magnet.

Status

Magnet operations were resumed following the holiday shutdown on January 11, 1999. Operations were conducted for user support until January 22nd, when the magnet was disconnected to allow power supply testing. The magnet was reconnected January 27th for additional testing with the power supply. User support operations resumed February 1, 1999 and continued until July 16, 1999 when the system was shutdown for the magnet move to new facilities. The magnet typically was operated four out of five weeks with the fifth week used for maintenance and operator relief. Approximately 307 pulses were provided to users and an additional 75 pulses were performed for magnet and power supply testing and diagnostic purposes. Full field pulses (60 T) accounted for about 195 of the pulses produced for users. In addition, there were 42 pulses at fields between 50 and 59 T, 15 pulses between 40 and 49 T, 16 pulses between 30 and 39 T and 39 pulses at fields below 30 T. No outstanding issues are identified at this time.

Major Projects

Project Title: **100 T Insert Magnet Project**

Report Date: **December 31, 1999**

Objective

The objective of this activity is to design, construct and test a 15 mm bore, capacitor powered insert coil for use with an outer coil set operated in a quasi-continuous mode. Together, the two systems will be capable of producing a total field of 100 T.

Status

- Three different insert coil designs based on different materials (CuNb, CuAg and CuSS) were developed. The coil geometry, conductor dimensions, and reinforcing materials have been determined for each coil design.

- We have selected CuNb as our initial design material.

- The CuNb conductor should be delivered from the Bochvar Institute before the end of 2000. A CuSS conductor was also delivered by Toulouse.

- The internal reinforcements for all the designs are the cobalt based multiphase alloy MP35N combined with Zylon fibers and epoxy resin..

- The magnetic field reduction due to eddy currents in the MP35N reinforcement has been modeled by computer simulation. A series of coils have been designed to analyze the eddy current effect of MP35N reinforcement.

- A duplex test magnet system has been designed. The objective of this system is to simulate the performance of the 100 T insert coil.

Research & Development Activities

Project Title: Cryogenic Component Development

Report Date: December 31, 1999

Objective

The objectives of this program are to develop and better understand cryogenic systems in order to improve our ability to support superconducting magnet technology. To this end, the Cryogenic Component Development (CCD) program has three main objectives:

- To develop cryogenic technology in support of large scale superconducting magnet systems.
- To conduct R&D to advance cryogenic technology for improved application.
- To collaborate with industry and other laboratories in development of cryogenic technology.

Status

Over the last year the CCD group has concentrated its efforts in two main projects. These are as follows:

- Design and development of the 900 MHz NMR magnet cryostat. The design of this system is complete and fabrication is underway at Ability Engineering and Technology. Installation of the completed 900 MHz magnet is scheduled to begin in early 2001.
- Design and development of the cryogenic system for a DOE funded high temperature superconducting magnetic ore separator. This is a industrial/laboratory program supported by the Superconducting Partnership Initiative. The resulting 3 T HTS coil will be tested in 2001.

In addition, the CCD group is pursuing several R&D activities. These are mostly funded by outside grants as indicated:

- Heat and mass transfer in horizontal two phase He II/vapor: This program is supported by a grant from the National Science Foundation. The work involves understanding the thermal-hydraulic nature of He II coexisting with its vapor. Both numerical modeling and experimental confirmation are included in the project. Experiments are being preformed using the Liquid Helium Flow Facility in the Cryogenics Laboratory.
- Liquid Helium Fluid Dynamics Studies: This program is supported by a grant from the Department of Energy. The work focuses on cryogenics issues of future particle accelerators. Current studies include: (1) propagation of intense thermal shock and second sound attenuation; and (2) High Reynold's number forced flow He II and instrumentation development using the Cryogenic Helium Experimental Facility.

Collaborations

- DESY- Hamburg: We are working together on a He II two phase flow experiment to confirm the operating characteristics of the cooling system for the TESLA electron accelerator. We are also performing Kapitza resistance measurements in support of RF cavity development.
- University of Oregon: We are collaborating with researchers in the Physics Department on an experiment to measure drag on a spherical body at high Reynold's numbers in liquid helium.

Research & Development Activities

Project Title: High Strength Materials

Report Date: December 31, 1999

The effort in material research and development programs related to the high field magnets at MST/NHMFL has been concentrated on (a) development of various fabrication routes for different conductors and reinforcement materials in collaboration with industrial partners and (b) investigation of the physical properties, atomic structure and microstructure of both kinds of materials (c) exploration of new materials which have the potential for fabrication of next generation magnets. The program emphasizes the requirement to develop fabrication routes capable of producing the conductors and reinforcement materials with homogeneous mechanical and physical properties and with appropriate sizes.

The study of fabrication routes and properties of the conductors took an approach to relate the properties both to design requirements and to the service life of the magnets. Fabrication of Cu, Cu-Ag, Cu-Nb and Cu+Al_2O_3 aims to make high strength conductors with the cross-section required for the magnets. Some considerations have been given both to the role of atomic structure distortion on the elastic-plastic transition and the mechanical instability of heavily deformed conductors. The assessments were also made on Young's modulus, yield stress and conductivity of the materials at room temperature and 77 K. In both Cu-Ag and Cu-Nb conductors, the crystallographic lattice distortion occurs and consequently no clear elastic-plastic transition can be observed. Cyclic deformations, such as fatigue, reduce the effect of the lattice distortion on the mechanical properties of the materials. More severe lattice distortions found in Cu-Nb than Cu-Ag conductors result in more rounding of the stress-strain curves. The Cu+Al_2O_3 materials have a most abrupt transition among all the conductors investigated, because the reinforcement particles are essentially not shear-susceptible under the stresses applied and least lattice distortion occurs. Because the lattice distortion is related to the fatigue behavior of the conductors, it should affect the service life of the pulse magnets.

The exploration of new conductors was concentrated on cryogenic deformation of Cu and Cu+Al_2O_3 and fabrication of various macro-composite. The assessment of the microstructure and properties of cryogenic deformed pure Cu indicates that the structure and strength formed by 77 K deformation need to be stabilized. Therefore, low temperature rolling and drawing are undertaken on Cu+Al_2O_3 conductors. The preliminary results indicate that the low temperature deformation indeed introduces more work hardening in Cu+Al_2O_3 conductors in a small strain range.

Currently, macro-composites made of stainless steel jacked Cu, Cu+0.3wt%Al_2O_3 and Cu+1.1wt%Al_2O_3 have been fabricated. The preliminary results indicate that the conductors have the potential to achieve high strength with large cross-sections.

The reinforcement material investigated is MP35N, which is a commercial available cobalt-nickel alloy reinforced mainly by both dislocations and coherent defects or precipitates which are only a few atomic layer thick. The materials have a higher Young's modulus than other currently available reinforcement materials, e.g. stainless steels. However, the lack of study of the heat treatment and cold work conditions before rendered the lower and inconsistent mechanical

properties. A systematic investigation has been undertaken on the heat treatment temperatures, times and amount of cold work on the strength, ductility and fatigue life of MP35N. The properties are related to the structure of the materials from the micro-scale to atomic-scale. Currently, the optimized fabrication routes supply an MP35N alloys in a repeatable manner with an ultimate tensile strength of 2500 MPa at 77 K. The materials can survive 2000 cycles at a maximum stress level of 2300 MPa at 77 K. The property meets the requirement of the current design of some pulse magnets.

Research & Development Activities

Project Title: **High Field HTS Insert Coils and Coil Technology (formerly Delta B)**

Report Date: **December 31, 1999**

Objectives

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 insulation for layer-wound coils.

Accomplishments

The primary accomplishment in the past year was the successful testing of the 3 T insert coil within the 19 T large bore resistive magnet. This coil was developed in collaboration with Oxford Superconducting Technology (OST), Inc., and required the heat treatment of long-lengths of Bi-2212 conductor. The coil, which was comprised of three separately powered stacks of double pancakes, generated 4.6 T at self-field and 3.0 T in the 19 T background. The average current densities in the coils ranged from 51 A/mm^2 to 86 A/mm^2, which is significantly improved over past designs and close to the ultimate target of 100 A/mm^2. Over 1 km of conductor was successfully heat treated and insulated using the NHMFL sol-gel insulation in the development of this coil.

Activities

Conductor development activities are internal and collaborative with industry. Internally, we are investigating the effects of Ba additions on the heat treatment, microstructure, and critical current density (J_c) of Bi-2212 conductor. We have found that for a narrow Ba-added stoichiometry, significant improvements are obtained. With OST, we are studying the effects of varying the Bi-2212 conductor geometry on conductor performance. Significant increases in J_c as compared to the conductor used in the 3 T insert indicates that a 5 T coil may be feasible within the next year. With OST, we are also studying conductors for wind-and-react double pancake coils and for react-and-wind double pancake and layer wound coils. Lastly, with Nordic Superconductor Technologies (NST) and the Korean Institute of Machinery and Materials (KIMM) we are evaluating Bi-2223 conductors for react-and-wind coils.

Also important for high field insert coils is the mechanical behavior of the HTS conductor. We are evaluating the stress-strain behavior at room temperature and low temperature, the effects of strain on J_c, and the effects of fatigue on J_c, of the various conductors under development.

Furthermore, we are studying pancake coils of small radial build to determine the mechanical performance of coils under Lorentz forces. By using coils with large diameter and small radial build, Lorentz forces are maximized while maintaining a fairly uniform distribution of stress within the coil. This approach allows functional performance limits to be determined in realistic model coils.

Building upon the success of the 3 T coil and the improvements in conductor performance, we are now developing a 5 T insert coil for the 19 T large bore resistive magnet. Design scoping studies indicate that, by reinforcing some of the coil, 5 T can be achieved with Bi-2212 conductor from OST. It is envisioned that this coil will be comprised of a wind-and-react stack of double pancake coils for the smallest diameter section, a react-and-wind stack of double pancake coils for the middle section, and a react-and-wind layer wound coil for the outermost section. In support of this effort, we are developing techniques for co-winding reinforcement and for winding layer-wound coils, including turn-to-turn insulation. Results from these smaller test coils will allow further optimization of the 5 T insert coil design.

Research & Development Activities

Project Title: Other Pulsed Magnet Projects

Report Date: December 31, 1999

In the spirit of cooperation the pulse group at NHMFL has collaborated with groups at Dresden, Frankfurt, Toulouse, and the radiographic physics department of the Sandia National Laboratory. The NHMFL pulse group provided production coils for use in the physics research facilities at Dresden and Frankfurt. The Toulouse collaboration encompasses coil and wire development for the production of a 50 T long pulse magnet system. The Sandia collaboration involves the development of several pulse coils for an electron beam experiment.

Dresden Collaboration

The NHMFL delivered four 50 T/24 mm bore pulse magnets for physics research.

Frankfurt Collaboration

The NHMFL delivered one 50 T/24 mm bore pulse magnet for physics research

Toulouse Collaboration

The NHMFL has received copper stainless steel conductor to develop and produce a long-pulse 50T coil for physics research at Toulouse.

Sandia Collaboration

The pulsed field group of the MS&T is developing a pulsed high magnetic field system for the advanced hydrodynamic radiography program at Sandia National Laboratories to generate intensive electron beams. The magnetic field profile along the axis of the system is required to be a gradient from 30 T at the center of a 110 mm bore pulsed magnet to 60 T at the center of a 45 mm bore pulse magnet. The two magnets will be energized with independent banks. The total energy of the system will be about 5 MJ. The preliminary design has been completed. The materials required for construction are on order. We developed the coil designs based on the properties of the CuNb and Glidcop AL15. Coil geometry, dimensions, and the reinforcing materials have been determined. We have completed the prototyping of the initial lead designs for these coils.

HTS Reciprocating Magnetic Ore Separator

The magnetic ore separator project is being conducted in collaboration with DuPont Superconductivity and Carpco, and is funded by the Department of Energy. When complete, the system will be a quarter-scale, working prototype in operation at one of DuPont's demonstration facilities. The magnet system consists of a 2^{+} T, 200 mm warm bore Ag/BSCCO conductor HTS magnet with a room temperature iron shield. The magnet, which is being built by American Superconductor, will be conductively cooled and operate at approximately 30 K. The goal is to provide a robust, industrial unit, which is competitive with existing LTS superconducting separators. During Phase I of this project (until December 1999), the NHMFL is conducted a magnet and cryogenic system design. The magnet will have a 250 mm cold bore and an overall length of 300 mm. It will be conductively cooled with a G.M. cryocooler. The cryostat will have a warm iron shield to minimize fringe field. During Phase II, the NHMFL will fabricate the cryogenic system, install the magnet and test the entire system before it is transported to DuPont for ore separation studies.

MECO Solenoids Design Study

MECO is an experiment to test muon and electron number violation by searching for muons converting to electrons in the field of a nucleus. The experiment is intended to discover this process if it occurs as infrequently as once for 10^{16} muon captures on the nucleus. The experiment will be performed in a new pulsed muon beam to be constructed in the experimental hall of the Alternating Gradient Synchrotron at Brookhaven National Laboratory.

The magnet system of the MECO experiment consists of three main superconducting solenoids. The magnet's field ranges between 5 T, 0.6 mm bore for the production solenoid to 2 T, 0.9 mm bore for the detector solenoid. The system includes iron pole pieces to shape the field between the 3 solenoid systems (Production, Transport and Detector solenoids.)

The NHMFL is conducting a two phase study for the muon collider magnet system. Phase I (May to June 1999) is an electromagnetic and thermal-mechanical analysis including cost scaling. The electromagnetic analysis included magnet optimization, field uniformity, and a 3D field FEM analysis. The NHMFL has proposed to conduct a preconceptual design of the MECO magnet system in order to develop a cost estimate.

Pulsed Magnets for the Advanced Hydrodynamic Radiography Program at Sandia National Laboratory

Collaborating with the Radiographic Physics Department at Sandia National Laboratory, the pulsed field group of the MS&T is developing a pulsed high magnetic field system for the Advanced Hydrodynamic Radiography Program to generate intensive electron beams. The magnetic field profile along the axis of the system is required to be 30 T at the center of a 110 mm bore pulsed magnet, increasing gradually up to 60 T at the center of a magnet with a bore of

45 mm. Each of the two magnets will be energized with its own bank. The total energy of the system will be about 5 MJ. The preliminary design of the pulsed magnet system has been completed. The unique pulse magnet involves high voltage and high energy, new materials and new technology. The project will be carried out in two steps. The first step is to develop a 50 T system. After gaining experience with the system construction and experiments, the second step will upgrade the magnet to 60 T. The materials required for the magnet construction of the first step are on order.

Navy SMES

The NHMFL has contracted with the Office of Naval Research for a demonstration of major components being developed for future electrified ships. Components to be tested initially include a 19 ton, 2 m bore, 4 T Superconducting Magnetic Energy Storage (SMES) magnet provided by the Naval Surface Warfare Center – Annapolis and a Power Electronics Building Block (PEBB) module provided by Virginia Polytechnic Institute and State University. The SMES magnet is being assembled in its cryostat (delivered separately) and installed in the Large Magnet Component Test Laboratory (LMCTL). The test program involves operations of the SMES magnet and PEBB both together and separately, supported by other utility and power/protection systems available in the LMCTL.

Muon Collider Design Study

The Fermi National Accelerator Laboratory is conducting a conceptual design of a future muon collider and has contracted the NHMFL to address magnet design issues. To date, our contributions have dealt with two superconducting magnet systems important to cooling a muon beam created by pion capture and decay. These systems include a "bent" solenoid/dipole system and an alternating-field solenoid system. The bent solenoid/dipole system requires modest fields (approximately 3 T from the solenoids and < 0.6 T from the dipole), but high homogeneity over a significant volume along the path of the beam. On the other hand, the alternating-field solenoid system requires quite high fields (approximately 15 T in the present system) as well as a precisely defined field profile along the beam path, which includes field reversal with a gradient at the zero crossing of nearly 50 T/m. Sizes of the coils are moderate. The bent solenoid/dipole system must fit around a 300 mm diameter beam tube. A liquid hydrogen adsorber (150 mm o.d.) sets the bore of the high-field coils for the alternating-field solenoid system, while a 400 mm o.d. RF cavity defines the bore of the coils in the zero-crossing region. The field profile for the alternating-field system is cyclic with a period of 1.5 m. Challenges of this system include the production of high fields over large volumes, handling the high forces of repulsion, and integration of the magnet cryogenic system with that of the liquid hydrogen adsorber.

NSCL: Sweeper Magnet

The National Superconducting Cyclotron Laboratory at Michigan State University has contracted with the NHMFL to build a 4 T superconducting sweeper magnet. The magnet is referred to as a sweeper because it "sweeps" charged particles out of a neutron beam and into a mass spectrometer. It is required to bend beams of 4 T/m rigidity though 40° on a one 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 4.2 K. There is a yoke of approximately 16 tons to enhance the peak field and reduce the fringe field.

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 design of this magnet system is underway and fabrication is scheduled to begin in early 2001.

EURUS/NRIM: High Field Florida-Bitter Magnets

We are presently working through EURUS Technologies on a long term collaboration to provide magnets to the National Research Institute for Metals of Tsukuba, Japan. In late 1998 a contract was signed for a replacement A coil, for the 30 T Florida Bitter coil that the NHMFL delivered in 1997. A contract for a replacement B coil is expected to be completed in the next few months and a contract for a replacement C coil is expected next year.

IPR-India

Due to delays in completing their model-coil test program at the Kurchatov Institute in Moscow, the Institute of Plasma Research–India has extended our contract to allow us to help with the analysis of that data. The tests at the Kurchatov Institute included a variety of transient-field scenarios and forced quenches conceived to characterize the losses, stability, and protection requirements of the cable-in-conduit conductors used in the model coil and planned for use in magnet systems of the IPR's SST-1 tokamak. Our participation in this analysis task is extremely relevant to the NHMFL mission in that the CICC technology used by the IPR has many similarities to that used in the present 45 T Hybrid as well as the proposed Series Connected Hybrid.

3 IN-HOUSE RESEARCH PROGRAM

The National Science Foundation has charged the NHMFL with developing an internal research capability that utilizes NHMFL facilities to carry out high quality research at the forefront of science and engineering that advances the scientific and technical capabilities of the NHMFL. To help achieve these goals, the NHMFL has established a competitive In-House Research Program (IHRP) to fund research projects normally of one- or two-year duration that are targeted toward enhancing the NHMFL at the three sites by:

- **Encouraging collaborations** that bring together complementary expertise among internal an/or external investigators,
- **Supporting bold but risky efforts** that hold significant potential to extend the range and type of high magnetic field experiments, or
- **Providing seed money** to develop initial data to assist in acquiring future external funding.

In 1999, 33 proposals were submitted and seven were funded for a total of $1,167,807. The seven new projects are as follows: (1) magnets and low dimensional materials, (2) millimeter wave spectroscopy in nano-magnets and low dimensional materials, (3) common trends in manganites and ruthenates, (4) NMR studies of field-induced phases in anisotropic correlated electron systems, (5) triple resonance micro-coils for high Field NMR, (6) low gravity plant experiments using high magnetic field gradient levitation, and (7) terahertz spectroscopy at high magnetic fields.

Since the IHRP began in 1996, a total of 39 programs have been funded, representing 102 principal investigators; each grant is in the order of $90K to $190K. The IHRP has added some important and interesting capabilities to NHMFL facilities at all three sites.

Tallahassee
- Quasi-optical bridge for EPR spectrometer (being commercialized)
- NMR field lock for enhance magnet stability
- Dilution refrigerator, He^3 system with microwave cables
- New EPR and NMR high-field spectrometers

Gainesville
- A new infrared detector cryostat and ultra-fast switches for pulsed sub-mm radiation
- RF coils for high-frequency NMR
- Very low temperature specific heat and nuclear relaxation measurements
- Hyperpolarized noble gas facility for MRI

Los Alamos
- Custom low noise instruments for pulsed fields (being commercialized)
- Coherent terahertz and picosecond photoluminescence spectroscopy
- New high strength copper composites for magnet construction
- A calorimeter operating in the 60 T long pulse magnet (accepted by *Nature*)

4 EDUCATION

One of the core commitments of the NHMFL is the enhancement of science education from elementary through postdoctoral levels and extending to the general public. As NSF Director Rita Colwell has stated, "One way the federal government can help foster a world-class system of education is linking K-12 education with our already world-class science and engineering enterprise." The NHMFL is strategically suited to engage students and teachers with our in-house scientists and faculty, and this is a dedicated commitment on the part of the laboratory.

The Center for Integrating Research and Learning at the NHMFL provides resources and connections necessary to enhance the learning and understanding of science research, technology, and related fields. The core programs for the K-12 audience focus on providing resources and experiences for students and teachers. Some highlights of our K-12 programs during 1999 are presented below.

- As part of our *Science, Tobacco & You* program, we engaged over **6,000** students across Florida through a Town Hall event (Web-based, regional host sites, and video telecast). The Florida Department of Health projects that **400,000** students will be reached each year through this program.
- The outreach program was highlighted as an invited program for the 1999 Centennial Meeting of the American Physical Society (APS). These multifaceted and interdisciplinary programs reached **2,500** students during this academic year.
- The Center's program was one of eight organizations selected by the Science Coalition to exhibit at its Signature Event on Capitol Hill in Washington, D.C.
- The NHMFL provides mentorship and internship experiences for students from middle grade levels (grades 6-8) through graduate level. We hosted over **80** middle or high school students.
- Approximately **4,000** students in grades 4-12 toured the NHMFL in Tallahassee.
- The Annual Open House attracted **3,100** visitors on a Fall Saturday.
- NHMFL teacher workshops and training programs enrolled **472** elementary, middle grades, high school, and community college teachers last year.
- Our Ambassador Program continues to flourish with active participation from over **75** regional K-12 teachers representing over **50** schools.
- Drawing upon the success of Research Experiences for Undergraduates (REU), the Center hosted the first annual Research Experiences for Teachers (RET) program targeting middle-grade (5-9) teachers and senior-year, pre-service teachers. Experienced educators are paired with prospective elementary and secondary teachers to work on research projects with scientists and researchers at NHMFL-Tallahassee.

The undergraduate, graduate, and postdoctoral programs of the NHMFL are strongly linked to the laboratory's research and user programs. Some highlights for the year include:

- NHMFL faculty reported advising over **164** undergraduate students and serving on over **90** graduate committees, with **15** NHMFL-affiliated graduate students earning Ph.D.s.
- NHMFL faculty taught **20** undergraduate and graduate courses.
- **Seventy-five** postdoctoral students conducted research at the NHMFL.

- NHMFL educators offered undergraduate and graduate level courses for prospective teachers through the FSU College of Education and provided a series of experiences for **56** Elementary Education majors as part of their formal course of study.
- The NHMFL REU program provided 18 undergraduates the opportunity to work with NHMFL researchers on challenging research projects.

Curriculum materials development, like all NHMFL education activities, is guided by the well-established premise that a research facility can, and should, influence reform in the teaching and learning of science. Building on the research efforts of the laboratory, the Center received $1.6 million from the State of Florida's Tobacco Pilot Program to deliver an interdisciplinary, interactive curriculum to all 2,000 elementary school classrooms in the state. The curriculum, *Science, Tobacco & You*, allows students to analyze the harmful effects of tobacco on their bodies, develop strategies for handling peer pressure, and examine the role that advertising plays in promoting tobacco addiction. The Center's educators traveled throughout Florida holding workshops for teachers in 11 different cities. Over 300 teachers, representing 60 of Florida's 67 school districts, attended and voiced unanimous approval of the program. Some of the participating teachers comments regarding *Science, Tobacco & You* are presented below.

- "The *Science, Tobacco & You* hands-on program is a wonderful learning opportunity for children—including the materials, internet, CD-ROM—everything is extremely interesting and diverse. It adapts to different learning styles of children." – Tallahassee
- "The students will *love* the Virtual You on the CD-ROM and I will be able to integrate the entire program into the curriculum and be teaching science and technology while I teach the other curriculum areas. " – Orlando
- "It [*Science, Tobacco & You*] is a strong curriculum with technology built in to it." – St. Petersburg
- "There are so many wonderful lessons and help that I would be foolish not to use *Science, Tobacco & You* with my students." – Chipley
- "I had heard this was great, and I was not disappointed…I learned a lot and am excited to teach science, a subject I'm sometimes not comfortable teaching." – Daytona Beach
- "These materials will help enhance the technology part of my curriculum for science as we study the human body." – Miami
- "…a great model for integrating technology (comfortably) in the classroom." – Boynton Beach.

5 OUTREACH ACTIVITIES

NHMFL outreach activities continued to gain momentum in all areas, broadened the laboratory's talent pool, and effectively transferred magnet-related technologies and materials. These efforts have had a profound effect on the NHMFL's ability to maintain a worldwide leadership role in high field research magnets. Collaborations with private sector companies represent a broad range of magnet-related technologies, as indicated below. The NHMFL continues to fabricate pulsed and continuous field magnets for an expanding list of other laboratories around the globe. The laboratory also collaborates with almost all to the Department of Energy national laboratories.

COLLABORATIONS

Magnet Technology

- EURUS Technologies – YBCO Current Leads
- IGC – 900 MHz
- IGC – HTS Insert Coil
- Nordic Superconductor Technologies – 1 GHz R&D
- Oxford Instruments – 1GHz R&D
- Resonance Research – Shim Systems for Keck Magnet
- Vacuumschmelze – 900 MHz Wire
- Advanced Photon Source, Argonne – Split Magnet Design Studies
- Center for Advanced Transportation, DOT, University of Central Florida – Maglev, Simulation-based design, testing & manufacturing
- Office of Naval Research – Electric Ship R&D
- Fermi National Accelerator Lab – Design Support for Muon-Muon Collider
- MAGLEV 2000, Brevard County., Florida – Maglev
- National Superconducting Cyclotron Lab, Michigan State University – 4 T Superconducting Sweeper Magnets
- New York University & Brookhaven National Laboratory – Magnet Design for Muon & Electron Experiments
- Princeton Plasma Lab – Optimizing Conductor, Insulators & Magnet Design
- Grenoble High Magnetic Field Laboratory – Insert for 31 T Magnet
- Nijmegen High Field Magnet Laboratory – Florida-Bitter Magnets
- National Research Institute for Metal, Japan – Replacement Coils for 30 T Magnet
- BWX Technologies – Superconducting Magnetic Energy Storage (SMES)

Pulsed Magnets

- 3M Company – Composite Conductor
- Clark University – 60 T, 18 mm
- Los Alamos, LANSCE – High Frequency Split-pair Magnets
- Sandia – Magnets for Hydrodynamic Radiography Program
- A.A. Bochvar Institute – Composite Wire for 100 T Magnet
- Institut für Experimentalphysik, Austria – 100 ms flat top at 35 T Magnet
- Institut für Technische Physik, Germany – Low Energy, High Field Magnet
- Institute of Low Temperature Physics, Brazil – Colossal Magnetoresistive Materials

- Institute of Materials Research, Czech Republic – Correlated Metals, Very High Pressure
- IFW Dresden Research Center – 60 T Magnets
- National Pulse Magnet Lab, Australia – 60 T Magnet
- PERI Ruppin Institute, Israel – Pulsed Magnet Development for Fusion Physics Applications
- Johann-Wolfgang-Goethe Universität, Germany – 50 T and 60 T magnets
- CNRS Magnetic Pulse Lab, France – Wind 150 kg Magnet for Duplex 80 T System

Testing & Characterization
- General Atomics – APT Project, Los Alamos
- Maxdem Inc. – High Strength Polymers
- Supercon Inc. – High Tc Composite Conductors
- Lawrence Berkeley – Current Transport of Rutherford-style HTS Cable
- Lawrence Berkeley – High-field Dipole Development
- Ohio State University – Critical Current of Specialty Conductors
- ALCATEL, France – Critical Current Density of Coils
- Deutsches Elektronen-Synchrotron – Cryogenics Relating to Accelerator
- Institute of Plasma Physics, China – Conductor for Advanced Tokamak
- Versaille Project on Advanced Materials & Standards – Pre-standards Research for Advanced Materials
- BWXT, Naval Nuclear Fuel Division – Solder Splices between NbTi Wires and Cables

Other
- TSI, Atlanta – Curriculum Development
- National Museum of American History, Smithsonian Institution – Information Age Exhibition
- Gulf Coast Alliance for Technology Transfer – Technology Transfer
- Biospace International – Protein Crystal Growth in High Fields

WORKSHOPS

Hosting and encouraging workshops has been an effective means of nourishing new solutions to cutting edge research and attracting new users to the NHMFL facilities. This year, 1999, has been a particularly active year for conferences and workshops sponsored by the NHMFL attracting over 1,500 participants. The following is a brief description of these meetings.

February 17-18, 1999
Directors of Industrial Research, Analytical Group Meeting
Tallahassee, FL

Fifty NMR directors and managers, representing the major chemical companies, pharmaceuticals, and the "Big Three" automobile companies attended the Winter Meeting of the Directors of Industrial Research, Analytical Group Meeting, hosted by The BF Goodrich Company. The meeting was held in Tallahassee this year so that members of these corporate research leaders could tour the NHMFL and meet with laboratory directors and faculty.

March 18-20, 1999

Second North American FT-ICR Mass Spectrometry Conference

San Diego, California

Two years ago, the NHMFL hosted the First North American Fourier Transform Ion Cyclotron Resonance Mass Spectrometry (FT-ICR MS) conference in Tallahassee. In response to community demand for a repeat performance, the NHMFL staged an even more successful conference in San Diego. The 1999 conference drew 128 attendees—a significant increase from 1997 (107 attendees, of which 20 were local). Dr. Charles Reed, chancellor of the California State University System and member of the NHMFL External Advisory Committee welcomed conferees. The session chairs organized the 24 plenary talks. The conference concluded with an after-dinner lecture by John D. Baldeschwieler, Caltech, who recounted the period from about 1964 to 1974 when he and his collaborators introduced ion cyclotron resonance to the chemical community and demonstrated its power for determining gas-phase ion-molecule reaction pathways, kinetics, energetic, and equilibria.

April 19-20, 1999

High B/T Workshop

NHMFL, University of Florida

The High B/T Workshop provided an important forum for the discussion of experiments—recent, planned, and potential ones—that require the simultaneous use of high magnetic fields ($B>15$ T) and very low temperatures ($T<10$ mK). The group also considered special techniques required and new system configurations that the NHMFL might incorporate into its vision for the future.

May 4-5, 1999

Workshop on Power Distribution & Management for Electric Ship Applications

NHMFL, Tallahassee

The NHMFL, FSU, and the Office of Naval Research supported this workshop. The objective was to assess the state-of-the-art in power distribution and management, as it may be applied to the U.S. Navy all-electric ship concept. Attendees identified critical areas of research and development that must be addressed before the benefits in performance, reliability, survivability, weight, volume, and cost can be achieved through implementation of advanced and emerging power system technologies. Hosting this workshop is another example of the NHMFL helping to forge new partnerships between government, the private sector, and academia. In this instance, the focus was on issues important to the power distribution and management concerns of the Navy, with a need to explore complementary requirements for commercial marine and utility applications. Over thirty people participated in the invitation-only conference.

August 12-13, 1999

Workshop on Innovative Measurement Technology

Sandia National Laboratories, Albuquerque, NM

This workshop focused on the application of nano- and micro-fabrication technologies to new instrumentation. Its goal is to identify opportunities to apply micro-electro-mechanical systems (MEMS) technology to new instrumentation that enables new science and enhances experimentation opportunities by increasing measurement sensitivity, decreasing noise,

decreasing data acquisition time, or shrinking sample size. The workshop was co-sponsored by Sandia National Laboratories and the NHMFL.

September 26-October 2, 1999
16th International Conference on Magnet Technology (MT-16)
Ponte Vedra Beach, Florida

MT-16 brings together scientists, engineers, and experts from around the world to focus on the latest developments in technology, operation, applications of research and industrial magnets, and magnet materials. The program features a range of topics such as magnets for accelerators and fusion and the generation of high fields. A major emphasis is on industrial applications, such as magnets for NMR and MRI, energy storage, levitation, and separation. Several sessions will be dedicated to new developments in high and low temperature superconductors and other magnet materials for reinforcement, impregnation, and insulation. It had been over a dozen years since this major international conference had been held in the United States, and by all accounts, it was an overwhelming success. There was a 25 percent increase in abstracts and participants over earlier conferences. Over 550 people actually attended and two-thirds of these participants came from countries outside the United States. The conference featured an industrial and scientific exhibition to display a wide range of products and services in magnet technologies that attracted 21 companies.

November 4-6, 1999
30th Southeastern Magnetic Resonance Conference (SEMRC)
NHMFL, Tallahassee

The NHMFL is pleased to have hosted this conference again—for the third time in five years. SEMRC features invited and contributed papers and posters in NMR, MRI, EPR, and ICR and over 125 participants attended the conference. The conference has attracted interest beyond the Southeast. The closing session of the conference was particularly noteworthy as it honored the life and work of Gitte Vold. Scott Prosser, Kent State University, and Stanley Opella, University of Pennsylvania, were the featured speakers.

6 BUDGET

Complete budget information was forwarded to the National Science Foundation in a letter with attachments to Dr. Lance Haworth, dated November 9, 1999. A summary is presented in this section, followed by the required tables and forms.

As of October 31, 1999, the costs and commitments for the NSF budget are as follows:

Expense Classification	*Dollars Expended To Date	*Dollars Encumbered To Date	*Total Dollars Expended & Encumbered
Salaries, Wages & Benefits	$17,365,109.01	$1,395.334.56	$18,760,443.57
Permanent Equipment	$6,951,270.81	$249,027.28	$7,200,298.09
Other Direct Expenses	$30,821,513.54	$2,040,611.14	$32,862,124.68
Total Direct Costs	$55,137,893.36	$3,684,972.98	$58,822,866.34
Overhead	$10,924,419.79	0	$10,924,419.79
Total Direct & Indirect Costs	$66,062,313.15	$3,684,972.98	$69,747,286.13

**Reference unaudited Departmental Ledger Summary (SS185LTD) as of 10/31/99*

COST SHARING

The original State commitment for matching, as presented in Chancellor Reed's letter of July 5, 1990, included direct recurring funds for faculty, visitor's program and expenses of approximately $4,200,000. The following table presents the current State of Florida matching requirements for fiscal years 1999 and 2000.

	1999 Matching ($)	1999 Increase (%)	2000 Matching ($)
State of Florida recurring funds cost sharing	$4,541,014	2.78%	$4,667,254
Indirect Cost – 46%	$2,088,866		$2,146,937
Total State Commitment	$6,629,880		$6,814,191
Overhead rate adjustment for negotiated institutional rate of 48%	$90,820		$93,345
Total State and Institutional Cost Sharing	$6,720,700		$6,907,536

During FY2000, the State again elected to provide additional funds for the operation of lab programs. We expect to utilize the additional State resources as available cost sharing funds for future funding opportunities.

Florida State University
National High Magnetic Field Laboratory
Budget vs. Actual Expenditures*
Cumulative FY96 – FY99

Expense Classification	Cumulative Budget $	FY99 Estimated Actual $	FY98 Actual Expense
Personnel Services			
Permanent Salaries	10,408,054	12,257,601	11,748,484
Permanent Fringes	3,121,775	3,660,044	3,640,509
OPS Salaries	7,504,086	2,449,073	2,059,461
OPS Fringes	566,878	94,354	78,806
Total Personnel Services	21,600,793	18,461,073	17,527,259
Permanent Equipment			
Furnishings	250,000	232,478	219,028
Research/Facility Equipment	7,449,270	6,557,933	6,206,513
Computers	300,000	376,324	290,708
Applications Software	0	5,273	5,273
Other Equipment	3,297,484	920	920
Total Permanent Equipment	11,296,754	7,172,928	6,722,441
TRAVEL			
Domestic & Foreign Travel	870,753	720,790	561,637
TOTAL TRAVEL	870,753	720,790	561,637
Other Direct Expenses			
Miscellaneous	26,101,287	32,836,193	24,121,256
TOTAL OTHER DIRECT EXPENSES	26,101,287	32,836,193	24,121,256
INDIRECT COST	10,130,413	11,335,865	7,927,850
PROGRAM TOTAL	70,000,000	70,526,849	56,860,445

- *Actual expenditures represent estimate expenditures plus encumbrances based on actual through 11/30/99. These are unaudited and subject to change.*

SUMMARY PROPOSAL BUDGET
Year 5—January 1-December 31, 2000

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (MONTHS) Proposed	Granted
AWARD NO.		

ORGANIZATION
Florida State University
National High Magnetic Field Laboratory

PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR
Jack E. Crow, Neil S. Sullivan, Gregory S. Boebinger

A. SENIOR PERSONNEL: PI/PD, Co-PIs, Faculty and Other Senior Associates List each separately with name and title. (A.7. Show number in brackets)	NSF-Funded Person-months CAL	ACAD	SUMR	Funds Requested By Proposer	Funds Granted by NSF (If Different)
1. **See Attachment III – Detail of Personnel by Classification** 6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)				$265,629	$
7. ( ) TOTAL SENIOR PERSONNEL (1-6)				$265,629	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( ) POSTDOCTORAL ASSOCIATES				$ 33,874	
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				$3,401,699	
3. ( ) GRADUATE STUDENTS□□□ □ □□ 4. ( ) UNDERGRADUATE STUDENTS□□□$ 16,610□ □□ 5. ( ) SECRETARIAL – CLERICAL (IF CHARGED DIRECTLY)□□□ □					
6. ( ) OTHER – Administrative/Clerical				$ 206,497	
TOTAL SALARIES AND WAGES (A + B)				$3,924,309	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				$1,166,187	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				$5,090,496	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Refer to Attachment II – Summary of Departmental Budget FY2000□□□ TOTAL EQUIPMENT□1,975,154□□ FORMTEXT □□_____□□□E. TRAVEL□1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)□□ FORMTEXT □□____137,375_□□□ FORMTEXT □□_____□□□□2. FOREIGN□□ FORMTEXT □□____23,900_□□□ FORMTEXT □□_____□□□F. PARTICIPANT SUPPORT□□□ 1. STIPENDS□$□ □□□□ 2. TRAVEL□□ □□□□ 3. SUBSISTENCE□□ □□□□ 4. OTHER□□ □□□□ TOTAL NUMBER OF PARTICIPANTS ( ) TOTAL PARTICIPANT COSTS					
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES (expendibles)				2,899,730	
2. PUBLICATION/DOCUMENTATION/DISSEMINATION (Toll, Mail, Reprographics)				150,000	
3. CONSULTANT SERVICES					
4. COMPUTER SERVICES					
5. SUBAWARDS Los Alamos National Laboratory Subcontract				4,232,655	
6. OTHER					
TOTAL OTHER DIRECT COSTS					
H. TOTAL DIRECT COSTS (A THROUGH G)□14,509,310□ □□I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE)□□□46% * (Total Direct-Permanent Equipment – LANL – Electricity) = □□□ TOTAL INDIRECT COSTS (F&A) (.46*(14,509,310-4,232,655-1,975,154-1,800,000))□2,990,690□ □□J. TOTAL DIRECT AND INDIRECT COSTS (H + I)□17,500,000□ □□K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)□ □ □□L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$17,500,00	$

M. COST SHARING: PROPOSED LEVEL **$6,907,536** AGREED LEVEL IF DIFFERENT: $

PI/PD TYPED NAME AND SIGNATURE*
National High Magnetic Field Laboratory
Jack E. Crow, Director
DATE

ORG. REP. TYPED NAME & SIGNATURE*
Florida State University
Raymond E. Bye, Jr
DATE

FOR NSF USE ONLY

INDIRECT COST RATE VERIFICATION

Date Checked	Date of Rate Sheet	Initials-ORG

SUMMARY PROPOSAL BUDGET
Year 5—January 1-December 31, 2000

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (MONTHS) Proposed	Granted
AWARD NO.		

ORGANIZATION
Los Alamos National Laboratory
National High Magnetic Field Laboratory

PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR
Jack E. Crow, Neil S. Sullivan, Gregory S. Boebinger

A. SENIOR PERSONNEL: PI/PD, Co-PIs, Faculty and Other Senior Associates List each separately with name and title. (A.7. Show number in brackets)	NSF-Funded Person-months CAL	ACAD	SUMR	Funds Requested By Proposer	Funds Granted by NSF (If Different)
1. **See Attachment III – Detail of Personnel by Classification**					$
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)				$1,018,317	
7. ( ) TOTAL SENIOR PERSONNEL (1-6)				$1,018,317	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. ( ) POSTDOCTORAL ASSOCIATES					
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				115,850	
3. ( ) GRADUATE STUDENTS					
4. ( ) UNDERGRADUATE STUDENTS					
5. ( ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)					
6. ( ) OTHER – Administrative/Clerical					
TOTAL SALARIES AND WAGES (A + B)				$1,134,167	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)					
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				$1,134,167	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) Refer to Attachment II – Summary of Departmental Budget FY2000					
TOTAL EQUIPMENT				148,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				35,010	
2. FOREIGN				18,035	
F. PARTICIPANT SUPPORT					
1. STIPENDS $ _____					
2. TRAVEL _____					
3. SUBSISTENCE _____					
4. OTHER					
TOTAL NUMBER OF PARTICIPANTS ( ) TOTAL PARTICIPANT COSTS					
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES (expendibles)				422,053	
2. PUBLICATION/DOCUMENTATION/DISSEMINATION (Toll, Mail, Reprographics)					
3. CONSULTANT SERVICES					
4. COMPUTER SERVICES					
5. SUBAWARDS					
6. OTHER					
TOTAL OTHER DIRECT COSTS					
H. TOTAL DIRECT COSTS (A THROUGH G)				1,757,265	
I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				2,475,390	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				4,232,655	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)					
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K) – Included in NHMFL overall request				$4,232,655	$

M. COST SHARING: PROPOSED LEVEL **$6,874,049** AGREED LEVEL IF DIFFERENT: $

PI/PD TYPED NAME AND SIGNATURE*	DATE	FOR NSF USE ONLY
National High Magnetic Field Laboratory Jack E. Crow, Director		INDIRECT COST RATE VERIFICATION
ORG. REP. TYPED NAME & SIGNATURE*	DATE	Date Checked / Date of Rate Sheet / Initials-ORG
Florida State University Raymond E. Bye, Jr		

NSF Form 1030 (10/99) ***Supersedes All Previous Editions***

*SIGNATURES REQUIRED ONLY FOR REVISED BUDGET (GPG III.C)

COST SHARING AND CONTRIBUTIONS

Florida State University—National High Magnetic Field Laboratory
Schedule of Funding and Matching Requirements

FSU #	EO	Agency	Total $	Total Matching $	1999-2000 $	Annual Matching $
NHMFL Budget Numbers					Available $	
Research						
2 Total			9,116,810	0	7,571,710	
Misc. State						
39 Total			2,000,000	0	2,734	0
SRAD Distributions						
48 Total			9,414,898	0	1,929,431	
Construction Funds						
91 Total			77,178,000	0	184,612	0
Total			97,709,709		9,688,487	0
NHMFL Grants						
Federal Grants						
20 Total			2,161,232	0	407,430	0
22 Total			80,541,203	610,150	19,211851	7,086,586
23 Total			820,000	0	205,000	0
27 Total			305,795	50,000	239,740	50,000
State of Florida Grants						
34 Total			2,559,816	0	952,980	0
39 Total			185,000	0	0	0
Private and Miscellaneous Grants						
40 Total			106,200	0	25,000	0
41 Total			729,114	50,000	564,114	50,000
42 Total			468,795	0	71,750	0
45 Total			2,500	0	0	0
Total			87,879,655	710,150	21,677,865	7,186,586
Grand Total			185,589,363	710,150	31,366,352	7,186,586

** based on available balance at 10/31/99*

APPENDIX: USERS & PROJECTS

NHMFL – DC FIELD FACILITY

USERS	INSTITUTION	FUNDING	PROJECT
Adams, E.D.	UF, Physics	Other	Magnetism of ^{3}He Nano-Clusters in a ^{4}He Matrix
Matsunaga, N.	UF, Physics		
Schuberth, E.A.	Walther Meissner Inst.		
Shvarts, V.A.	NHMFL/UF, Physics		
Xia, J.S.	NHMFL/UF, Physics		
Akimoto, H.	U. of Massachusetts	IHRP/UF	Nonlinear Spin Dynamics of Dilute ^{3}He-^{4}He at Very High B/T
Candela, D.	U. of Massachusetts		
Mullin, W.J.	U. of Massachusetts		
Adams, E.D.	UF, Physics		
Xia, J.S.	NHMFL/UF, Physics		
Sullivan, N.S.	NHMFL/UF, Physics		
Arnowitz, L.	BioSpace International	NASA	Protein Crystal Growth Studies in the Low-Gravity (Magnetic Levitation) Environment
Steinberg, E.	BioSpace International		
Stover, C.C.	BioSpace International		
Brooks, J.S.	NHMFL/FSU, Physics		
Stalcup, T.F.	NHMFL/FSU, Physics		
Balicas, L.	Venezuelin Institute	NSF	Effect of Uniaxial Stress on the Field-Induced Spin-Density Waves Phase Diagram and Rapid Oscillations of $(TMTSF)_2ClO_4$
Choi, E.S.	Seoul National U.		
Brooks, J.S.	NHMFL/FSU, Physics		
Qualls, J.	NHMFL/FSU, Physics		
Balicas, L.	Venezuelin Inst.	NSF	Electronic Structure of the Organic Conductor α-$(ET)_2MHg(SCN)_4$
Qualls, J.S.	NHMFL/FSU, Physics		
Brooks, J.S.	NHMFL/FSU, Physics		
Harrison, N.	NHMFL/LANL		
Montgomery, L.K.	Indiana U.		
Tokumoto, M.	ETL, Japan		
Balicas, L.	Venezuelin Inst.	NSF	Shubnikov de Haas Study in the High Magnetic Field State of η-Mo_4O_{11}
Harrison, N.	NHMFL/LANL		
Brooks, J.S.	NHMFL/FSU, Physics		
Sarrao, J.	NHMFL		
Fisk, Z.	NHMFL/FSU, Physics		
Barbosa-Cánovas, G.V.	Washington State U.	Other	Inactivation of *Escherichia coli and Saccharomyces cerevisiae* Using 18 T Static and Pulsed Magnetic Field
Harte, F.M.	Washington State U.		
San Martin, M.F.	Washington State U.		
Bergemann, C.	U. of Cambridge, U.K.	NSF	High Field Normal State of the Unconventional Superconductor Sr_2RuO_4
Brooks, J.S.	NHMFL/FSU, Physics		
Mao, Z.Q.	Kyoto U., Japan		
Maeno, Y.	Kyoto U., Japan		
Borsa, F.	Iowa State U.	Other	^{139}La High Field NMR in a $La_{1.90}Sr_{0.10}CuO_4$ Single Crystal
Julien, M.-H.	Iowa State U.		
Kuhns, P.	NHMFL		

Brooks, J.S. Biskup, N. Kato, R. Oshima, K.	NHMFL/FSU, Physics NHMFL RIKEN, Japan Okayama, Japan	NSF	Angular Dependent Magnetoresistance in $(DMET\text{-}TSeF)_2X$ System
Brooks, J.S. Han, S.Y. Rutel, I.B. Anzai, H.	NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics Himeji Inst. of Tech.	NSF	Anomalous Low Temperature Conductivity in $(TMTSF)_2PF_6$
Brooks, J.S. Han, S.Y. Kim, Ju. H.	NHMFL/FSU, Physics NHMFL U. of N. Dakota	NSF	Zeeman Effect on de Haas-van Alphen Oscillations in a 2D Magnetic Breakdown System
Brooks, J.S. Qualls, J..S. Brooks, J.S.	NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics	NSF	Anomalous Spin Splitting Effects in $\alpha\text{-}(ET)_2MHg(SCN)_4$
Brooks, J.S. Qualls, J.S. Harrison, N. Balicas, L. Montgomery, L.K. Tokumoto, M.	NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/LANL Venezuelin Inst. Indiana U. ETL, Japan	NSF	Competition Between Pauli and Orbital Effects in a Charge-Density Wave System
Brooks, J.S. Reavis, J.A. Medwood, R.A. Stalcup, T.F. Meisel, M.W. Perenboom, J.A.A.J.	NHMFL/FSU, Physics NHMFL/FSU, Physics Atlantic High School, FL NHMFL/FSU, Physics UF, Physics U. of Nijmegen	IHRP/FSU	Ergodic Behavior of Granular Matter in Low Gravity
Bowers, C.R. Patel, A. Pasquet, O. Bharatam, J. Hughes, E.L.	NHMFL/UF UF Chemistry UF-France REU UF Chemistry UF Chemistry	NSF	Field and Wavelength Dependence of Optically Pumped NMR in Bulk InP
Bowers, C.R. Vitkalov, S.A. Simmons, J.A. Reno, J.L.	UF, Chemistry UF, Chemistry Sandia Natl. Lab Sandia Natl. Lab	NSF	A New ESR Test for Skyrmions in the Regime of the Quantum Hall Effect
Cao, G. Crow, J.E. Alexander, C.S. McCall, S. Guertin, R.P.	NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics Tufts U.	IHRP/FSU	Rapid Suppression of Metal-Insulator Transition, and Magnetic Moment for Dilute La-Doping in $Ca_3Ru_2O_7$
Chen, C.-J. **Haik, Y.** Pai, V.M.	FAMU-FSU CoE FAMU-FSU CoE FAMU-FSU CoE	Therakos, Inc.	Magnetically-Coupled Optical-Based Noninvasive Glucose Monitoring System

Clark, W.G. Pieper, M. Tanaka, K.B. Brown, S.E. Alavi, B. Ardavan, A. Kriza, G. Hwu, S.-J. Skove, M. McCarten, J.	UCLA UCLA UCLA UCLA UCLA Cambridge U. Rsearch Inst., Budapest Clemson U. Clemson U. Clemson U.	NSF	NMR Investigations of Three Low-Dimensional Systems
Crabtree, G.W. Kwok, W.K. Olsson, R.J. Karapetrov, G. Paulius, L.M. Moulton, W.G. Hofman, D.J.	Argonne Nat'l Lab Argonne Nat'l Lab Argonne Nat'l Lab Argonne Nat'l Lab W. Michigan U. NHMFL/FSU, Physics Argonne Nat'l Lab	IHRP	Enhancement of the Upper Critical Point in Heavy Ion Irradiated $YBa_2Cu_3O_{7-\delta}$
Crow, J.E. Caldwell, T. McCall, S. Kuhns, P.L. Reyes, A.P. Cao, G. Moulton, W.G.	NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL NHMFL NHMFL NHMFL/FSU, Physics	NSF	Magnetic Properties of the Linear Chain System Tetragonal $LiCu_2O_2$
Datta, T. Bleiweiss, M.	U. of S. Carolina U. of S. Carolina	NSF	A Study of the Magneto-Electronic Properties of Novel Semiconducting and Semimetallic Structures
Del Barco, E. Hernandez, J.M. Tejada, J. Biskup, N. Achey, R. Rutel, I. Dalal, N. Brooks, J.S.	U. of Barcelona U. of Barcelona U. of Barcelona NHMFL NHMFL NHMFL FSU, Chemistry NHMFL/FSU, Physics	NSF	High Frequency Resonant Experiments in the Nanomagnet Fe_8: Evidence for Coherent Magnetization Tunneling
Du, R.R. Zudov, M.A. Simmons, J.A. Reno, J.L.	U. of Utah U. of Utah Sandia Natl. Lab Sandia Natl. Lab	NSF	High Magnetic Field Transport Near Landau Level Filling Factor $\nu=1/2$ in a Thick Quantum Hall System
Engel, L.W. Ye, P.D. Tsui, D.C. Simmons, J.A. Wendt, J.R. Vawter, G.A. Reno, J.R.	NHMFL Princeton U. Princeton U. Sandia Natl. Lab Sandia Natl. Lab Sandia Natl. Lab Sandia Natl. Lab	NSF	Geometric Resonance of Composite Fermions in Microwave Conductivity Measurement
Engel, L.W. Ye, P.D. Tsui, D.C. Simmons, J.A. Wendt, J.R. Vawter, G.A. Reno, J.R.	NHMFL Princeton U. Princeton U. Sandia Natl. Lab Sandia Natl. Lab Sandia Natl. Lab Sandia Natl. Lab	IHRP-FSU	Microwave Photoresistance in an Array of Antidots

Engel, L.W. Ye, P.D. Tsui, D.C. Pfeiffer, L.N. West, K.W.	NHMFL Princeton U. Princeton U. Bell Lab/Lucent Bell Lab/Lucent	IHRP-FSU	Sub-GHz Microwave Resonance of Extremely Clean Two-Dimensional Electron System at $\nu<1/5$
Epstein, A.J. Kmety, C.R.	Ohio State U. Ohio State U.	NSF	Field-Induced Magnetic Properties in the Molecule-Based Magnets: $M[N(CN)_2]_2$ (M = Mn, Fe)
Fisk, Z. DiTusa, J.F. Manyala, N. Sidis, Y. Aeppli, G. Young, D.P.	NHMFL/FSU, Physics LSU LSU LSU NEC Research Inst. NHMFL/FSU, Physics	NSF	$Fe_{1-x}Co_xSi$ in High Magnetic Fields
Fisk, Z. Bianchi, A. Drymiotis, F. Jackson, D. Torelli, M.	NHMFL/FSU, Physics NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics	NSF	Correlated Electron Materials
Furdyna, J.K. McCarty, A.D. Martins, G.B. Saylor, C. Brunel, L.-C.	U. Notre Dame NHMFL NHMFL NHMFL NHMFL	NSF	High Field EPR of the Strongly Coupled $Cd_{1-x}Mn_xSe$ and $Cd_{1-x}Mn_xS$ Magnetic Semiconductor Alloys
Garmestani, H. Meda, L. Dong, X. Dahmen, K.-H.	NHMFL/FAMU-FSU CoE NHMFL/FAMU-FSU CoE NHMFL/FAMU-FSU CoE FSU, Chemistry	NSF	Residual Stress in Thin Films of Strontium-Doped Lanthanum Manganites
Gantmakher, V. Tsydynzhapov, G.	Russian Academy Sciences Russian Academy Sciences	NSF/Visitors Program	Response to the Magnetic Field of Superconducting Materials from the Vicinity of the Superconductor-to-Insulator Transition
Gasparov, V.A. Gasparov, L.V. Wang, H.S. Li, Q. Brandt, B.L.	Russian Academy Sciences UF, Physics Penn State U. Penn State U. NHMFL	VOLNA	Superconducting Properties of $BaNbO_{3-X}$ Films
Halperin, W.P. Bachman, H. Mitrovic, V.F. Sigmund, E. Kishio, K, Kagayama, T. Reyes, A. Kuhns, P. Moulton, W.G.	Northwestern U. Northwestern U. Northwestern U. Northwestern U. Tokyo U. Tokyo U. NHMFL NHMFL NHMFL	IHRP	^{17}O NMR Evidence for Paramagnetic Vortex Pinning in $NdBa_2Cu_3O_7$

Halperin,, W.	Northwestern U.	NSF	NMR Detection of Bitter Magnet Temporal Fluctuations
Sigmund, E.	Northwestern U.		
Mitrovic, E.	Northwestern U.		
Bachman, H.	Northwestern U.		
Thomas, G.	Northwestern U.		
Calder, E.	Northwestern U.		
Kuhns, P.	NHMFL		
Reyes, A.	NHMFL		
Moulton, W.G.	NHMFL/FSU		
Hari, P.	CA State at Fresno	NSF	Photo-Darkening in Glassy As_2S_3
Su, T.	U. of Utah		
Taylor, P.C.	U. of Utah		
Kuhns, P.L.	NHMFL		
Moulton, W.G.	NHMFL/FSU, Physics		
Sullivan, N.S.	NHMFL/UF, Physics		
Harrison, N.	NHMFL/LANL	NSF/DOE	Quantum Oscillations in the Charge-Density Wave Compound Nse_3 in Strong Magnetic Fields
Balicas, L.	Venezuelin Inst.		
Brooks, J.S.	NHMFL/FSU, Physics		
Mielke, C.H.	NHMFL/LANL		
Sarro, J.	LANL		
Fisk, Z.	NHMFL/FSU, Physics		
Harrison, N.	NHMFL/LANL	NSF/DOE	The Thermodynamic Properties of α-(BEDT-$TTF_)_2KHg(SCN)_4$
Balicas, L.	Venezuelin Inst.		
Brooks, J.S.	NHMFL/FSU, Physics		
Mielke, C.H.	NHMFL/LANL		
Hascicek, Y.S.	NHMFL	NHMFL	Non-Vacuum YBCO Films on Buffer Layered Ni Tapes: Processing, Growth, and Properties
Mutlu, I.H.	Harran, U., Turkey		
Celik, E.	Sakarya U., Turkey		
Ramazanoglu, M.K.	FSU, Physics		
Akin, Y.	UF, Material Science		
Crow, J.E.	NHMFL/FSU, Physics		
Hascicek, Y.S.	NHMFL	NHMFL	High Field Critical Current Measurements in Nb_3Al Multifilamentary Superconductors
Sumption, M.	Ohio State U.		
Tomsic, M.	EURUS Technologies		
Gregory, E.	IGC Adv. Superconductors		
Hascicek, Y.S.	NHMFL	NHMFL	Sol-Gel Buffer Layers on Ni Tapes for YBCO
Celik, E.	Sakarya U., Turkey		
Okuyucu, H.	Gazi U., Turkey		
Mutlu, I.H.	Harran, U., Turkey		
Hebard, A.F.	NHMFL/UF, Physics	IHRP/UF	Spin-Peierls Transition in NaV_2O_5 at High Magnetic Fields
Bompadre, S.G.	NHMFL/UF, Physics		
Kotov, V.N.	NHMFL/UF, Physics		
Hall, D.	NHMFL		
Maris, G.	U. Groningen		
Bass, J.	U. Groningen		
Palstra, T.T.M.	U. Groningen		
Hentges, R.	OI-ST	Oxford Superconducting Technology	Recent Developments of Nb_3Sn Superconducting Wire at Oxford Instruments, Inc., Superconducting Technology (OI-ST)
Zhang, Y.	OI-ST		
Hong, S.	OI-ST		
Field, M.	OI-ST		

Hill, S. Brooks, J.S. Mao, Z.Q. Maeno, Y.	Montana State U. NHMFL/FSU, Physics U. of Kyoto, Japan U. of Kyoto, Japan	NSF	Cyclotron Resonance in the Layered Perovskite Superconductor Sr_2RuO_4
Hill, S. Mola, M. Brooks, J.S. Qualls, J.S. Ward, B.H.	Montana State U. Montana State U. NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics	NSF	Josephson Plasma Resonance and Vortex Structure/Dynamics in Organic Superconductors
Hill, S. Mola, M. Brooks, J.S. Qualls, J.S.	Montana State U. Montana State U. NHMFL/FSU, Physics NHMFL/FSU, Physics	NSF	Angle Dependent Magnetization within the Superconducting State of κ-$(ET)_2Cu(NCS)_2$
Gama, S. Coelho, A.A. Rivas-Padilla, E.P.	UNICAMP, Brazil UNICAMP, Brazil UNICAMP, Brazil	Other	High Field Magnetotransport Measurements in Perovskites Compounds
Goodrich, R.G. Harrison, N, Fisk, Z.	LSU NHMFL/LANL NHMFL/FSU, Physics	NSF	Preliminary dHvA Measurements on $La_{1-x}Sm_xB_6$ and $Ce_{1-x}Ca_xB_6$
Goodrich, R.G. Hall, D. Fisk, Z.	LSU NHMFL NHMFL/FSU, Physics	NSF	Magnetic Field Dependence of the Paramagnetic to the High Temperature Magnetically Ordered Phase Transition in CeB_6
Graf, M.J. Opeil, C.P. de Visser, A. Menovsky, A.A. Hannahs, S.T.	Boston College Boston College Waals-Zeeman Inst. Waals-Zeeman Inst. NHMFL	Research Corp.	Magnetoresistance of Single Crystal $U(Pt_{1-x}Pd_x)_3$ with x=0, 0.002
Guertin, R.P. Cao, G. McCall, S. Dobrosavljevic, V. Alexander, C.S. Crow, J.E.	Tufts U. NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics	IHRP/FSU	Impact of Dilute La-Doping on Metal-Insulator Transition and Magnetic Phase Transition in Ca_2RuO_4
Guertin, R.P. Harrison, N. Cao, G. Crow, J.E.	Tufts U. NHMFL/LANL NHMFL NHMFL/FSU, Physics	NSF	Search for High Field-Induced Magnetic Transitions in $Ca_3Ru_2O_7$ and $BaIrO_3$
Ingersent, K. Si, Q. Smith, J.L.	NHMFL/UF, Physics Rice U., Physics Rice U., Physics	Other	Quantum Critical Behavior in Heavy Fermion Systems
Ishiguro, T. Ohmichi, E. Maeno, Y.	Kyoto U. Kyoto U. Kyoto U.	CREST/ JST	Magnetoresistance of Sr_2RuO_4 Under High Magnetic Fields Parallel to the Layer Plane
Jones, E.D. Bajaj, K.K. Tozer, S.T. Wei, X.	Sandia Natl. Lab Emory U. NHMFL NHMFL	DOE	Photoluminescence-Linewidth-Derived Exciton Mass for InGaAsN Alloys

Kang, W. Eom, J. Wegscheider, W.	U. of Chicago U. of Chicago Schotky Inst.	Packard Foundation	Magnetotransport Study of Two-Dimensional Electron System in High Quality GaAs/AlGaAs Quantum Wells
Karczewski, G. Wojtowicz, T. Wang, Y.J.	Polish Acad. Sciences Polish Acad. Sciences NHMFL	Fullbright Foundation & NHMFL	Electron Cyclotron Resonance of 2DEG in Diluted Magnetic Semiconductor Heterostructures
Khokhlov, D.	Moscow State U.		Non-Equilibrium Phenomena in Doped IV-VI Semiconductors and Related Theoretical Studies
Krystek, J. Sienkiewicz, A. Von Schütz, J.U.	NHMFL Polish Acd. Sciences U. of Stuttgart	IHRP-FSU	Multifrequency, High Field EPR Study of Low-Dimensional Radical Ion Salts
Marshall, A.G. Shi, S.D.-H. Drader, J.J. Hendrickson, C.L.	NHMFL/FSU NHMFL/FSU NHMFL NHMFL	NSF	FT-ICR MS in a High Homogeneity 25 T Resistive Magnet
Marchenkov, V.V. Gornostyrev, Yu.N. Startsev, V.E. Tagirova, D.M. Deryagin, A.I. Antonova, O.V. Hall, D.W. Stalcup, T.F. Brooks, J.S. Weber, H.W.	Inst. Metal, Russia Inst. Metal, Russia Inst. Metal, Russia Inst. Metal, Russia Inst. Metal, Russia Inst. Metal, Russia NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics Austrian U.	NSF	Peculiarities of the Electron-Dislocation Scattering in Magnetotransport of Transition Compensated Metals at High Magnetic Field
Martin, S.W. Borsa, F. Meyer, B.	Iowa State U. Ames Lab/Iowa State Ames Lab/Iowa State	DOE	^{109}Ag NMR Studies of Mobile Ions in the Glassy Fast Ionic Conductor 0.525 $Ag_2S + 0.475(0.5B_2S_3+0.5SiS_2)$
Meisel, M.W. Morgan, A.N. Watson, B.C. Maloney, J.R. Brooks, J.S. Paul, A.-L. Ferl, R.J.	UF, Physics UF, Physics UF, Physics UF, Physics NHMFL/FSU, Physics UF, Horticultural Sciences UF, Horticultural Sciences	IHRP	Stress Response to High Magnetic Fields in Transgenic Arabidopsis Plants
Meisel, M.W. Watson, B.C. Jensen, D.A. Fanucci, G.E. Talham, D.R. Hall, D.	UF, Physics UF, Physics UF, Chemistry UF, Chemistry UF, Chemistry NHMFL	NSF	Studies of Novel Low Dimensional Magnets
Musfeldt, J.L. Wei, X. Long, V.C. Zhu, Z. Whangbo, M.	SUNY Binghamton NHMFL SUNY Binghamton SUNY Binghamton N. Carolina State U.	SUNY Binghamton	Spectroscopic Studies of α'-NaV_2O_5 in High Magnetic Fields

Naughton, M.J. Sushko, Yu V. Wang, D.Z. Yang, S.X. Ren, Z.F. Bianchi, A. Fisk, Z.	Boston College NHMFL/BC Boston College Boston College Boston College NHMFL NHMFL/FSU, Physics	NSF	Competing Magnetic and Superconducting States in $RuSr_2GdCu_2O_8$
Ng, H.K. Leem, Y.A. Storr, K.	FSU, Physics FSU, Physics FSU, Physics	IHRP/FSU	Enhanced Effective Mass at ν=1 in $Zn_{1-x-y}Cd_xMn_ySe$ Heterostructures
Noh, T.W. Jung, J.H. Lee, H.J. Choi, E.J. Moritomo, Y. Wany, Y.J. Wei, X.	Seoul Natl. U. Seoul Natl. U. Seoul Natl. U. Seoul Natl. U. Nagoya U., Japan NHMFL NHMFL	Korea/ NHMFL	Melting of Charge/Orbital Ordered States in $Nd_{1/2}Sr_{1/2}MnO_3$: Magnetic Field Dependent Optical Studies
Oseroff, S. Fainstein, A. Talon, J. Van Tol, J.	San Diego State U. Centro Atomico Bariloche Industrial Research Ltd. NHMFL	Other	High Field Magnetic Resonance in $RuSr_2GdCu_2O_8$
Palm, E.C. Murphy, T.P. Hall, D. Toser, S.W. Hannahs, S.T. Kauppinen, J.P. Pekola, J.P.	NHMFL NHMFL NHMFL NHMFL NHMFL Nanoway Oy, Finland U. Jÿvaskylä, Finland	NSF	Thermometry at Low Temperatures and High Magnetic Fields
Park, Y.W. Suh, D.-S.	Seoul Nat'l. U. Seoul Nat'l. U.	Korea Sci. & Eng. Foundation	Magnetotransport Measurement of Metallic Polyacetylene
Park, Y.W. Suh, D.-S. Kim, T.J. Akagi, K. Shirakawa, H. Brooks, J.S.	Seoul Nat'l. U. Seoul Nat'l. U. Seoul Nat'l. U. U. of Tsukuba U. of Tsukuba NHMFL/FSU, Physics	Korea Sci. & Eng. Foundation	Magnetoresistance of S-Typed Helical Polyacetylene Doped with Iodine
Park, Y.W. Suh, D.-S. Kim, T.J. Akagi, K. Shirakawa, H. Brooks, J.S.	Seoul Nat'l. U. Seoul Nat'l. U. Seoul Nat'l. U. U. of Tsukuba U. of Tsukuba NHMFL/FSU, Physics	Korea Sci. & Eng. Foundation	Magnetotransport Properties of R-Type Helical Polyacetylene Doped with Iodine
Pekarek, T.M. Hughes, S.B. Graf, A.T. Duffy, M. Maymi, C. Crooker, B.C. Miotkowski, I. Ramdas, A.K.	U. of N. Florida Stanton College Prep. U. of N. Florida U. of N. Florida U. of N. Florida Fordham U. Purdue U. Purdue U.	Research Corp.	Magnetization Measurements on the III-VI Diluted Magnetic Semiconductor $Ga_{1-x}Mn_xS$ at High Fields

Petrou, A. Cheong, H.D. Kioseoglou, G. Dutta, M. Pamulapati, J. Wang, Y.J. Wei, X.	SUNY Buffalo SUNY Buffalo SUNY Buffalo U.S. Army U.S. Army NHMFL NHMFL	NSF	Magneto-Optical Study of Interface Roughness in Type-II AlGaAs/AlAs Quantum Well Structures
Pourrahimi, S.	Superconducting Systems Inc.	Superconducting Systems, Inc.	Nb_3Al Superconductors for Above 850 MHz NMR Magnets
Reyes, A. Abdelrazek, M. Kuhns, P. Moulton, W.G.	NHMFL NHMFL/FSU, Physics NHMFL NHMFL/FSU, Physics	IHRP	Evidence for Ba-Site Occupation of Pr^{3+} in $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ from Cu NQR
Reyes, A. Caldwell, T. Abdelrazek, M. Achey, R. Kuhns, P. Moulton, W.G. Fisk, Z. Young, D.	NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL NHMFL/FSU, Physics NHMFL/FSU, Physics NHMFL	IHRP/FSU	Field Suppression of In-Gap Quasiparticle Excitations in SmB_6
Sarma, B.K. Feller, J. Ketterson, J.B.	U. of Wisconsin U. of Wisconsin Northwestern U.	NSF	Ultrasound Measurements Near the Metamagnetic Transition in UPt_3
Sarrao, J. Goodrich, R.G. Hall, D. Fisk, Z.	LANL LSU NHMFL NHMFL/FSU, Physics	NSF	Preliminary dHvA Measurements on $La_{1-x}Ce_xRhIn_5$
Schwartz, J. Hamdan, N.M. Sastry, P.V.P.S.S.	NHMFL/FAMU-FSU CoE King Fahd U. NHMFL	DOE	Phase Formation and Superconducting Properties of Fluorine-Doped $(Hg,X)Ba_2Ca_2Cu_3O_y$ Superconductors
Schwartz, J. Sastry, P.V.P.S.S. Durbin, S.M. Atwell, S.L. Magaña, R. Jr. Pelt, J.S.	NHMFL/FAMU-FSU CoE NHMFL FAMU-FSU CoE FAMU-FSU CoE FAMU-FSU CoE FAMU-FSU CoE	IHRP/FSU	Fabrication of C-Axis Textured $(HgRe)_1Ba_2Ca_1Cu_2O_y$ Thin Fims on Single Crystal Substrates
Schwartz, J. Trociewitz, U.P. Sahm, P.R.	NHMFL/FAMU-FSU CoE Aachen U. of Technology Aachen U. of Technology	DOE	Microstructural Development and Superconducting Properties of Ba-Added $Bi_2Sr_2CaCu_2O_{8+\delta}$
Schwartz, J. Viouchkov, Y. Weijers, H.W.	NHMFL/FAMU-FSU CoE NHMFL NHMFL	IHRP/FSU	Influence of Thermal Cycling on Mechanical Properties $Bi_2Sr_2CaCu_2O_x$ Superconductors
Schmiedeshoff, G.M. Palm, E. Hannahs, S.T. Murphy, T. Smith, J.L.	Occidental College NHMFL NHMFL NHMFL LANL	NSF	Electrical Resistivity of UBe_{13} in High Magnetic Fields

Schrama, J.M. Singleton, J. Ardavan, A. Kurmoo, M. Day, P.	U. of Oxford U. of Oxford U. of Oxford IPCMS-France The Royal Inst.	Engineering & Physical Sciences Council	Sensitivity of Fermi Surface Traversal Resonance to the Density-Wave Transition in α-(BEDT-TTF)$_2$KHg(SCN)$_4$
Singleton, J. Edwards, R.S. Schrama, J.M. Rzepniewski, E. Ardavan, A. Kurmoo, M.	U. of Oxford U. of Oxford U. of Oxford U. of Oxford U. of Oxford IPCMS, France	Engineering & Physical Sciences Council	Angle Dependent Resonances in the Organic Superconductor κ-(ET)$_2$Cu(NCS)$_2$
Singleton, J. Honold, M.M. Nam, M-.S. Yaguchi, H. Harrison, N. Mielke, C.H. Kartsovnik, M.V. Kushch, N.D. Kurmoo, M. Day, P.	U. of Oxford U. of Oxford U. of Oxford U. of Oxford NHMFL/LANL NHMFL/LANL Walther-Meissner ICPR, RAS IPCMS The Royal Inst.	Engineering & Physical Sciences Council	Mapping of the Quantum Hall Regime in α-(BEDT-TTF)$_2$MHg(SCN)$_4$ (M=K, Tl) Organic Conductors
Singleton, J. Symington, J.A. Nam, M-.S. Ardavan, A. Harrison, N. Mielke, C.H. Blundell, S.J. Kurmoo, M. Day, P.	U. of Oxford U. of Oxford U. of Oxford U. of Oxford NHMFL/LANL NHMFL/LANL U. of Oxford IPCMS The Royal Inst.	Engineering & Physical Sciences Council	Angle Dependence of the Upper Critical Field and Evidence for the Fulde-Ferrell-Larkin-Ovchinnikov State in the Organic Superconductor κ-(BEDTTTF)$_2$Cu(SCN)$_2$
Smalley, R.E. Walters, D.A. Casavant, M.J. Qin, X.C. Schmidt, J. Huffman, C.B. Haroz, E.H. Smith, K. Colbert, D.T.	Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST Rice U., CNST	NSF	Magnetic Alignment of Carbon Nanotubes
Snoke, D. Negoita, V. Eberl, K. Chang, Y.C.	U. of Pittsburgh U. of Pittsburgh Max Planck/Stuttgart U. of Illinois	NSF	Magnetic Field Effects on Indirect Excitons in GaAs Coupled Quantum Wells
Stewart, G.R. Kim, J.S. Hall, D. Heuser, K.	UF, Physics UF, Physics NHMFL U. Augsburg, Germany	NSF	Indications of Non-Fermi Liquid Behavior at the Metamagnetic Transition of UPt_3
Sullivan, N.S. Parks, C. Stachowiak, P.	NHMFL/UF, Physics UF, Physics UF, Physics	NSF	NMR Studies of Quantum Tunneling in a 2D Film of ^{3}He Atoms
Sullivan, N.S. Kim, K.	NHMFL/UF, Physics Stanford U.	NSF	Correlation Effects and Long-Range Ordering of Quantum Rotors in 2D

Symington, J.A. Singleton, J. Edwards, R.S. Rzepniewski, E. Ardavan, A. Schleuter, J.	U. of Oxford U. of Oxford U. of Oxford U. of Oxford U. of Oxford Argonne	Engineering & Physical Sciences Council	Conductivity Studies on the Organic Superconductor β"-$(ET)_2SF_5CH_2CF_2SO_3$
Thoener, M.	VACUUMSCHMELZE	VACUUMSCHMELZE	Enhanced Nb_3Sn Conductors for NMR Application Beyond 900 MHz
Tsui, D.C. Pan, W. Du, R.R. Störmer, H.L. Pfeiffer, L.N. Baldwin, K.W. West, K.W.	Princeton U. Princeton U. U. of Utah Columbia U. Bell Labs/Lucent Bell Labs/Lucent Bell Labs/Lucent	NSF	Strongly Anisotropic Electronic Transport at $\nu = 9/2$ and 5/2 under a Tilted Magnetic Field
Tyner, B. Sullivan, N.S.	UF, Physics NHMFL/UF, Physics	NSF	Tunnel Diode Microwave Marginal Oscillator for Magnetic Resonance at High B/T
Valles, Jr., J.M. Wasserman, S. Liu, J. Denegre, J.M. Mowry, K.L.	Brown U., Physics Brown U., Physics Brown U., Physics Brown U., Molecular Bio. Brown U., Molecular Bio.	Other	Manipulation of Cell Division Using Static Magnetic Fields
von Molnár, S. Watts, S.M. Wirth, S. Barry, A. Coey, J.M.D.	FSU, MARTECH FSU, MARTECH FSU, MARTECH Trinity College, Ireland Trinity College, Ireland	MURI	High Field Magnetotransport in Half-Metallic Chromium Dioxide
von Molnar, S. Li, Y. Parker, J.S. Xiong, P. Yang, F.Y. Chien, C.L.	FSU/MARTECH FSU/MARTECH FSU/MARTECH FSU/MARTECH John Hopkins U. John Hopkins U.	MURI	High Field Shubnikov-de Haas Oscillations in Electrodeposited Bi Single Crystal Films
von Molnár, S. Anane, A. Raquet, B.	FSU/MARTECH FSU/MARTECH FSU/MARTECH	MURI	Electrical Noise in $La_{2/3}Sr_{1/3}MnO_3$
Wang, Y.J. McCombe, B.D. Jones, E.D. Peeters, F.M.	NHMFL SUNY Buffalo Sandia Natl. Lab U. Antwerpen	Korea Ministry of Ed.	Resonant Magnetopolaron Effect in Modulation-Doped GaAs/AlGaAs Quantum Wells at High Magnetic Fields
Warren, W.S. Lin, Y.-Y. Ahn, S. Garrett-Roe, S. Murali, N. Brey, W. Bowers, C.R.	Princeton U. Princeton U. Princeton U. Princeton U. NHMFL NHMFL NHMFL/UF	NHMFL	Resolution Enhancement Using CPMG-HOMOGENIZED Detection of Solution NMR on the Keck Magnet

Woo, J.C. Kim, D.H. Leem, Y.A. Rhee, S.J. Sung, M.G. Moon, I.C.	Seoul Natl. U. Seoul Natl. U. FSU, Physics U. of Illinois Seoul Natl. U. Seoul Natl. U.	Korea Ministry of Ed.	Zeeman Spectroscopy of GaAs/AlGaAs Quantum Wire Arrays
Yokoi, H. Toser, S.W. Kim, Y. Wojtowicz, T. Karczewski, G. Kossut, J.	NRIM, Japan NHMFL NHMFL/LANL Polish Acad. Sciences Polish Acad. Sciences Polish Acad. Sciences	Science & Technology Agency of Japan	Pressure Induced Quenching of Exciton Photoluminescence and Its Recovery by Magnetic Fields in CdTe/CdMnTe Quantum Wells
Yamada, Y. Sastry, P.V.P.S.S. Viouchkov, Y. Schwartz, J.	Tokai U. NHMFL NHMFL NHMFL/FAMU-FSU CoE	IHRP/FSU	Mechanisms of Magnetic Field Induced Texture Development in High-T_c Materials
Zheng, G.-Q. Moulton, W.G. Kuhns, P. Reyes, A.P. Clark, W.G.	Osaka U., Japan NHMFL/FSU Physics NHMFL NHMFL UCLA	NSF	High Magnetic Field NMR Study of the d-Wave Vortex in the Overdoped High-T_c Superconductor
Zheng, J.P. Wei, X.	FAMU-FSU CoE NHMFL	FSU/CRCP	Optical Spectra of Quantum Confinement Systems at High Magnetic Fields

NHMFL – Pulsed Field Facility

Users	Institution	Funding	Project
Agosta, C.C. Coffey, T. Bayindir, Z. DeCarolis, J. Bennett, M. Tokumoto, M.	Clark U. Clark U. Clark U. Clark U. NHMFL/LANL ETL, Japan	NSF	Measuring Properties of Materials in Pulsed Magnetic Fields with a Radio Frequency Tunnel Diode Oscillator
Ando, Y Balakirev, F.F. Passner, A. Betts, J.B. Schneemeyer, L.F. Segawa, K. Boebinger, G.S.	CRIEPI, Japan NHMFL/LANL Lucent Technologies NHMFL/LANL Lucent Technologies CRIEPI, Japan NHMFL/LANL	Other/ Overseas	Large, Linear c-Axis Magnetoresistance in $YBa_2Cu_3O_{7-\delta}$
Ando, Y. Ono, S. Murayama, T. Balakirev, F.F. Betts, J.B. Boebinger, G.S.	CRIEPI, Japan CRIEPI, Japan CRIEPI, Japan NHMFL/LANL NHMFL/LANL NHMFL/LANL	Other/ Overseas	Low Temperature Normal State of the High T_c $Bi_2Sr_{2-x}La_xCuO_{6+\delta}$ Revealed by 60 T Magnetic Fields
Arko, A.J. Cornelius, A.L. Sarrao, J.L.	LANL LANL LANL	DOE	Angular Magnetization and de Haas-van Alphen Measurements to 50 T on $CeRhIn_5$
Aronson, M.C.	U. of Michigan	NSF	Magnetoresistance of Low Carrier Density Hexaborides
Awschalom, D.D. Crooker, S.A. Rickel, D.G. Lyo, K. Samarth, N.	UC Santa Barbara NHMFL/LANL NHMFL/LANL Sandia Natl. Lab Penn State U.	NSF	Field-Driven Annealing of the Magnetic Fluctuation Potential in Magnetic Semiconductor Quantum Wells
Awschalom, D.D. Johnston-Halperin, E. Crooker, S.A. Peng, X. Alivisatos, P.A.	UC Santa Barbara UC Santa Barbara NHMFL/LANL UC Berkeley UC Berkeley	NSF	Spin Spectroscopy of CdSe Quantum Dots in High Magnetic Fields
Awschalom, D.D. Johnston-Halperin, E. Crooker, S.A. Rickel, D.G. Peng, X. Alivisatos, P.A.	UC Santa Barbara UC Santa Barbara NHMFL/LANL NHMFL/LANL UC Berkeley UC Berkeley	IHRP/LANL	Techniques for Time and Spin Resolved Photoluminescence Studies of CdSe Quantum Dots in High Magnetic Fields
Balakirev, F.F. Betts, J.B. Boebinger, G.S. Motoyama, N. Eisaki, H. Uchida, S.	NHMFL/LANL NHMFL/LANL NHMFL/LANL U. of Tokyo U. of Tokyo U. of Tokyo	NSF	Shared Transport Regimes in Two-Leg Spin-Ladders and High-T_c Superconductors

Bao, W. Lacerda, A.H. Thompson, J.D.	LANL NHMFL/LANL LANL	DOE	Phase Transition in Magnetic Field in V_2O_3
Boebinger, G.S. Balakirev, F.F. Betts, J.B. Rosenbaum, T.F. Saboungi, M.-L. Schynders, H.	NHMFL/LANL NHMFL/LANL NHMFL/LANL U. of Chicago Argonne (ANL) ANL	NSF	Large Magnetoresistance of Silver Selenide in a Pulsed Field
Brown, S.E. Clark, W.G. Pieper, M. Hillman, C. Alavi, B. Lacerda, A.	UCLA UCLA UCLA UCLA UCLA NHMFL/LANL	NSF	^{1}H NMR Studies in the Regime of the Field-Induced Field-Induced Spin-Density Wave Phases of $(TMTSF)_2PF_6$
Bud'ko, S.L. Luban, M. Canfield, P.C. Lacerda, A.H. Torikachvili, M.S. Müller, A. Kögerler, P.	Ames Lab/Iowa State Ames Lab/Iowa State Ames Lab/Iowa State NHMFL/LANL San Diego State U. U. Bielefeld, Germany U. Bielefeld, Germany	DOE	High Field Magnetization Studies of Molecular Magnets $\{Mo_{72}Fe_{30}\}$ and $\{V_6\}$
Bud'ko, S.L. Myers, K.D. Canfield, P.C. Lacerda, A.H.	Ames Lab/Iowa State Ames Lab/Iowa State Ames Lab/Iowa State NHMFL/LANL	DOE	Magnetotransport and Quantum Oscillations in $CeAgSb_2$ and $LaAgSb_2$
Canfield, P.C. Fisher, I.R. Bud'ko, S.L. Harrison, N. Lacerda, A.H.	Ames Lab/Iowa State Ames Lab/Iowa State Ames Lab/Iowa State NHMFL/LANL NHMFL/LANL	DOE	Search for De Haas – Van Alphen Oscillations in Quasicrystals
Clark, R. Starrett, R. Reilly, D. Mielke, C.H. Rickel, D.G.	U. New S. Wales U. New S. Wales U. New S. Wales NHMFL/LANL NHMFL/LANL	Other/ Overseas	Proof Tests of Planar Micro-Magnetometer
Crooker, S.A. Johnston-Halperin, E. Awschalom, D.D. Knobel, R. Samarth, N.	NHMFL/LANL UC Santa Barbara UC Santa Barbara Penn State U. Penn State U.	NSF	Charged Excitons in Spin-Polarized 2D Electron Gases
Crooker, S.A. Samarth, N. Awschalom, D.D.	NHMFL/LANL Penn State U. UC Santa Barbara	NSF	"Quasi 2-D" Spin Distribution in II-VI Magnetic Semiconductor Heterostructures: Clustering and Dimensionality
Haanappel,, E.G. Pricopi, L. Askanazy, S. Lejay, P. Demuer, A. Lapertot, G. Harrison, N.	Service Nat'l des Champs Service Nat'l des Champs Service Nat'l des Champs CNRS, France Dept. la Matière Condensée Dept. la Matière Condensée NHMFL/LANL	Other/ Overseas	dHvA Experiments on the Heavy Fermions $CeAl_2$, $CeRu_2Si_2$ and URu_2Si_2

Harrison, N. Balicas, L. Brooks, J.S. Teklu, A. Goodrich, R.G. Cooley, J.S. Smith, J.L.	NHMFL/LANL Venezuelin Institute NHMFL/FSU, Physics LSU LSU LANL LANL	NSF	Quantum Oscillations Studies of $U_xTh_{1-x}Be_{13}$ Intermetallics
Jaime, M. Movshovich, R. Sarrao, J.L.	LANL LANL LANL	IHRP/UF	High Field Heat Capacity of $YbInCu_4$
Jaime, M. Movshovich, R. Sarrao, J.L. Stewart, G.R. Beyermann, W.P. Gomez-Berisso, M. Canfield, P.C. Hundley, M.F.	LANL LANL LANL UF, Physics UC Riverside Centro Atómico, Bariloche Iowa State U., Ames LANL	IHRP/UF	Specific Heat of $Ce_3Bi_4Pt_3$ Measured in the New 60 T Long Pulse Magnet
Jiang, H.W. Kim, Y. Lee, X.	UCLA NHMFL/LANL UCLA	IHRP/LANL	Positively Charged Magnetoexciton Transitions in a ρ-doped GaAs/AlGaAs Single Heterojunction
Jiang, H.W. Kim, Y. Lee, X. Schaff, W.	UCLA NHMFL/LANL UCLA Cornell U.	NSF	Topological Phase Diagram of Two-Subband Electron Systems in the High Magnetic Field Regime
Krusin-Elbaum, L. Maley, M.P. Morozov, N. Bulaevskii, L.N. Shibauchi, T.	IBM LANL LANL LANL LANL/IBM	IHRP/LANL	Investigations of C-Axis Transport in Highly Anisotropic Layered Superconductors
Mielke, C.H. Harrison, N. Montgomery, L.K.	NHMFL/LANL NHMFL/LANL Indiana U.	NSF	Kappa Phase Organic Superconductors with In-Plane Tilted Magnetic Field (H$\|\|$ac)
Musfeldt, J.L. Kim, Y.M. Crooker, S.	SUNY Binghamton NHMFL NHMFL	NSF	Spectroscopic Studies of α'-NaV_2O_5 at 60 T
Nakotte, H. Chang, S. Torikachvili, M. Lacerda, A. Takabatake, T.	New Mexico State U. New Mexico State U. San Diego State U, NHMFL/LANL Hiroshima U.	NSF	Magnetism in Single-Crystalline CePtSn
Orbach, R.L. Wood, G.G. Hammann, J. Vincent, E. Joh, Y.G. Boebinger, G.S.	UC Riverside UC Riverside CEA, France CEA, France NHMFL/LANL NHMFL/LANL	NSF	Finite Size Effects on Spin Glass Dynamics
Perry, C.H. Kim, Y. Simmons, J.A.	Northeastern U. NHMFL/LANL Sandia Natl. Lab	IHRP/LANL	In-Plane Magnetoluminescence of Modulation-Doped GaAs/$Al_{0.3}Ga_{0.7}As$ Coupled Double Quantum Wells

Perry, C.H. Munteanu, F.M. Rickel, D.G. Kim, Y. Simmons, J.A. Reno, J.	Northeastern U. NHMFL/LANL NHMFL/LANL NHMFL/LANL Sandia Natl. Lab Sandia Natl. Lab	NSF	Energy Behavior with Magnetic Field of Negatively Charged Magneto-Excitons in a GaAs/AlGaAs Quantum Well
Perry, C.H. Munteanu, F.M. Rickel, D.G. Kim, Y. Simmons, J.A. Reno, J.	Northeastern U. NHMFL/LANL NHMFL/LANL NHMFL/LANL Sandia Natl. Lab Sandia Natl. Lab	NSF	Photoluminescence Detected Doublet Structure in the Integer and Fractional Quantum Hall Regime
Perry, C.H. Munteanu, F.M. Rickel, D.G. Kim, Y. Simmons, J.A. Reno, J.	Northeastern U. NHMFL/LANL NHMFL/LANL NHMFL/LANL Sandia Natl. Lab Sandia Natl. Lab	NSF	Photoluminescence Detected Enhancement of the Electron-Hole Exchange Interaction in a Quantum Well
Prokes, K. Nakotte, H. Chang, S. Bennett, M. Mielke, C.H.	Hahn-Meitner Inst. New Mexico State U. New Mexico State U. NHMFL/LANL NHMFL/LANL	Other/ Overseas	Magnetoresistance and Complex-Conductivity Studies of Small Intermetallic Uranium-Based Single Crystals in Pulsed Magnetic Fields
Prokes, K. Nakotte, H. Chang, S. Torikachvili, M. Lacerda, A.	Hahn-Meitner Inst. New Mexico State U. New Mexico State U. San Diego State U. NHMFL/LANL	Other/ Overseas	Magnetoresistance of Single-Crystalline UIrGe in High Magnetic Fields
Sarrao, J.L. Jaime, M. Movshovich, R.	LANL LANL LANL	IHRP/LANL	UCd_{11} Studied in the New 60 T Long-Pulse Magnet
Schilling, A. Fisher, R.A. Phillips, N.E. Welp, U. Kwok, W.K. Crabtree, G.W. Hundley, M.F. Lacerda, A.H.	Lawrence Berkeley LBNL LBNL Argonne Nat'l Lab Argonne Nat'l Lab Argonne Nat'l Lab LANL NHMFL/LANL	Other/ Overseas	Calorimetric Study of Flux-Lattice Melting in YBCO
Schmiedeshoff, G.M. Beyermann, W.P. Lacerda, A.H. Smith, J.L.	Occidental College U. CA Riverside NHMFL/LANL LANL	NSF	Thermal Expansion and Magnetostriction of $LuNi_2B_2C$
Sechovsky, V. Mikulina, O. Kamarád, J. Lacerda, A. Nakotte, H. Beyermann, W.	Charles U., Prague Czech Acad. Science Czech Acad. Science NHMFL/LANL New Mexico State UC Riverside	NSF	Magnetic Phase Transitions in UNiAl and UNiGe Under High Magnetic Field and Pressure

Srdanov, V.I. Trill, H. Kim, Y. Lacerda, A.	UC Santa Barbara UC Santa Barbara NHMFL NHMFL/LANL	NSF	Magnetic Properties of Small Iron Clusters in Sodalite
Wosnitza, J. Harrison, N. Qualls, J.S. Brooks, J.S. Schleuter, J. Kini, A.M. Geiser, U. Winter, R.W. Gard, G.L.	U. Karlsruhe NHMFL/LANL NHMFL/FSU, Physics NHMFL/FSU, Physics Argonne (ANL) ANL ANL Portland State U. Portland State U.	Other/ Overseas	Fermiology of the Organic Superconductor β"-(BEDT-TTF)$_2$SF$_5$CH$_2$CF$_2$SO$_3$
Wosnitza, J. Harrison, N. Qualls, J.S. Brooks, J.S. Balthes, E. Schweitzer, D.	U. Karlsruhe NHMFL/LANL NHMFL/FSU, Physics NHMFL/FSU, Physics U. Stuttgart U. Stuttgart	Other/ Overseas	Quasi-Two-Dimensional Spin-Split Fermi-Liquid Behavior of κ-(BEDT-TTF)$_2$I$_3$

NHMFL – NMR Facility

Users	Institution	Funding	Project
Alamo, R. G.	FAMU-FSU CoE	Other	Solid State NMR Studies in Polypropylenes
Angerhofer, A. Parrish, S.	NHMFL/UF UF, Chemistry	UF	ENDOR on Short-Lived Carotenoid Triplet States of the Outer Antenna Complex PCP of Dinoflagellates
Ben, R.N. Eniade, A. Hauer, L.	SUNY Binghamton SUNY Binghamton SUNY Binghamton	Other	Synthesis of Structurally Diverse C-Linked AFGP Mimics
Blackband, S.J.	NHMFL/UF/UFBI	IHRR-NIH	MR Studies of the Brain
Blackband, S.J. Grant, S. Webb, A. Gibbs, S. Plant, D. Mareci, T.	NHMFL/UF/UFBI U. of Chicago U. of Illinois NHMFL/FSU CoE UF/UFBI NHMFL/UF/UFBI	IHRP-UF	NMR Microscopy and Spectroscopy of Single Cells
Blackband, S.J. Bui, J.D. Buckley, D.L. Forder, J.R.F. Phillips, M.I.	NHMFL/UF/UFBI UF, Physiology UFBI, Neuroscience U. of Alabama UFBI, Physiology	NIH	NMR Microscopy of Isolated Perfused Brain and Heart Slices
Blackband, S.J. Constantinidis, I. Grant, S.C. Stabler, R.C.C. Long, Jr.	NHMFL/UF/UFBI Emory U. U. of Chicago Emory U. Emory U.	NIH	MR Microimaging Studies of Alginate Beads for Cell Encapsulation
Blackband, S.J. Kim, H.W. Buckley, D.L. Peterson, D. Duensing, R. Narayan, P.	NHMFL/UF/UFBI UF/UFBI UF/UFBI UF/UFBI UF/UFBI UF/Neuroscience	NIH	Development of Prostate MRI/S Using Transcieve Coils at 3 T
Blackband, S.J. Beck, B. Brooker, R. Fitzsimmons, J. Duensing, R. Peterson, D.	NHMFL/UF/UFBI UF/UFBI U. of South Florida UFBI, Radiology UFBI, Radiology UFBI, Radiology	NHMFL-UFBI	Development of Large Volume High Frequency RF Coils
Blackband, S.J. Bowtell, R. Crozier, S. Beck, B.	NHMFL/UF/UFBI U. of Nottingham U. of Queensland UF/UFBI	NIH-UFBI	Development of Novel Multi-Layer Transverse Gradient Coils

Bowers, C.R. Storhaug, V. Webster, E. Bharatam, J. Cottone, A. Gianna, R. Gaffney, B.J.	NHMFL/UF UF, Chemistry UF, Chemistry UF, Chemistry UF, Chemistry UF, Chemistry FSU, Biology	IHRP	Hyperpolarized Xenon-129 NMR Studies of Xenon-Protein Interactions in the Solution and Lyophylized State
Bowers, C.R. Vitkalov, S.A. Simmons, J.A. Reno, J.L.	NHMFL/UF UF, Chemistry Sandia Labs Sandia Labs	NSF	Creation of Octupole Nuclear Spin Polarization by Optical Pumping in Strained GaAs/AlGaAs Quantum Wells
Chen, C.-J. Haik, Y. Pai, V.M.	FAMU-FSU CoE FAMU-FSU CoE FAMU-FSU CoE	Other	Magnetically-Coupled Optical-Based Noninvasive Glucose Monitoring System
Cross, T.A. Busath, D. Phillips, L.R. Cole, C. Hendershot, R.J. Cotton, M.	NHMFL/FSU Brigham Young U. BYU BYU BYU NHMFL/FSU	NIH	High Definition Structure of a Proton Wire
Cross, T.A. Nishimura, K. Kim, S.	NHMFL/FSU NHMFL NHMFL/FSU	NSF	Determination of 3D Helix Bundle Structure of Influenza Virus M2-TMP Based on Solid State NMR Distance Measurement
Cross, T.A. Tian, C. Tobler, K. Lamb, R.	NHMFL/FSU FSU/Biophysics Northwestern U. Northwestern U.	NSF	Initial Structural Characterization of the Intact M2 H+ Channel Protein
Cross, T.A. Tian, C. Mo, Y. Wang, J. Miller, C.	NHMFL/FSU FSU, Biophysics FSU, Chemistry FSU, Biophysics Brandeis U.	NIH	Uniform Alignment of the *Streptomyces* K^+ Channel
Cross, T.A. Fu, R. Cotten, M.	NHMFL/FSU NHMFL NHMFL/FSU	NIH	Inter- and Intramolecular Distance Measurements by Solid State MAS NMR: Determination of Gramicidin A Channel Dimer Structures in Hydrated Phospholipid Bilayers
Cross, T.A. Kim, S. Kovacs, F. Quine, J.	NHMFL/FSU FSU, Biophysics FSU, Biophysics FSU, Mathematics	NSF	Complete Cross-Validation and R-Factor Calculation of Solid-State NMR Derived Structures
Cross, T.A. Wang, J. Grage, S. Ulrich, A. Fu, R.	NHMFL/FSU FSU, Biophysics U. of Jena, Germany U. of Jena, Germany NHMFL	NSF	Development of Orientational Constraints from ^{19}F Labeled Peptides

Cross, T.A. Wang, J. Denny, J. Tian, C. Kim, S. Mo, Y. Kovacs, F. Song, Z. Nishimura, K. Gan, Z. Fu, R. Quine, J.R.	NHMFL/FSU FSU, Biophysics FSU, Mathematics FSU/Biophysics FSU, Biophysics FSU, Chemistry FSU, Biophysics NHMFL NHMFL NHMFL NHMFL FSU, Mathematics	NSF	Imaging Membrane Protein Helical Wheels
Cross, T.A. Wang, J. Kovacs, F. Kim, S. Mo, Y. Song, Z.	NHMFL/FSU FSU, Biophysics FSU, Biophysics FSU, Biophysics FSU, Chemistry NHMFL	NSF	Structural Determination of the M2 Transmembrane Peptide (TMP) H+ Channel from Influenza A Virus
Cross, T.A. Kaback, H.R. Gao, F. Fu, R. Wang, J.	NHMFL/FSU UCLA/HHMI UCLA/HHMI NHMFL NHMFL	NHMFL	Membrane Protein Structure as Determined by Use of ^{19}F Solid State NMR Spectroscopy
Dalal, N.S. Giese, M.W. Pierce, K.L. Fu, R. Gan, Z.	FSU, Chemistry FSU, Chemistry FSU, Chemistry NHMFL NHMFL	IHRP	^{17}O High Resolution Solid State NMR Measurements on Ferro-electrics at Fields up to 25 T
Dalal, N.S. Fu, R.	FSU, Chemistry NHMFL	IHRP	^{31}P Isotropic Chemical Shift as a Probe of the Ferroelectric Transition in Ferroelectric RbH_2Po_4 and their Analogs
Dupont, J. Kehayias, J.J. Murali, N.	FSU, Nutrition Tufts U. NHMFL	FSU	Determination of Total Body Water in Humans by Deuterium NMR Spectroscopy
Edison, A.S. Bubb, M.R. Lenox, R.H.	UF, Biochemistry UF, Medicine U. of Pennsylvania	UF, College of Medicine (COM)	Biophysical Studies of MARCKS: Implications for Neuroplasticity
Dunn, B. Green, T. Edison, A.S. Kay, J. Wlodawer, A.	UF, Biochemistry UF, Biochemistry UF, Biochemistry Cardiff U. Natl. Cancer Inst.	UF, COM	Structural and Dynamical Studies of IA-3: A Potent Yeast Proteinase A Inhibitor
Hillman, J. Smith, L. Edison, A.S. Novak, J.	UF, Oral Biology UF, Neuroscience UF, Biochemistry U of Alabama	NIH	Structural Studies of Mutacin 1140
Edison, A.S. Zachariah, C. Thomas, S. Espinoza, E.	UF, Biochemistry UF, Biochemistry UF, Biochemistry UF, Biochemistry	NSF	Structure/Function Relations of Neuropeptides and Neuropeptide Precursor Proteins

Fajer, P. Adhikari, B. Li, H. Sale, K. Palm, T. Somerset, J. Brown, L. Hambly, B.	NHMFL/FSU NHMFL/FSU NHMFL NHMFL/FSU NHMFL NHMFL U. of Sydney U. of Sydney	NSF	EPR and Fluorescence Studies of Myosin Head Structure and Dynamics
Fitzsimmons, J. Duensing, R, Peterson, D. Beck, B.	UFBI, Radiology UFBI, Radiology UFBI, Radiology NHMFL/UFBI	NHMFL/UFBI	Development of High Frequency Phased Array Rf Coils
Fu, R.	NHMFL	NHMFL	Homonuclear Dipolar Recoupling Under Fast MAS by Simultaneous Frequency and Amplitude Modulation
Fu, R. Ma, Z.R. Zheng, J.P.	NHMFL NHMFL FAMU-FSU CoE	FSU Award	NMR Study of Proton Storage and Transfer Mechanisms in Amorphous Ruthenium Oxide
Gan, Z.	NHMFL	NHMFL	High Resolution NMR of Half-Integer Quadrupolar Nuclei Using Satellite Transitions and Magic-Angle Spinning (STMAS)
Gibbs, S. J. Locke, B.R. Moerland, T.S. Caban, J. McFadden, L.	FAMU-FSU, CoE FAMU-FSU, CoE FSU, Biology FSU, Biology FSU, Biology	Whitaker Foundation	Analysis of Transdermal Drug Delivery via Electroporation and Iontophoresis Using Pulsed Field Gradient NMR
Gibbs, S.J. Park, J. Pavlovskaya, G.E.	FAMU-FSU, CoE FAMU-FSU, CoE FAMU-FSU, CoE	IHRP	Magnetic Resonance Imaging of Non-Uniform Flow in Porous Media
Gibbs, S.J. Raghavan, K.	FAMU-FSU, CoE FAMU-FSU, CoE	FAMU-FSU NHMFL	Rapid Computational Techniques for Estimating Velocity and Apparent Diffusion from PFG NMR Data
Greenbaum, N.L. Newby, M.I.	NHMFL/FSU NHMFL/FSU	Other	Structural Features of the Eukaryotic U2snRNA-Intron Branch Site Pairing
Greenbaum, N.L. Yeager, S.J.	NHMFL/FSU NHMFL/FSU	Other	Role of a 5' Methylguanosine Cap in the Structure of a Spliced Leader RNA
Locke, B.R. Moerland, T.S. Gibbs, S.J. Acton, M.	FAMU-FSU, CoE FSU, Biology FAMU-FSU, CoE FAMU-FSU, CoE	NASA	Analysis of Electrophoretic Transport of Macromolecules Using Pulsed Field Gradient NMR
Logan, T.M. Twigg, P.D. Wylie, G.P. Caspar, D.L.D. Murphy, J.R.	NHMFL/FSU FSU, Biophysics FSU, Chemistry FSU, Biophysics Boston U.	NIH-NSF	Structural Studies of Monomeric Forms of the Diphtheria Toxin Repressor in Solution

Logan, T.M. Wang, G.-S. Wylie, G.P. Twigg, P.D. Caspar, D.L.D. Murphy, J.R.	NHMFL/FSU FSU, Biophysics FSU, Chemistry FSU, Biophysics FSU, Biophysics Boston U.	NIH-NSF	Structure and Possible Function of the C-Terminal Domain of the Diphtheria Toxin Repressor
Logan, T.M. Callihan, D.E.	NHMFL/FSU FSU, Chemistry	NIH-NSF	Conformations of Peptide Fragments from FKBP: Comparison with the Native and Urea-Unfolded States
Logan, T.M. Callihan, D.E. King, T.D.	NHMFL/FSU FSU, Chemistry FSU, Chemistry	NIH-NSF	Structural Characterization of Long Fragments of the FK505 Binding Protein as Models of Early Events in Protein Folding
Logan, T.M. Murali, N. Wang, G.S. Jolivet, C.	NHMFL/FSU NHMFL FSU, Biophysics FSU, Chemistry	NIH-NSF	Application of a High-Resolution Superconducting NMR Probe in Natural Product Structure Determination
Logan, T.M. Webb, A. Subramanian, R. Gor'kov, L. Brey, W.	NHMFL/FSU U. of Illinois U. of Illinois NHMFL NHMFL	IHRP	Developing Nano-Liter Probes for High Resolution Biomolecular NMR in Ultra High Field NMR Magnets with Low Homogeneity
Logan, T.M. Wylie, G.P. Mertz, L. Murphy, J.R.	NHMFL/FSU FSU, Chemistry FSU, Chemistry Boston U.	NIH-NSF	Peptide Binding by a Prokaryotic SH3-Like Domain from the Diphtheria Toxin Repressor Protein
Mareci, T.H. Silver, X. Inglis, B.A. Wirth, E.D. Anderson, D.K. Bossart, E.L. Reier, P.J.	NHMFL/UF/UFBI UF, Biochemistry UF/UFBI UF/UFBI UF, Neuroscience UF, Physics UF/UFBI	NIH	NMR Studies of *In Vitro* and *In Vivo* Spinal Cords
Massiot, D.	CRMHT-CNRS	CNRS	Solid State NMR Study of Highly Coupled Quadrupolar Nuclei at Very High Magnetic Field
Moerland, T.S. Vanderlinde, O.H. Carbone, F.A.	FSU, Biology FSU, Biology FSU, Biology	NSF	Intracellular Mobility of Solute Compounds in Striated Muscle
Quine, J.R. Denny, J.K.	FSU, Mathematics FSU, Mathematics	NSF	Helix Bundles and Coiled Proteins
Randall, E.W. Smith, S.A. Kinchesh, P.	U. of London NHMFL U. of London	U. of London	GAMMA Calculations in Large Stray Field Gradients
Samoson, A. Bull, L.M.	Natl. Inst., Estonia Inst. Jean Rouxel	NSF	High Resolution ^{17}O NMR Study of Zeolites
Samoson, A. Kolodziejski, W. Kaflak-Hachulska, A.	Natl. Inst., Estonia U. of Warsaw U. of Warsaw	NSF	Proton MAS NMR Studies of Human Bone and Bone Components

Samoson, A. Du, L.-S. Grey, C.P.	Natl. Inst., Estonia SUNY-Stony Brook SUNY-Stony Brook	NSF	NMR Studies of Fluoride-Ion Mobility and Oxygen/Fluorine Ordering in Fluorides and Oxyfluorides
Samoson, A. Fu, R. Gan, Z. Dalal, N.S. Cross, T.A.	Natl. Inst., Estonia NHMFL NHMFL FSU, Chemistry NHMFL/FSU	NSF	Solid State NMR Applications at Very High Fields: Preliminary Spectra at the 833 MHz
Samoson, A. Gan, Z.	Natl. Inst., Estonia NHMFL	NSF	High-Field Resolution Enhancement in ^{1}H MAS NMR
Smith, J.C. Houpt, T.A. Snyder, D. Jahng, J.W.	FSU, Psychology FSU, Biology FSU, Neuroscience Yonsei College, Korea	FSU	Behavioral and Neural Effects of Static High Magnetic Fields
Smith, S.A.	NHMFL	NHMFL	GAMMA: The Magnetic Resonance Simulation Package
Stiegman, A.E.	FSU, Chemistry	FSU	High Field Solid-State NMR of Titanium/Silica Low-Thermal-Expansion Glass and Titania Silicalite Catalysts
Van Doren, S. R. Gao, G.	U. of Missouri U. of Missouri	Other	NMR Studies of Backbone Motions of Proteins That Affect Cancer Progression

NHMFL – EMR Facility

User	Institution	Funding	Project
Brunel, L.-C. Wang, Q. Scheer, H. Bratt, P.J. Maniero, A.-L. Bubenzer-Hange, C. Angerhofer, A.	NHMFL UF, Chemistry U. München UF, Chemistry NHMFL U. München UF, Chemistry	NSF	A Combined High Field and Pulsed EPR Study of the Primary Donor in Rhodobacter sphaeroides
Brunel, L.-C. Redding, K.E. Boudreaux, B.G. MacMillan, F. Maniero, A.-L.	NHMFL U. of Alabama U. of Alabama Goethe U., Germany NHMFL	NSF	The Primary Electron Donor of Photosystem I: A High-Field EPR Analysis of Mutants with Altered Axial Ligands
Brunel, L.-C. Van Tol, J.	NHMFL NHMFL	NSF	Transient EPR at 240 GHz in Ruby
Brunel, L.-C. Budil, D.E. Krzystek, J. Saylor, C.A. Sienkiewicz, A. Smith, G.M. Van Tol, J. Wylde, R.	NHMFL Northeastern U. NHMFL NHMFL Polish Academy Science St. Andrews U. NHMFL Thomas Keating Ltd.	IHRP	Multifrequency Quasi-Optical EMR Spectrometer at NHMFL
Brustolon, M. Maniero, A.-L. Zoleo, A.	U. of Padova NHMFL U. of Padova	CNR	High Field EPR of Fullerene Adducts Radical Anions
Cheong, S.-W. Saylor, C.A. Van Tol, H. Brunel, L.-C.	Rutgers U. NHMFL NHMFL NHMFL	Other	High Field EPR Signal for Short Chains in Non-Magnetically Doped Y_2BaNiO_5
Dalal, N.S. Cage, B. Weekley, A. Brunel, L.-C.	FSU, Chemistry FSU, Chemistry FSU, Chemistry NHMFL	NHMFL	K_3CrO_8 In K_3NbO_8 as a Proposed Standard for G-Factor, Spin Concentration, and Field Calibration in High Field EPR Spectroscopy
Fajer, P. Sale, K. Sár, C. Jek, J. Hideg, K. Sienkiewicz, A.	NHMFL/FSU FSU, Biology U. of Pecs U. of Pecs U. of Pecs Natl. Academy Sciences	NSF	Technique Development in EPR Spectroscopy
Hendrickson, D.N. Krzystek, J. Telser, J. Knapp, M.J. Brunel, L.-C.	UC San Diego NHMFL Roosevelt U. UC Berkeley NHMFL	NSF	High Frequency and High Field EPR Spectroscopy of Manganese(III) Porphyrins and Me_2dbm Complexes: Influence of Axial Ligand on Electronic Structure
Hendrickson, D.N. Nakano, M. Yoo, J. Krzystek, J.	UC San Diego UC San Diego UC San Diego NHMFL	NSF	High Frequency EPR Spectroscopy of Neutral and One-Electron Reduced Dodecanuclear Manganese Complexes

Maniero, A.-L.	NHMFL		
Christou, G.	Indiana U.		
Hendrickson, D.N.	UC San Diego	NIH	High Frequency EPR Spectroscopy of Polynuclear Transition Metal Complexes
Nakano, M.	UC San Diego		
Yoo, J.	UC San Diego		
Krzystek, J.	NHMFL		
Maniero, A.-L.	NHMFL		
Christou, G.	Indiana U.		
Kamenev, K.	U. of Edinburg	European Community	FIR Manifestation of the Metal-Insulator Phase Transition in $Nd_{0.5}Sr_{0.5}MnO_3$
Zvyagin, S.	NHMFL		
Wany, Y.-J.	NHMFL		
Brunel, L.-C.	NHMFL		
Kispert, L.D.	U. of Alabama	NSF	330 to 670 GHz EPR Studies of Canthaxanthin Radical Cation Stabilized on a Silica-Alumina Surface
Konovalova, T.A.	U. of Alabama		
Krzystek, J.	NHMFL		
Bratt, P.J.	UF, Chemistry		
Van Tol, J.	NHMFL		
Brunel, L.-C.	NHMFL		
Lüthi, B.	U. of Frankfurt	U. of Frankfurt	Collapse of the Charge-Ordered State in $Nd_{0.5}Sr_{0.5}MnO_3$: Microwave Evidences
Zvyagin, S.	NHMFL		
Saylor, C.	NHMFL		
Brunel, L.-C.	NHMFL		
Kamenev, K.	U. of Edinburg		
Maniero, A.L.	NHMFL	NHMFL	High Frequency EPR Spectra of Nitroxides in Single Crystal: The Role of "Forbidden" Transitions
Brunel, L.-C.	NHMFL		
Brustolon, M.	U. of Padova		
Segre, U.	U. of Modena		
Pasimeni, L.	U. of Padova	Italian Dept. Tech.	High Field EPR Study of Salts of TDAE with Fullerene Derivatives
Maniero, A.-L.	NHMFL		
Brunel, L.-C.	NHMFL		
Redding, K.E.	U. of Alabama	DoE	The Primary Electron Donor of Photosystem I: A High-Field EPR Analysis of Mutants with Altered Axial Ligands
Boudreaux, B.G.	U. of Alabama		
MacMillan, F.	Goethe U.		
Maniero, A.-L.	NHMFL		
Brunel, L.-C.	NHMFL		
Smirnova, T.I.	U. of Illinois	NIH	Electronic Relaxation of NMR Gd(III) Contrast Agents at High Magnetic Fields
Smirnov, A.I.	U. of Illinois		
Belford, R.L.	U. of Illinois		
Clarkson, R.B.	U. of Illlinois		
Van Tol, J.	NHMFL		
Tagirov, M.S.	Kazan State U.	Kazan State U.	High Field EPR Measurements on Tm^{3+} Ions
Tayurskii, D.A.	Kazan State U.		
Van Tol, J.	NHMFL		
Brunel, L.-C.	NHMFL		
Telser, J.	Roosevelt U.	Roosevelt U.	Elucidation of the Electronic Structure of Manganese(III) Corrole Complexes
Krzystek, J.	NHMFL		
Hoffman, B.M.	Northwestern U.		
Licoccia, S.	U. of Rome		
Telser, J.	Roosevelt U.	Roosevelt U.	EPR from "EPR-Silent" Species: HF and HF EPR Spectroscopy of a Vanadium(III) Molecular Complex
Krzystek, J.	NHMFL		
Van Tol, J.	NHMFL		

NHMFL – ICR Facility

User	Institution	Funding	Project
Leary, J.A. Andersen, U.N. König, S. Freitas, M.A. Marshall, A.G.	UC Berkeley UC Berkeley UC Berkeley NHMFL NHMFL/FSU	NSF	Characterization of a Single Crystal Cubic Prussian Blue $CO_8(tacn)_8(CN)_{12}$ Cluster by Ion Trap and FT-ICR MS with Microelectrospray Ionization
Marshall, A.G. Freitas, M.A. Hendrickson, C.L. Emmett, M.R.	NHMFL/FSU NHMFL NHMFL NHMFL	NIH, NSF	Gas-Phase Bovine Ubiquitin Cation Charge State Conformations Resolved by Gas-Phase Hydrogen/Deuterium Exchange Rate and Extent
Marshall, A.G. Li, W. Hendrickson, C.L. Emmett, M.R.	NHMFL/FSU FSU, Chemistry NHMFL NHMFL	NIH	Identification of Intact Proteins in Mixtures by Alternated Capillary Liquid Chromatography Electrospray Ionization and LC-ESI Infrared Multiphoton Dissociation FT-ICR MS
Marshall, A.G. Shi, S.D.-H. Hendrickson, C.L. Siegel, M.M. Kong, F. Carter, G.T.	NHMFL/FSU FSU, Chemistry NHMFL Wyeth-Ayerst Research Wyeth-Ayerst Research Wyeth-Ayerst Research	NSF, Wyeth-Ayerst	Structural Validation of Saccharomicins by High-Resolution and High Mass Accuracy FT-ICR MS and Infrared Multiphoton Dissociation MS/MS
Marshall, A.G. Freitas, M.A. Hendrickson, C.L.	NHMFL/FSU NHMFL NHMFL	NIH, NSF	Gas Phase Activation Energy for Unimolecular Dissociation of Biomolecular Ions Determined by Focused Radiation for Gaseous Multiphoton Energy Transfer (FRAGMENT)
Marshall, A.G. Rodgers, R.P. Blumer, E.N. Freitas, M.A.	NHMFL/FSU FSU, Chemistry FSU, Chemistry NHMFL	NSF	Jet Fuel Chemical Composition, Weathering, and Identification as a Contaminant at a Remediation Site, Determined by FT-ICR MS
Marshall, A.G. Drader, J.J. Shi, S.D.-H. Hendrickson, C.L. Blakney, G.T. Laude, D.A.	NHMFL/FSU NHMFL FSU, Chemistry NHMFL U. of Texas U. of Texas	NSF	Digital Quadrature Heterodyne Detection for High Resolution FT-ICR MS
Marshall, A. G. Vining, B.A. Bossio, R.E.	NHMFL/FSU FSU, Chemistry FSU, Chemistry	NSF	Phase Correction for Collision Model Analysis and Enhanced Resolving Power of FT-ICR MS

NHMFL – Geochemistry Facility

User	Institution	Funding	Project
Salters, V.J.M. Bennett, L. Cooper, W.	NHMFL/FSU NHMFL/FSU NHMFL/FSU	S. FL Water Management Dist.	Analysis of Organic Phosphorus in Surface Waters from the Florida Everglades by Capillary Electrophoresis and High Performance Liquid Chromatography Coupled to Inductively Coupled Plasma Mass Spectrometry
Salters, V.J.M. Bizimis, M.	NHMFL/FSU NHMFL	NSF	Hf, Nd and Sr Isotope Compositions of Carbonatites
Zindler, A. Bourdon, B. Wörner, G.	NHMFL/FSU IPGP-CNRS Univ. Göttingen	NSF	U-Th Evidence for Crustal Involvement in the Petrogenesis of Nevados de Payachata, Chile
Odom, A.L. Xie, J.	NHMFL/FSU NHMFL/FSU	NSF, Canadian Atomic Energy Commission	Dosimetric Properties of Aluminum Hole Centers in Quartz: Implications for the Nature of Giant Radiation-Induced Color Haloes
Odom, A.L. Platero, A. Sachi-Kocher, A.	NHMFL/FSU San Juan Comm Coll. NHMFL	Other	Near Kilometer Scale Strontium Isotopic Homogenization in Meta-Granites, North-Central New Mexico
Salters, V.J.M. Longhi, J.	NHMFL/FSU Columbia Univ.	NSF	Parametrization of Trace Element Partitioning on the Mantle Solidus
Salters, V.J.M. Sonke, J.E.	NHMFL/FSU NHMFL	NSF	Rare-Earth-Element and Trace-Element Trends in the Everglades as Tracers for Sedimentary Processes
Wang, Y. Hsieh, Y.P. Landing, W.M. Choi, Y. Salters, V.J.M. Cooper, W. Proctor, L.	NHMFL/FSU FAMU FSU, Oceanography NHMFL/FSU NHMFL/FSU NHMFL/FSU NHMFL/FSU	S. FL Water Management Dist.	Distribution and Carbon Isotopic Composition of Dissolved Organic Matter in Florida Everglades
Wang, Y. Amundson, R. Niu, X-F.	NHMFL/FSU UC-Berkeley FSU, Statistics	DOE	Radiocarbon Isotopic Variations in Soil CO_2 Flux
Zindler, A. Zou, H.	NHMFL/FSU UC- Los Angeles	NSF	Major, Trace Element, and Nd-Sr-Pb Isotope Studies of Cenozoic Basalts in SE China: Mantle Sources, Regional Variations, and Tectonic Significance
Zindler, A. Zou, H.	NHMFL/FSU UC- Los Angeles	Other/FSU	Theoretical Studies of ^{238}U-Th-^{226}Ra and ^{235}U-^{231}Pa Disequilibria in Young Lavas Produced by Mantle Melting