



DMR Support for National User Facilities and Major Instrumentation Projects

Solid State Sciences Committee
The National Academies, Washington, DC
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W. Lance Haworth
Acting Director, Division of Materials Research



The National Facilities Program in DMR

- NAF program supports unique experimental capabilities for materials research and a wide range of other disciplines
 - USER FACILITIES for the research and education communities
 - Specialized high-cost, state-of-the-art instruments
 - Resources and research experience for students
 - Student and teacher education, general public awareness, curriculum development materials, educational outreach
- NSF normally supports construction and operation costs
- Facilities are open to researchers at US and international academic institutions, government and industry based on competitive proposals



DMR National Facilities

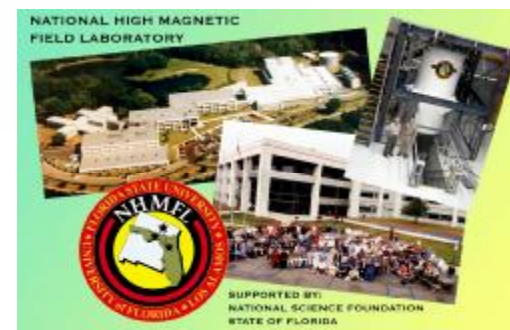
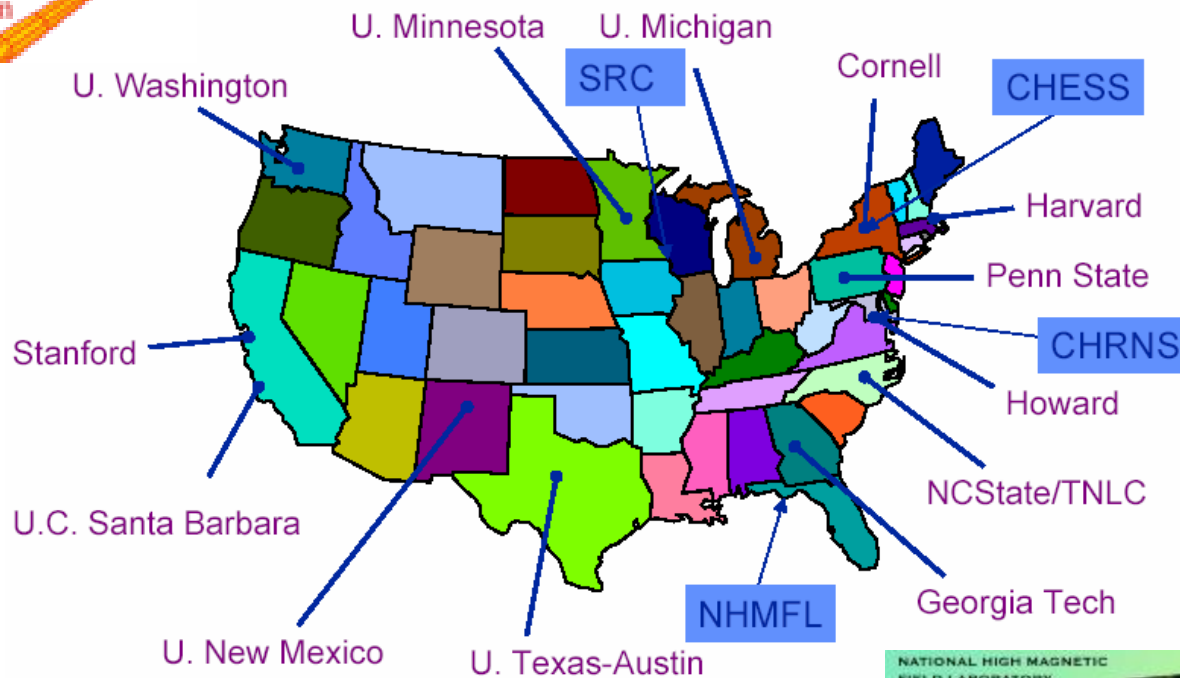
- National High Magnetic Field Laboratory
 - Florida State University, University of Florida, Los Alamos NL
 - Partnership between NSF and the State of Florida
- Neutron Facility
 - CHRNS at the National Center for Neutron Science, NIST
- Synchrotron Facilities
 - CHESS at Cornell University (NSF-PHY supports CESR)
 - SRC at the University of Wisconsin
 - *CHEM/MAT/CARS beamline at APS (NSF-CHE lead)*
- Nanotechnology Facilities
 - National Nanotechnology Infrastructure Network
 - 13 Universities
 - **NSF-ENG lead**, plus DMR, CHE, BIO co-funding



DMR NATIONAL FACILITIES

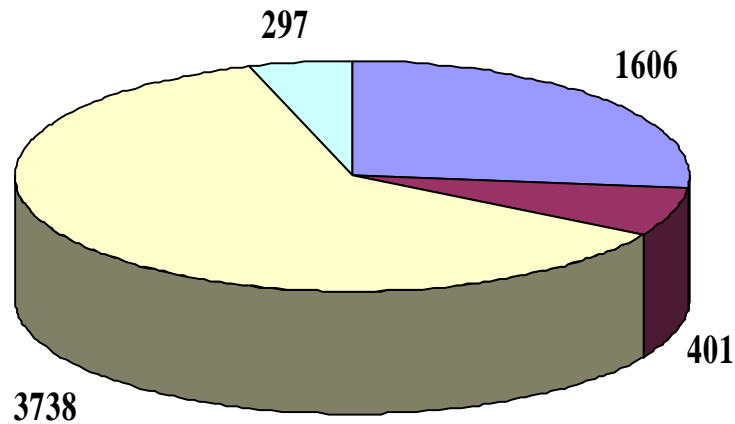


National Facilities & NNIN Sites

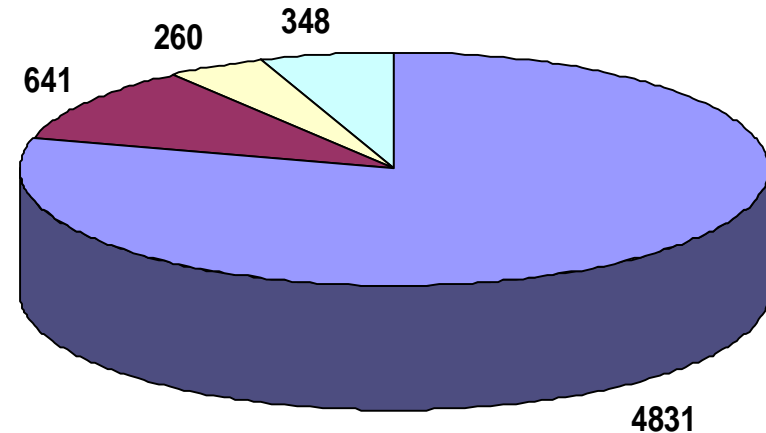




Researchers Using DMR Facilities



- Faculty and senior researchers
- Postdocs
- Graduate students:
- undergraduates



- US colleges and Institutions University
- Industry
- Government Organizations
- Foreign Institutions

Center for High Resolution Neutron Scattering
Cornell High Energy Synchrotron Source
National High Magnetic Field Laboratory
Synchrotron Research Center
National Nanofabrication Infrastructure Network*



National High Magnetic Field Laboratory

<http://www.magnet.fsu.edu/>



- Established 1991, renewed 1996 and 2001, extended 2006
- Continuous-field and pulsed magnets, high B/T, magnetic resonance facilities
- ~900 users annually
- Major magnet development projects include 45T, 900MHz wide-bore NMR, 60T long pulse, 100 T Pulse (with DOE)
- Current Award (\$26M/year) ends December 2007
- **COMMUNITY GUIDANCE and FUTURE PLANS**
 - **NAS COHMAG Report 2005 'Opportunities in High Magnetic Field Science'**
 - **NSF Panel on Future Support for High Magnetic Fields 2005**
 - Richardson, Maple, Moore, Sarachik, Greene, Evans-Lutterodt, Tycko
 - Recommended renewal review rather than recompetition
 - **DMR plans renewal review during FY 2007**



Two University-based Synchrotron Facilities

<http://www.chess.cornell.edu/>

<http://www.src.wisc.edu/>

- **Unique Characteristics**

- Education & training of accelerator physicists and synchrotron scientists
- Long beam times allocated for difficult and time-consuming experiments

- **CHESS - based on the the Cornell Electron Storage Ring**

- Hard x-rays, 4-100keV. ~500 users annually (~300 from bio)
- Research in CMP, surface science, chemistry, biology, environmental sciences, materials
- MacCHESS, NIH Research Resource for protein crystallography (including hazardous viruses)
- DMR support since 1979, 5 year renewal FY 2003. BIO, NIH co-fund



- **SRC – Stoughton, WI**

- Soft x-rays UV, 5-1000eV. >300 users annually
- Studies of valence electrons, correlated electron systems, superconductors, magnetism, nanostructures, atoms/ions/molecules
- Microanalysis of cells, tissues and minerals
- Nanolithography (EUV and x-ray) and metrology for nanocircuit fabrication
- DMR support since 1977, 3 year renewal FY 2006





Neutron Scattering Facility



Center for High Resolution Neutron Scattering

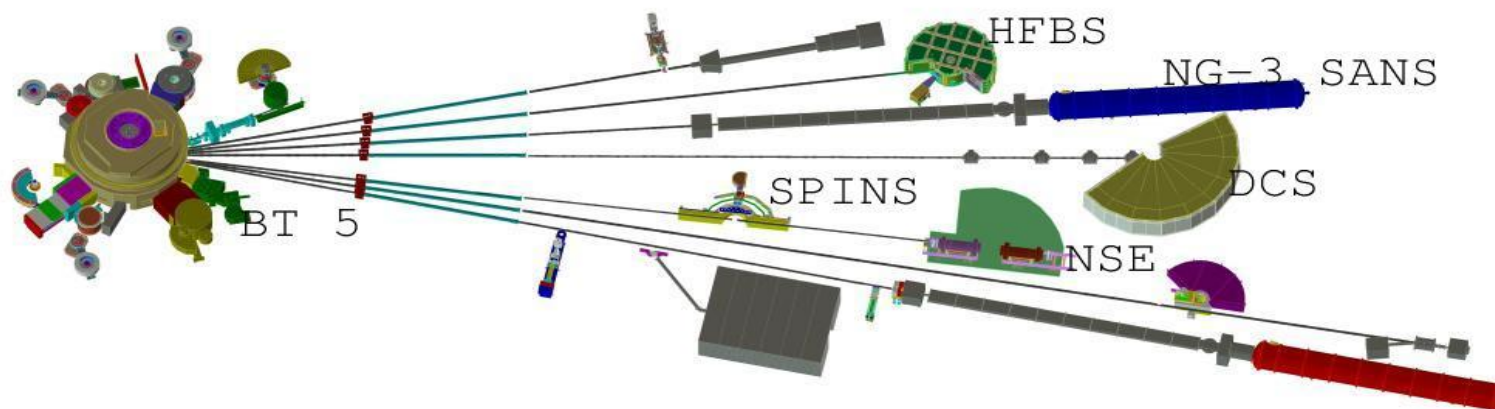
- Supported jointly by DMR and NIST (NCNR)
 - Length scales from 1nm to over 1micron
 - Time scales from 10fs to 100ns
 - Projects in materials science, chemistry, biology, CMP
 - Polymers, metals, ceramics, magnetic materials, porous media, fluids and gels, biological molecules
 - Annual summer school for graduate students, postdocs, other potential users
 - DMR support since 1989, over 450 users annually



Center for High Resolution Neutron Scattering

<http://www.ncnr.nist.gov/programs/CHRNS/>

CHRNS INSTRUMENTS



- a 30 meter, high resolution, small-angle neutron scattering instrument (NG3)
- a diffractometer for ultra-high-resolution small angle scattering (USANS)
- cold-neutron, triple-axis, neutron scattering spectrometer (SPINS)
- a very flexible cold-neutron time-of-flight spectrometer (DCS)
- a backscattering spectrometer with 1 microeV resolution (HFBS)
- a neutron spin echo spectrometer (NSE)



National Nanotechnology Infrastructure Network

established 2004

www.nnin.org/



An national network partnership of user facilities for nanoscale science, engineering and technology

~3500 users annually from industry, academia, and government labs

Access to tools for fabrication, synthesis, characterization, design, simulation, and integration

Projects reviewed for technical feasibility



New DMR Program began FY04 NSF 05-513 (updated)

Mid-Scale Instrumentation Projects (IMR-MIP) Instrumentation for Materials Research

- ~\$2M - \$20M per instrument
e.g. beamline instrumentation, high-field magnets, etc.
- **2 types of proposals**
 - Conceptual & Engineering Design
 - Construction
- **6 CED awards made to date**
- **FY 06 competition currently underway**

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Separate competition for IMR (Instrument Development) also planned for FY 2007



DMR MidScale Instrumentation Awards

FY 2004 and 2005

Magnets, Neutrons, Light Sources

- **CNST: Low Energy Neutron Scattering** **\$3.1M**
- **CED: Neutron Vibrational Spectrometer at SNS** **\$1.5M**
- **CED: Series Connected Hybrid Magnet** **\$1.8M**
- **CED: Free Electron Laser Light Source**
for High Magnetic Field Research **\$1.8M**
- **CED/CNST: Thermal Neutron Imaging System for SNS** **\$2.0M**
- **CED: Distributed Data Analysis**
for Neutron Scattering Experiments (DANSE) **\$1.0M**
- **CED: Phase I Energy Recovery Linac (ERL)**
– DMR, PHY, CHE, OMA **\$18.0M**
- **Additional CNST + CED awards are planned for FY 2006**



Reports and Community Guidance

- Cooperative Stewardship (NRC 1999)
- S&E Infrastructure for the 21st Century (NSB 2003)
- Advanced Research Instrumentation and Facilities (NAS 2005)
- Midsize Facilities (NRC 2006)
- Opportunities in High Magnetic Field Science (NRC 2005)
- Future Support for High Magnetic Fields (NSF 2005)
 - ('Richardson Panel')
- Interagency WG on Neutron Science (OSTP 2002)
- Interagency WG on Synchrotron Science (OSTP, summer 2006)



Support for Facilities and Instrumentation

A Specific Challenge for DMR

- Program balance and budget constraints
- Maintain support for individuals and small groups (COV)
- DMR budget changes 1995-2005 (current dollars)
 - Individuals and Small Groups Programs, ITR +39% (05 \$117M)
 - Centers, PREMs and IMIs +25% (05 \$70M)
 - **Facilities & Instrumentation +52% (05 \$47M)**
 - All Other +59% (05 \$6M)
 - **DMR total +37% (05 \$240M)**
- Support for university-based synchrotron facilities?
- Support for “Mid-Scale Instrumentation” including beamlines at national facilities?
- Role of CHRNS in context of the SNS?
- NSF support for a future ERL?
 - Formal process via the MREFC account (constr. >\$100M)
 - Director’s Office and NSB review/approval
 - (N-3) rule