NATIONAL SCIENCE FOUNDATION

Directorate for Mathematical and Physical Sciences

Directorate for Mathematical and Physical Sciences (MPS)

MPS Merit Review and Oversight Mechanisms

Proposal Review: MPS maximizes the quality of the proposals it supports through the use of a competitive, merit-based review process. In FY 2006, 80% of research funds were allocated to externally reviewed projects.

Committee of Visitors (COV): MPS convenes Committees of Visitors, composed of qualified external evaluators, to review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of the National Science Foundation's investments. COV reports and Directorate responses are at http://www.nsf.gov/od/oia/activities/cov/covs.jsp.

MPS Advisory Committee (MPSAC): MPS also receives advice from the Mathematical and Physical Sciences Advisory Committee on such issues as: the mission, programs, and goals that can best serve the scientific community; promoting quality graduate and undergraduate education in the mathematical and physical sciences; and priority investment areas in MPS-supported research. Minutes are at http://www.nsf.gov/mps/advisory.jsp.

Other Advisory Committees: MPS also participates in three advisory committees that advise multiple agencies: the High Energy Physics Advisory Panel (with the U.S. Department of Energy (DOE)); the Nuclear Science Advisory Committee (with DOE); and the Astronomy and Astrophysics Advisory Committee (with DOE and the National Aeronautics and Space Administration (NASA)). Standing committees and studies of the National Research Council provide another mechanism for obtaining advice.

MPSAC Membership as of October 2006

L. Bildsten, University of California, Santa Barbara
S. Coppersmith, Wisconsin
S. Gruner, Cornell
R. Kohn, New York University
S. Koonin, British Petroleum
E. Ostriker, Maryland
D. Oxtoby, Pomona
M. Rieke, Arizona
E. Simmons, Michigan State University
Dr. Arnold, Minnesota
C. Burrows, Utah
C. Canizares, Massachusetts Institute of Technology
L. Dalton, Washington
R. Hughes, Bryn Mawr
J. Onuchic, University of California, San Deigo
M. de la Cruz, Northwestern
M. Witherell (CHAIR), University of California, Santa Barbara
I. Johnstone, Stanford
W. Jorgensen, Yale
D. Keyes, Columbia
T. Maldonado, Texas A&M
D. McDuff, Stony Brook
I. Robertson, University of Illinois at Urbana - Champaign
W. Soboyejo, Princeton
R. Williams, Space Telescope Science Institute

MPS

Dear Reader:

This brochure has been created with the intent of informing you about the Mathematical and Physical Sciences Directorate of the National Science Foundation (NSF). We hope the material we've collected here gives you an idea of how the research we conduct serves as the foundation for advances in computers, public health, national security and economic growth.

MPS research spans the full range of spatial and time scales accessible to human investigation–distance scales ranging from the size of atoms to the structure of galaxies and of the universe itself, and timescales ranging from reactions lasting millionths of a billionth of a second to the evolution and age of the universe. We develop new mathematical structures and investigate the fundamental particles and processes of matter. We bring what we've learned in physical sciences to exploring complex biological systems, human and social dynamics, sustainable energy, and the environment. Past research in MPS has led to the Magnetic Resonance Imaging (MRI) machines you find in hospitals, the biological and chemical detectors you see in airports, and the development of alternate fuel technologies.

Research in the mathematical and physical sciences serves as the basis for much technological innovation. In the next few years, our research will support the nation's investment in innovation through the American Competitiveness Initiative and the America COMPETES Act, help improve computing power past the physical and conceptual limits of Moore's Law, and shed light on the very nature of matter, space, time and the physical laws that govern the evolution of the universe.

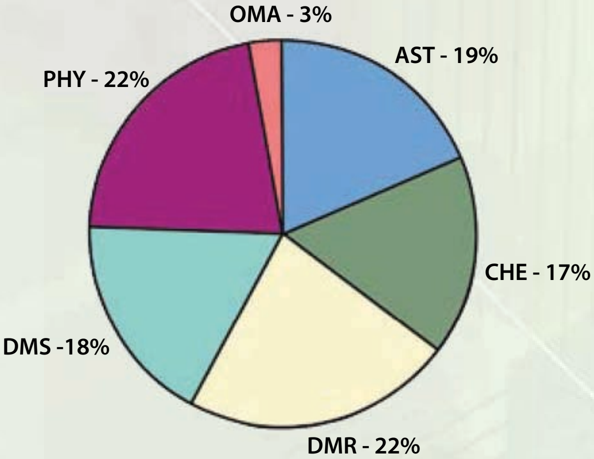
We hope this brochure will give you a flavor of the research we support at universities and laboratories throughout our country, and we invite you to learn more about us on our web site at http://www.nsf.gov/dir/index.jsp?org=MPS.

With Regards,

Tony Chan
Assistant Director
Directorate for Mathematical and Physical Sciences

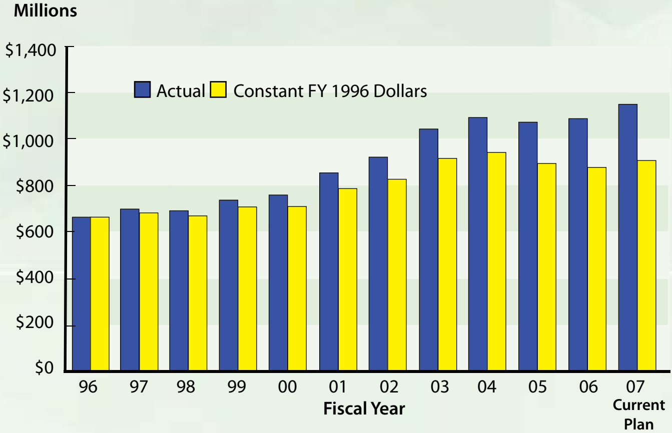
Directorate for Mathematical and Physical Sciences (MPS)

MPS Funding FY 2007 Current Plan



Pie chart showing MPS total budget for FY 2007. MPS will spend $1.15 billion in FY 2007.
Totals may not add due to rounding.

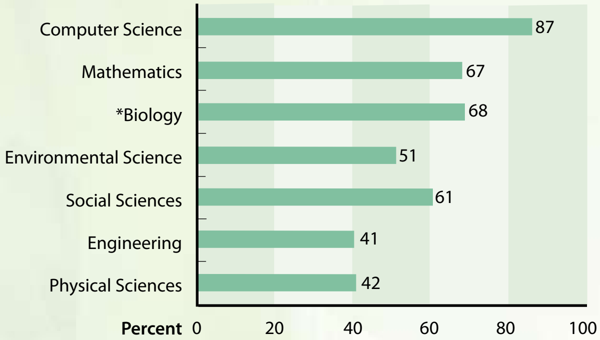
Budget in Actual and Constant FY 1996 Dollars



MPS annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the MPS budget. Over this 12-year period, the constant dollar budget for MPS has increased 38%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

NSF Support as a Percentage of Total Federal Support of Academic Basic Research



** Excludes the National Institutes of Health*

The National Science Foundation contributes significant portions of the total Federal support of many areas of academic basic research. Note that the Directorate for Mathematical and Physical Sciences includes basic research in the mathematical sciences (67% of Federal support) and in the physical sciences (42% of Federal support). Source: FY 2006 Performance Highlights, NSF-07-11.

Innovation Resulting from U.S. Federally Funded Research

Innovation	Funder
The Internet	DARPA/NSF
Web Browser	NSF
Bar Codes	NSF
Fiber Optics	NSF
Routers	NSF
MRI	NIH/NSF
Doppler Radar	NSF
Speech Recognition	NSF/DARPA
Nanotechnology	NSF
Computer Aided Design	NSF/DARPA

The basic science research supported by the U.S. government has led to numerous technical innovations that have improved the health, economy and security of the nation. This chart lists a sampling of these advances. NIH = the National Institutes of Health in the Department of Health and Human Services; DARPA = the Defense Advanced Research Projects Agency in the Department of Defense.
Source: Losing the Competitive Advantage? American Electronics Association, 2005.

Division of Astronomical Sciences (AST)

Mission

The mission of the Division of Astronomical Sciences is to support forefront research in ground-based astronomy; to help ensure the scientific excellence of the U.S. astronomical community; to provide access to world-class research facilities through merit review; to support the development of new instrumentation and next-generation facilities; and to encourage broad understanding of and diverse participation in the astronomical sciences.

The Division supports research in all areas of astronomy and astrophysics and related multidisciplinary studies. Modes of support include single-investigator and collaborative awards, as well as funding for acquisition and development of astronomical instrumentation, technology development for future ground-based facilities, and educational projects that leverage the Division's research investments to build research and workforce capacity and to increase scientific literacy.

Astronomical Facilities

The Division invested 54% of its FY 2007 appropriation in the management and operation of ground-based astronomical facilities. Through the national observatories and international partnerships, the Division provides support for a system of multi-aperture, research-class telescopes as well as frontier facilities that enable transformational capabilities in both radio and optical/infrared astronomy. Technological advances in a number of key areas of telescope construction and design–including sophisticated adaptive optics technology to compensate for the blurring effects of the Earth's atmosphere at optical/infrared wavelengths and high-resolution aperture synthesis techniques of radio astronomy–allow these instruments to operate at the forefront of ground-based capabilities.

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Credit: Gemini Observatory ALTAIR Adaptive Optics Image.

A high-resolution image taken with the Gemini Observatory shows Jupiter's two giant red spots brushing past one another in the planet's southern hemisphere. The image was obtained in near-infrared light using adaptive optics that corrects, in real-time, for most of the distortions caused by turbulence in Earth's atmosphere. The result is a view from the ground that rivals images from space.

Programs in Astronomical Sciences

Individual Investigator Programs
Astronomy and Astrophysics Research Grants (AAG)
Faculty Early Career Development Program (CAREER)
NSF Astronomy and Astrophysics Postdoctoral Fellowships (AAPF)
Partnerships in Astronomy and Astrophysics Research and Education (PAARE)
Research Experiences for Undergraduates (REU)
Research at Undergraduate Institutions (RUI)

Astronomical Instrumentation Programs
Advanced Technologies and Instrumentation (ATI)
Major Research Instrumentation (MRI)
Program for Research and Education with Small Telescopes (PREST)
University Radio Observatories (UROs)

Large Facilities
Atacama Large Millimeter Array (ALMA)
Gemini Observatory
National Astronomy and Ionosphere Center (NAIC)
National Optical Astronomy Observatory (NOAO)
National Radio Astronomy Observatory (NRAO)
National Solar Observatory (NSO)

A Guide to Programs / Browse Funding Opportunities is available at http://www.nsf.gov/funding/browse_all_funding.jsp.

Electromagnetic Spectrum Management (ESM)

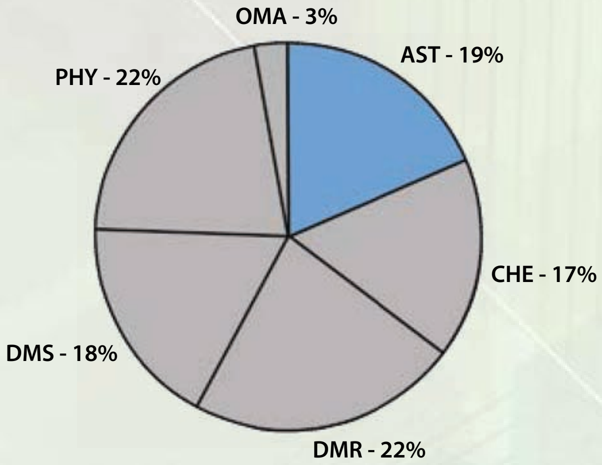
AST represents the interests of NSF and the scientific community in protecting access to portions of the electromagnetic spectrum that are needed for research purposes. The sensitivity of radio and optical telescopes can be compromised by electromagnetic interference from sources such as airborne and satellite radio transmissions and light pollution. ESM personnel protect these and other scientific resources by participating in the establishment of regulations, operating procedures and technical standards related to government, private sector and international uses of the spectrum.

The Atacama Large Millimeter Array (ALMA) is an international collaboration to develop a world-class radio telescope composed of 66 antennas that will work together to study the universe from a high and dry site in the Chilean Andes. Once construction is completed, ALMA will function as the most capable imaging radio telescope ever built.

Credit: ALMA/European Organization for Astronomical Research in the Southern Hemisphere/National Astronomical Observatory of Japan/NRAO.

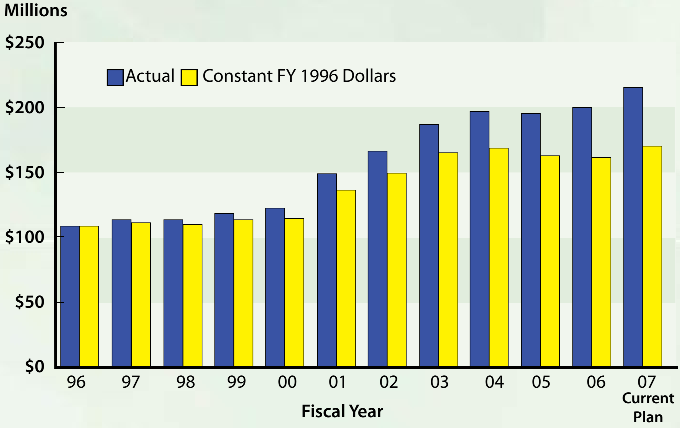
Division of Astronomical Sciences (AST)

MPS Funding FY 2007 Current Plan



Pie chart showing divisional portions of MPS total budget for FY 2007. AST will spend $215 million in FY 2007, which is 19% of the total MPS budget. *Totals may not add due to rounding.*

Budget in Actual and Constant FY 1996 Dollars

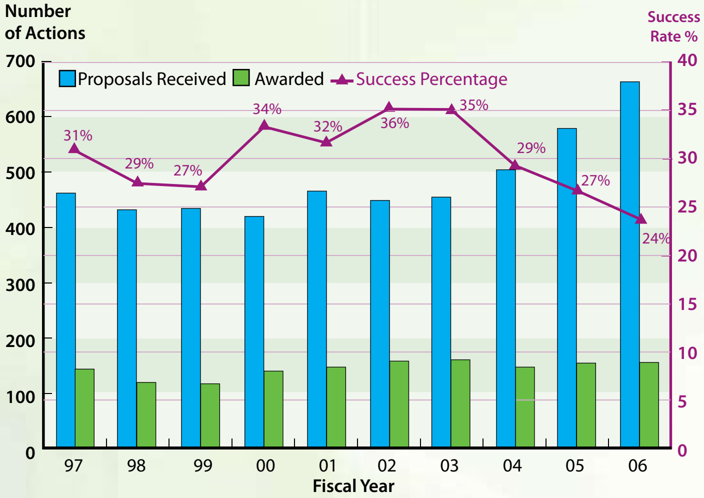


AST annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the AST budget. Over this 12-year period, the constant dollar budget for AST has increased 56%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

AST

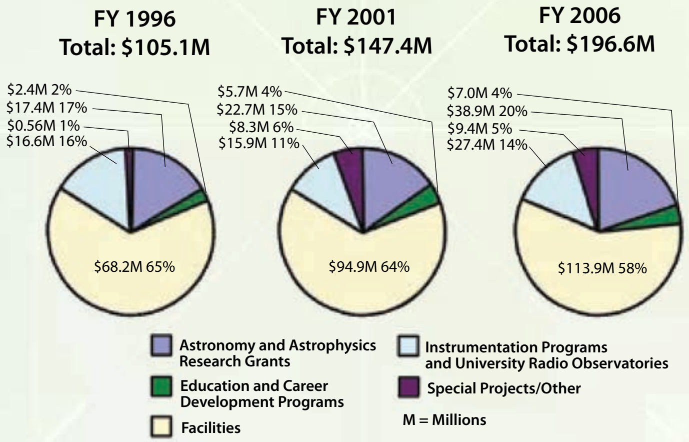
Success Rates and Number of Actions



Graph shows number of proposals submitted versus awarded for Research Grants as defined by NSF and resultant success rates. Success rate is defined as the number of new or renewal proposals awarded funding divided by the total number of proposals received. The number of proposals received by AST in 2006 was 44% higher than in 1997.

Note: the distribution of success rates reflects the average for the Astronomical Sciences Division and may not represent success rates in individual programs.

Modes of Support



Pie charts showing AST investments for FY 1996, 2001 and 2006.

Division of Chemistry (CHE)

Mission

The mission of the Division of Chemistry is to promote the health of academic chemistry and to enable basic research and education in the chemical sciences. Modes of support include single-investigator and multi-investigator awards, as well as funding for shared instrumentation, instrumentation development, and educational projects that leverage the division's research investments to build research capacity. The Division supports research in all traditional areas of chemistry and in multidisciplinary fields that draw upon the chemical sciences. Projects that help build infrastructure and workforce and partnerships that advance the chemical sciences are also supported.

Funding Modalities

The Division is sensitive to the chemistry community's concern about preserving the single investigator method of research but is also receptive to an increasing number of investigators who favor research work in small and large groups. The Division's plan is to continue to offer the chemistry community the possibility of submitting their best scientific research ideas through one of three modalities: as single investigators, as small groups (collaboratives) and as larger groups (centers).

Establishing interdisciplinary centers for chemical research is important as centers offer a means to increase funding and visibility for Chemistry, facilitate strong scientific synergism, and achieve the goals of the American Competitiveness Initiative.

Workforce Development and Broadening Participation

In March 2007, the Division approved an aggressive and ambitious broadening participation plan with the ultimate goal of having the face of America represented internally at NSF and externally in the chemistry community. The plan can be viewed on the CHE web site.

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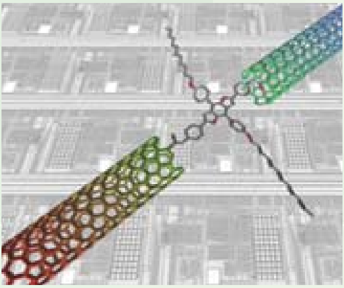


Credit: Support for this work was provided by the Nanoscale Science and Engineering Initiative of the NSF under Grant No. CHE-0117752 and by the New York State Office of Science, Technology, and Academic Research (NYSTAR).

A nanotube electrode developed for directly measuring the conductance of single molecules.

Programs in Chemistry

Individual Investigator Programs
Organic and Macromolecular Chemistry: Organic Dynamics; Organic Synthesis
Inorganic, Bioinorganic, and Organometallic Chemistry
Analytical and Surface Chemistry
Physical Chemistry: Experimental Physical Chemistry; Theoretical and Computational Chemistry

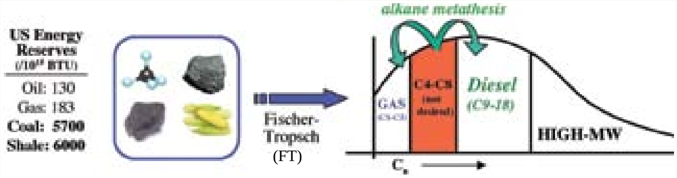
Integrative Chemistry Activities
Chemical Bonding Centers
Collaborative Research in Chemistry
Chemical Research and Instrumentation and Facilities
Research Experiences for Undergraduates
Undergraduate Research Collaboratives

A Guide to Programs / Browse Funding Opportunities is available at http://www.nsf.gov/funding/browse_all_funding.jsp.

The **Chemical Bonding Centers (CBC)** program supports centers that address major, long-term basic chemical research problems. Appropriate research problems are high-risk but potentially high-impact and will attract broad scientific and public interest. Center teams may be connected through cyberinfrastructure, will respond rapidly to emerging opportunities and may include researchers from academia, industry, government laboratories and international organizations. Centers are selected through a multi-stage peer-review process. Phase I awards are $1.5 million for 3 years. Successful Phase I awards may compete for Phase II funding, which is approximately $3 to $4 million per year for 5 to 10 years.

Chemistry and the Global Community

The Division has a successful partnership with the German Research Foundation (DFG) and is working to expand its collaborations with other countries in Europe, Asia, and Central and South America.

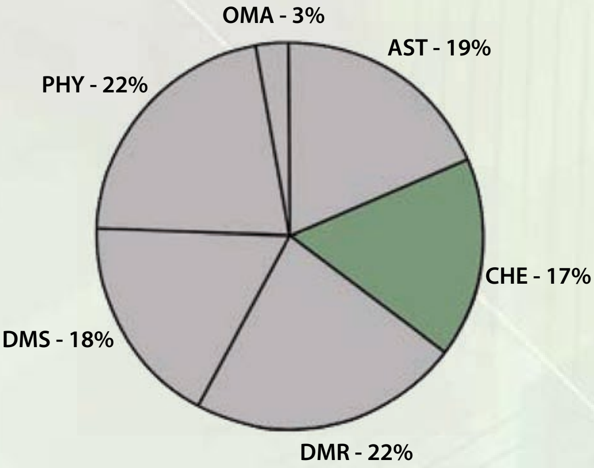


Credit: Alan Goldman (Rutgers University) and Maurice Brookhart (University of North Carolina), the Center for Enabling Novel Technologies through Catalysis (CENTC).

Clean Diesel - from "anything." The energy content of U.S. coal is comparable to that of the entire world's reserves of petroleum. Agricultural and waste biomass also comprise enormous domestic sources of energy. These and virtually any other sources of carbon can be converted to hydrocarbons of various chain lengths using "FT" chemistry. Chains that are 9 to 18 carbons long constitute "FT Diesel," a clean-burning transportation fuel that yields at least 30% more miles per gallon than conventional gasoline. A newly developed system for catalytic "alkane metathesis" has the potential to convert the shorter carbon chains that are also produced by FT chemistry (which are not useful as transportation fuel) into a combination of FT Diesel and heating gas, thereby improving the total yield and economics of biomass- or coal-to-liquid conversion.

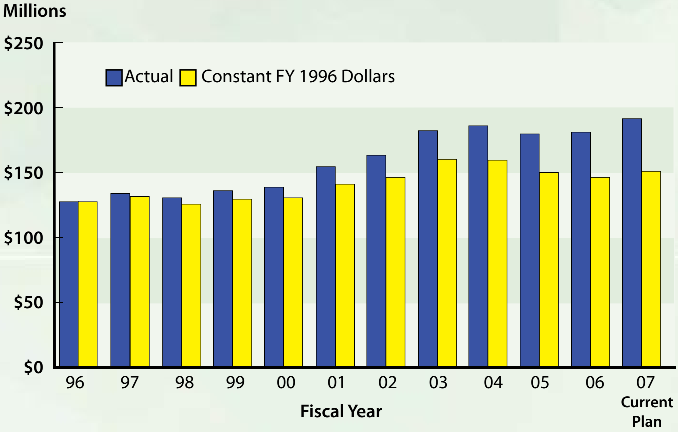
Division of Chemistry (CHE)

MPS Funding FY 2007 Current Plan



Pie chart showing divisional portions of MPS total budget for FY 2007. CHE will spend $191 million in FY 2007, which is 17% of the total MPS budget. *Totals may not add due to rounding.*

Budget in Actual and Constant FY 1996 Dollars

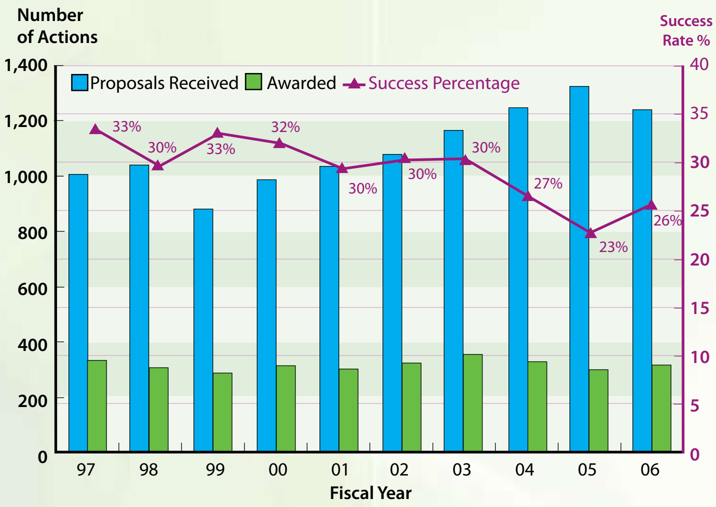


CHE annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the CHE budget. Over this 12-year period, the constant dollar budget for CHE has increased 18%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

CHE

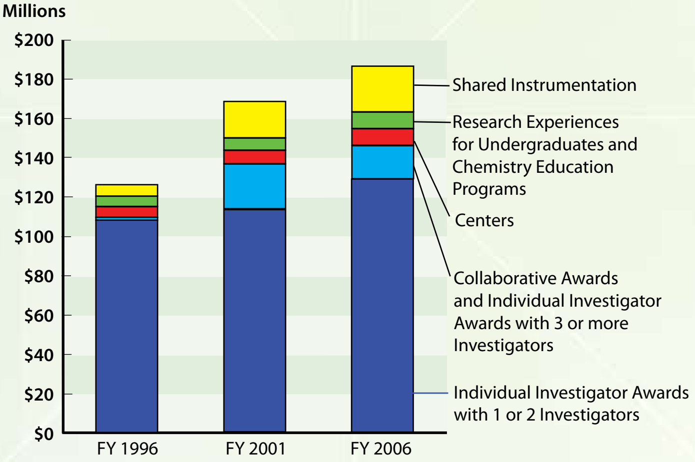
Success Rates and Number of Actions



Graph shows number of proposals submitted versus awarded for Research Grants as defined by NSF and resultant success rates. Success rate is defined as the number of new or renewal proposals awarded funding divided by the total number of proposals received. The number of proposals received by CHE in 2006 was 23% higher than in 1997.

Note: the distribution of success rates reflects the average for the Chemistry Division and may not represent success rates in individual programs.

Modes of Support



Bar charts showing CHE modes of support for FY 1996, 2001 and 2006.

Division of Materials Research (DMR)

Mission

To make new discoveries about the behavior of matter and materials; to create new materials and new knowledge about materials phenomena; to address fundamental materials questions that often transcend traditional scientific and engineering disciplines and may lead to new technologies; to prepare the next generation of materials researchers; to develop and support the instruments and facilities that are crucial to advance the field; and to share the excitement and significance of materials science with the public at large.

The research and educational activities supported are critical to national competitiveness. DMR supports experimental and theoretical research over a broad range of subfields, including condensed matter and materials physics, solid state and materials chemistry, electronic and photonic materials, metals, polymers, ceramics, and biomaterials. Funding modes range from awards to individual investigators and small groups to centers, instrumentation and major facilities.

Broadening Participation

The Division of Materials Research strives to broaden the participation of women and underrepresented minority groups in science and engineering at all academic levels. One aspect of this vision is the Partnership for Research and Education in Materials (PREM) program, which develops and supports long-term partnership between minority serving institutions and DMR centers and facilities. This program was started in 2004 and currently supports 10 awards.

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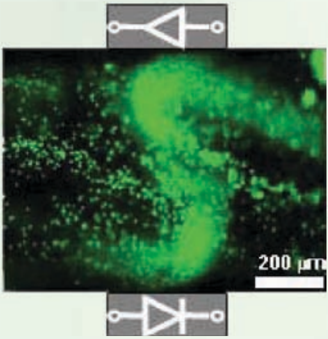
A microfluidic diode mixer operated by AC field. The orientation of the diodes applies a torque on the liquid in the microchannel, which leads to a mixing vortex.



Credit: S-T Chang, V.N. Paunov, D.N. Petsev and O.D. Velev, Nature Materials 6 (2007) pp. 235-240.

Programs in Materials Research

Programs for Individual Investigators and Groups
Biomaterials
Ceramics
Condensed Matter and Materials Theory
Condensed Matter Physics
Electronic Materials
Metals
Polymers
Solid State and Materials Chemistry

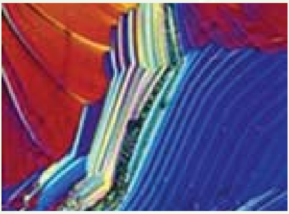
Crosscutting DMR Programs
Instrumentation for Materials Research
Materials Research Science and Engineering Centers (MRSEC)
- MRSECs address fundamental materials research problems whose scope and complexity requires the advantages of scale and interdisciplinary interaction provided by a center. Twenty-six centers are currently supported. For more information visit http://www.mrsec.org/.
- Partnerships for Research and Education in Materials (PREM)

National Facilities
- DMR supports user facilities for neutron scattering, x-rays, high magnetic fields and nano-fabrication.

Office of Special Programs
- International Materials Institutes
- Materials World Network
- Research Experiences for Undergraduates (REU) and Teachers (RET)

A Guide to Programs / Browse Funding Opportunities is available at http://www.nsf.gov/funding/browse_all_funding.jsp.

The Materials World Network (MWN), initiated and supported by the Division of Materials Research in partnership with over 50 research funding organizations worldwide, engages global intellectual resources for the advancement of materials research and education. International collaborative projects underpin the network; the International Materials Institutes serve as its nodes. The NSF annual investment in the MWN is about $10 million.

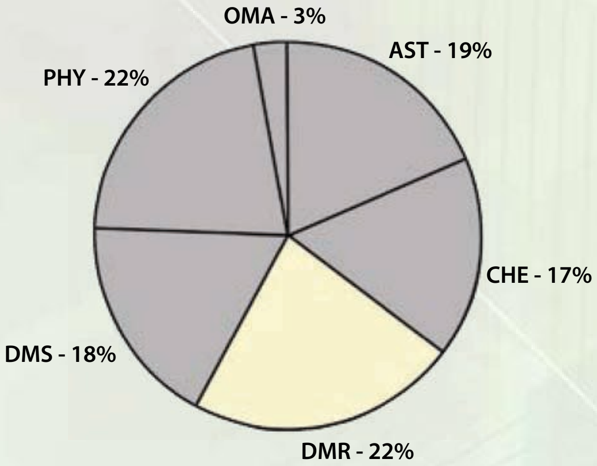


The Division of Materials Research supports user facilities that provide the scientific community with instrumentation and expertise in high magnetic fields, neutron and x-ray scattering, and nano-fabrication. The photomicrograph at left shows a high temperature superconducting crystal (Yttrium 123), one of many materials being explored at the National High Magnetic Field Laboratory in Tallahassee, Florida.

Credit: Michael W. Davidson.

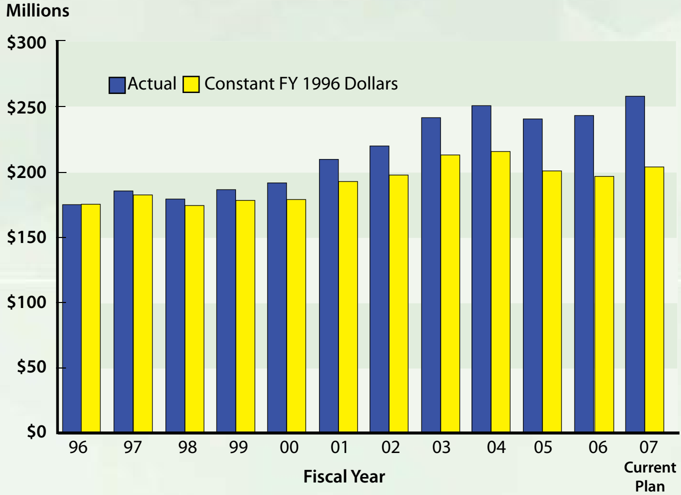
Division of Materials Research (DMR)

MPS Funding FY 2007 Current Plan



Pie chart showing divisional portions of MPS total budget for FY 2007. DMR will spend $257 million in FY 2007, which is 22% of the total MPS budget. *Totals may not add due to rounding.*

Budget in Actual and Constant FY 1996 Dollars



DMR annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the DMR budget. Over this 12-year period, the constant dollar budget for DMR has increased 16%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

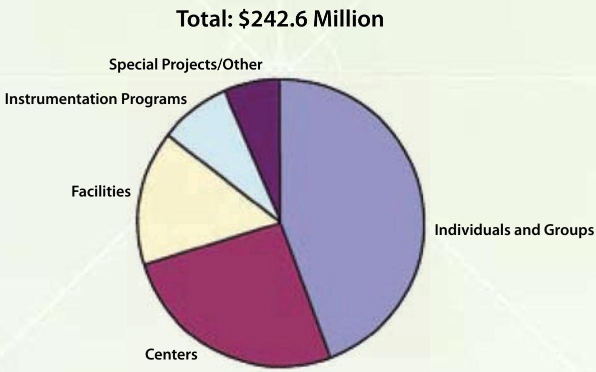
DMR

Success Rates and Number of Actions

Graph shows number of proposals submitted versus awarded for Research Grants as defined by NSF and resultant success rates. Success rate is defined as the number of new or renewal proposals awarded funding divided by the total number of proposals received. The number of proposals received by DMR in 2006 was 26% higher than in 1997.

Note: the distribution of success rates reflects the average for the Materials Research Division and may not represent success rates in individual programs.

Materials Research Funding FY 2006



Pie chart showing breakdown of FY 2006 DMR by funding catagories.

Division of Mathematical Sciences (DMS)

Mission

The Division of Mathematical Sciences supports research and education projects at the frontiers of discovery that achieve NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense." Modes of support include awards to individual investigators and small groups, workforce training grants, and a portfolio of national mathematical sciences institutes. The Division supports research in core areas of mathematics and statistics as well as interdisciplinary research that crosses traditional boundaries of the physical, biological, social, and engineering sciences.

Discovery, Connections, Community

The influence of mathematical science on our daily lives is fundamental and pervasive. For example, every secure commercial transaction on the Internet is an application of research in number theory and algebraic geometry. Melding of the banking, insurance, and finance industries turns on recent advances in probability and stochastic calculus. And improvements in weather prediction, search engines, and industrial design processes are predicated on advances in algorithms and computational mathematics. Investing in discovery in mathematics and statistics; exploiting interdisciplinary connections across fields of science, engineering and technology; and cultivating a diverse community of researchers, students, professionals, and citizens–these are essential components of the innovation engine that drives the Nation's economy, and they lie at the root of many DMS activities and programs.

Mathematical Sciences Priority Area

FY 2007 marks the close of a six-year, NSF-wide activity that saw substantial growth in the Division's budget and mix of awards. The goal of the priority area was to advance frontiers in three interlinked areas: fundamental mathematical and statistical sciences, interdisciplinary research connecting the mathematical sciences with science and engineering, and critical investments in mathematical sciences education.

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Web site: http://www.nsf.gov/div/index.jsp?div=DMS

Credit: John Stembridge, University of Michigan.

The largest of the exceptional simple Lie groups is called E8. It is realized as the group of symmetries of a 57-dimensional geometry and itself has dimension 248. The figure above is a two-dimensional projection of an eight-dimensional combinatorial object called the Gosset polytope 421, which describes much of the construction of E8.

Programs in Mathematical Sciences

Disciplinary Programs

Algebra, Number Theory, and Combinatorics
Analysis
Applied Mathematics
Computational Mathematics
Foundations
Geometric Analysis
Mathematical Biology
Probability
Statistics
Topology

Special DMS Programs

Collaboration in Mathematical Geosciences
Focused Research Groups in the Mathematical Sciences
Infrastructure
Joint DMS/National Institute of General Medical Sciences (NIGMS) Initiative in Mathematical Biology
Mathematical Sciences: Innovations at the Interface with Computer Sciences
Mathematical Social and Behavioral Sciences

A Guide to Programs / Browse Funding Opportunities is available at http://www.nsf.gov/funding/browse_all_funding.jsp.

Mathematical Sciences Research Institutes are large scale projects that advance research in the mathematical sciences, increase the impact of the mathematical sciences in other disciplines, enable the mathematical sciences to respond to national needs, and expand the talent base engaged in mathematical and statistical research in the U.S.

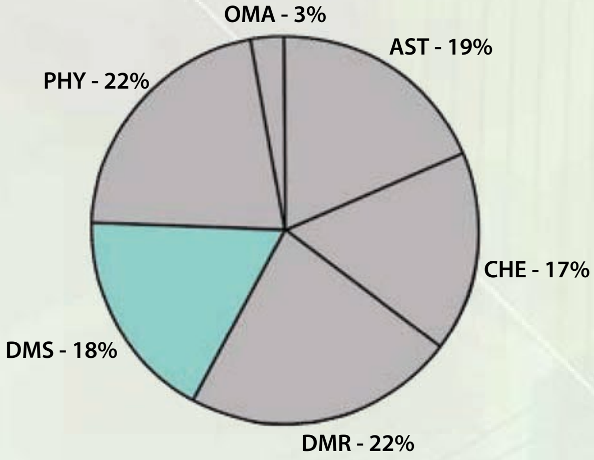
The **Workforce** program offers competitions such as Enhancing the Mathematical Sciences Workforce for the 21st Century, whose goal is to increase the number of well-prepared U.S. citizens and permanent residents who pursue careers in the mathematical sciences and in other NSF-supported disciplines.

Enhancing Diversity in Graduate Education (EDGE): A Transition Program for Women in the Mathematical Sciences The EDGE Program, a DMS Workforce project funded jointly with The Andrew W. Mellon Foundation, is designed to strengthen the ability of women and minority students to successfully complete graduate programs in the mathematical sciences.

Participants and faculty in the 2005 EDGE Program held on the campus of North Carolina A&T State University, under the direction of Local Coordinators Dr. Janis Oldham and Patricia Shelton. The program, established in 1998, is co-directed by Dr. Sylvia Bozeman (Spelman College) and Dr. Rhonda Hughes (Bryn Mawr College).

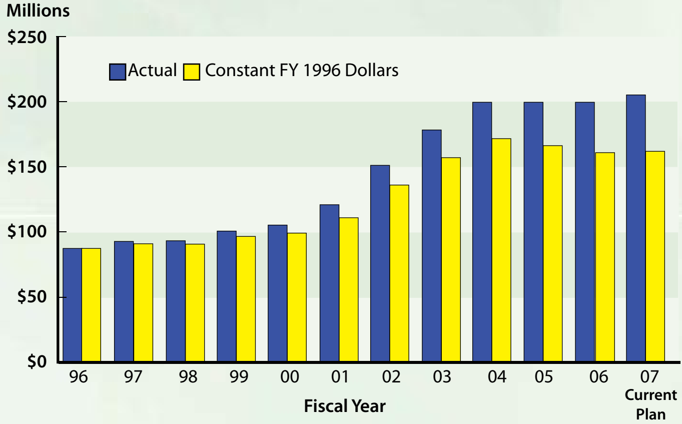
Division of Mathematical Sciences (DMS)

MPS Funding FY 2007 Current Plan



Pie chart showing divisional portions of MPS total budget for FY 2007. DMS will spend $206 million in FY 2007, which is 18% of the total MPS budget. *Totals may not add due to rounding.*

Budget in Actual and Constant FY 1996 Dollars

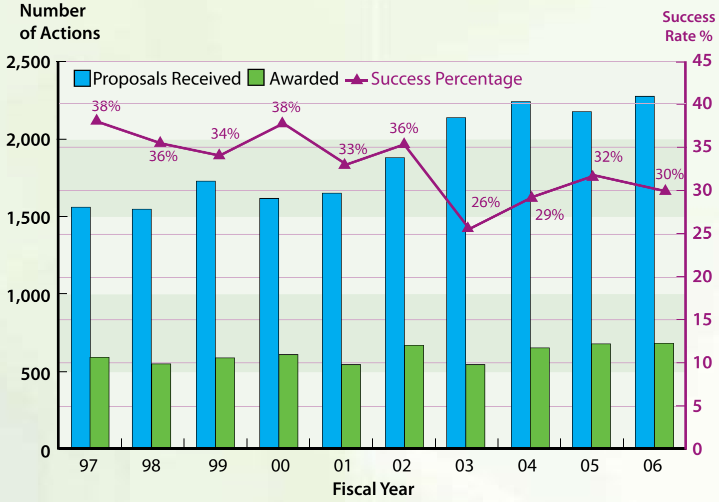


DMS annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the DMS budget. Over this 12-year period, the constant dollar budget for DMS has increased 85%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

DMS

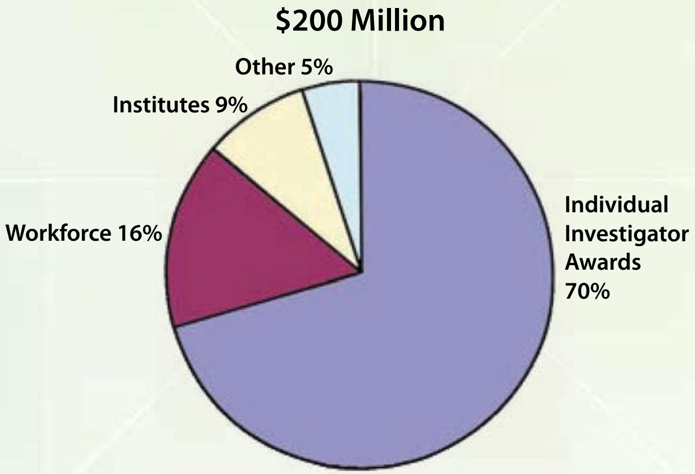
Success Rates and Number of Actions



Graph shows number of proposals submitted versus awarded for Research Grants as defined by NSF and resultant success rates. Success rate is defined as the number of new or renewal proposals awarded funding divided by the total number of proposals received. The number of proposals received by DMS in 2006 was 45% higher than in 1997.

Note: the distribution of success rates reflects the average for the Mathematical Sciences Division and may not represent success rates in individual programs.

Mathematical Sciences FY 2006 Budget



Pie chart showing breakdown of FY 2006 DMS budget by funding categories. Individual Investigator awards refer to awards in Disciplinary Programs and Special DMS Programs.

Division of Physics (PHY)

Mission

To support fundamental research across the intellectual frontiers of physics, to support research that has broader impacts on other fields of science and on the health, economic strength, and defense of society, to enhance education at all levels and share the excitement of science with the public through integration of education and research, and to steward the physics community so as to maintain the intellectual capital essential for future advances. Modes of support include single-investigator awards, group awards, centers and institutes, some interdisciplinary in nature, and several national user facilities, as well as research equipment/instrumentation development grants.

Physics research probes the properties of matter at its most fundamental level, the interactions between particles, and the organization of constituents and symmetry principles that lead to the rich structure and phenomena that we observe in the world around us. Physics seeks a deep understanding of processes that led to the formation of the cosmos, to the structure of matter at the very shortest distance scales where quantum effects dominate, and to the structure of atomic and molecular systems that shape and control the everyday world of chemistry and biological systems. Because of the breadth and scope of physics, it forms part of the core educational curriculum in most sciences and in engineering.

Workforce Development and Broadening Participation

The Physics Division strongly supports workforce development and broadening participation at all levels, from outreach efforts in large facilities and centers, to supporting ef orts through groups such as the National Society of Black Physicists and National Society of Hispanic Physicists, to large scale projects such as QuarkNet, Center for High Energy Physics Research and Education Outreach (CHEPREO), Cosmic Ray Observatory Project (CROP), and Astrophysics Science Project Integrating Research and Education (ASPIRE), to individual Principal Investigator awards. Students involved in these projects gain skills and knowledge to become members of the nationally critical high-tech workforce.

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Credit: LIGO Laboratory.

Aerial view of the Laser Interferometer Gravitational-Wave Observatory (LIGO).

Credit: Photo by FIU student Jonathan Diaz.

Temperature and humidity sensors being installed on the endcap of the Compact Muon Solenoid (CMS) detectors' hadron calorimeter (HCAL). Florida International University (FIU) graduate student Luis Lebolo is shown at the above-ground staging area for the CMS experiment, connecting the sensors onto the detector.

Programs in Physics

Programs for Individual Investigators and Groups
Atomic, Molecular, Optical and Plasma Physics
Biological Physics
Elementary Particle Physics
Gravitational Physics
Nuclear Physics
Particle and Nuclear Astrophysics
Physics at the Information Frontier
Education and Interdisciplinary Research
Theoretical Physics (including Atomic, Molecular, and Optical Physics, Elementary Particle Physics, Nuclear Physics, Cosmology and Astrophysics, and Mathematical Physics)

Crosscutting PHY Programs
Physics Frontier Centers
National Facilities
- National Superconducting Cyclotron Laboratory (NSCL)
- Cornell Electron Storage Ring (CESR)
- Laser Interferometer Gravitational-Wave Observatory (LIGO)
- Large Hadron Collider (LHC), a joint NSF-DOE-CERN project
- IceCube Neutrino Observatory
- LArge Plasma Device (LAPD)

Research Experiences for Undergraduates (REU) and Teachers (RET)

A Guide to Programs / Browse Funding Opportunities is available at http://www.nsf.gov/funding/browse_all_funding.jsp.

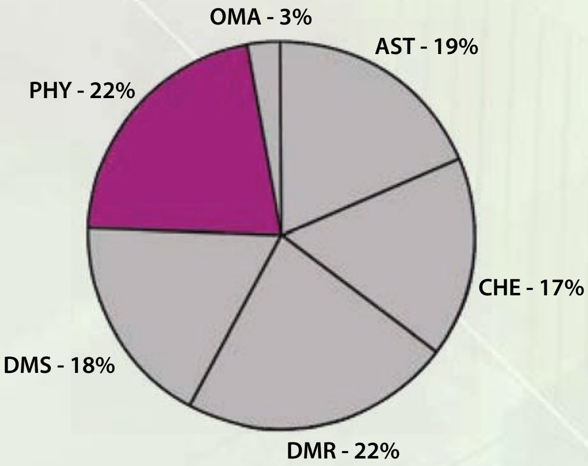
The Physics Frontier Centers
This program has been established to foster major advances at the intellectual frontiers of physics by providing needed resources, e.g., combinations of talents, skills, disciplines, and/or specialized infrastructure, not usually available to individual investigators or small groups. The program supports university-based centers and institutes where the collective efforts of a larger group of individuals can enable transformational advances in the most promising research areas. Activities supported through the program are in all sub-fields of physics within the purview of the Division of Physics. Interdisciplinary projects at the interface between these physics areas and other physics sub-fields and disciplines, e.g., biology, quantum information science, mathematical physics, condensed matter physics, and emerging areas of physics are also included.

Physics and the Global Community

The Physics Division participates in numerous international efforts, including large scale facilities such as LIGO, LHC and IceCube facilities, and large astrophysics detectors such as Borexino, Very Energetic Radiation Imaging Telescope Army System (VERITAS), the Pierre Auger Observatory, Milagro, and High Resolution Fly's Eye (HI-RES). In addition, the Physics Division also participates in the Open Science Grid (OSG), a distributed shared cyberinfrastructure which provides computing and storage resources for large NSF supported international projects and partners internationally with other grid projects such as Enabling Grids for E–sciencE (EGEE) in Europe and related efforts in South America and Asia.

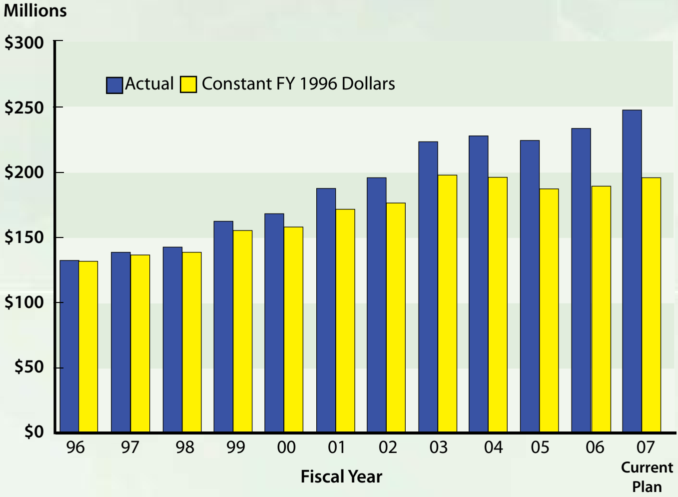
Division of Physics (PHY)

MPS Funding FY 2007 Current Plan



Pie chart showing divisional portions of MPS total budget for FY 2007. PHY will spend $249 million in FY 2007, which is 22% of the total MPS budget. *Totals may not add due to rounding.*

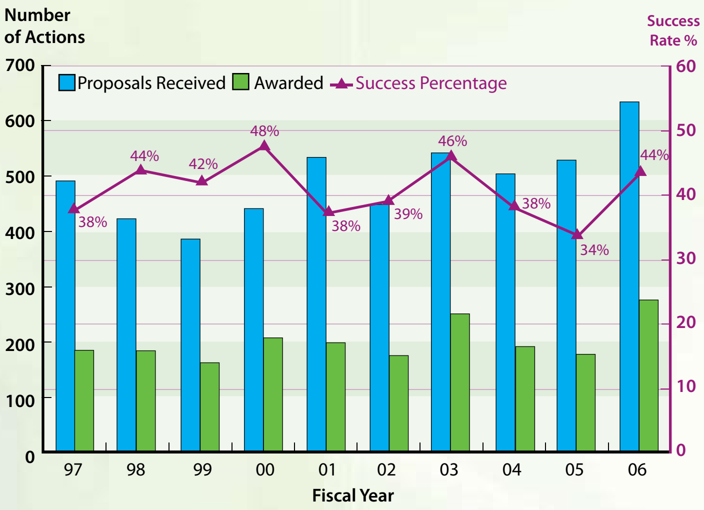
Budget in Actual and Constant FY 1996 Dollars



PHY annual budgets in actual and constant FY 1996 dollars. Constant dollars show the purchasing power of the PHY budget. Over this 12-year period, the constant dollar budget for PHY has increased 49%.

Data provided from FY 1998 to 2008 NSF Budget Requests to Congress, http://www.nsf.gov/about/budget/. Constant 1996 Dollar Deflator from Section 10 of the Gross Domestic Product and Implicit Outlay Deflators, Historical Tables of the U.S. Budget, FY 2005, http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf.

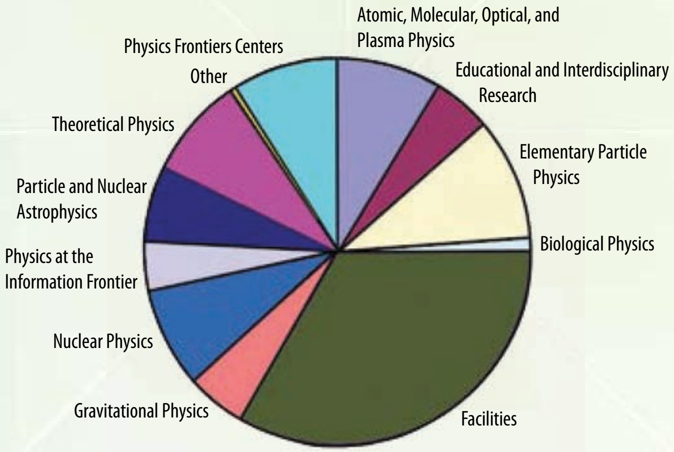
Success Rates and Number of Actions



Graph shows number of proposals submitted versus awarded for Research Grants as defined by NSF and resultant success rates. Success rate is defined as the number of new or renewal proposals awarded funding divided by the total number of proposals received. The number of proposals received by PHY in 2006 was 29% higher than in 1997.

Note: the distribution of success rates reflects the average for the Physics Division and may not represent success rates in individual programs.

Physics FY 2006 Funding

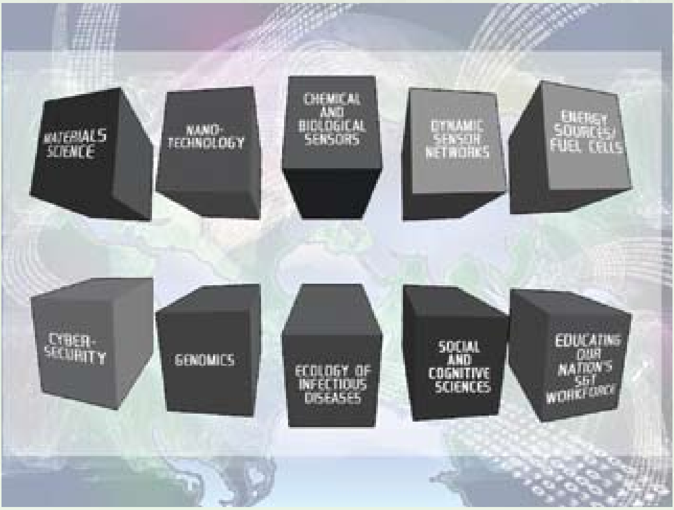


Pie chart showing breakdown of the FY 2006 PHY budget by program.

Office of Multidisciplinary Activities (OMA)

OMA provides a focal point in the Directorate for partnerships (e.g., with other agencies, industry, national laboratories, State and local governments, international organizations), seeds crosscutting research in areas of particular promise, and supports innovative experiments in education that could lead to new paradigms in graduate and undergraduate education in the mathematical and physical sciences, particularly in multidisciplinary settings.

While OMA does not accept external proposals, the Office especially encourages submission by MPS Divisions of initiatives from multi-investigator, multi-disciplinary teams pursuing problems on a scale that exceeds the capacity of individual investigators. OMA is particularly receptive to projects incorporating education and research training experiences that contribute to a diverse, high-quality workforce with technical and professional skills, career path flexibility, and appetite for lifelong learning appropriate to the dynamic, global science, and technology enterprise of the 21st century.



Credit: NSF Office of Legislative and Public Affairs.

OMA supports interdisciplinary interactions within MPS as well as with other NSF Directorates. Examples of scientific themes covered are provided above.

Directorate for Mathematical and Physical Sciences (MPS)
http://www.nsf.gov/dir/index.jsp?org=mps

Division of Astronomical Sciences (AST)
http://www.nsf.gov/div/index.jsp?div=AST

Division of Chemistry (CHE)
http://www.nsf.gov/div/index.jsp?div=CHE

Division of Materials Research (DMR)
http://www.nsf.gov/div/index.jsp?div=DMR

Division of Mathematical Sciences (DMS)
http://www.nsf.gov/div/index.jsp?div=DMS

Division of Physics (PHY)
http://www.nsf.gov/div/index.jsp?div=PHY

Office of Multidisciplinary Activities (OMA)
http://www.nsf.gov/div/index.jsp?div=OMA

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Thomas Rieker · Joseph Schweitzer · Paul Spyropoulos · Ramona Winkelbauer

Directorate for Mathematical and Physical Sciences (MPS)

The NSF Directorate for Mathematical and Physical Sciences is comprised of the Divisions of Astronomical Sciences, Chemistry, Materials Research, Mathematical Sciences, Physics and the Office of Multidisciplinary Activities. These organizations provide the basic structure for MPS support of research and education. The MPS Divisons support both disciplinary and interdisciplinary activities and partner with each other and with other NSF Directorates.

MPS Mission Statement

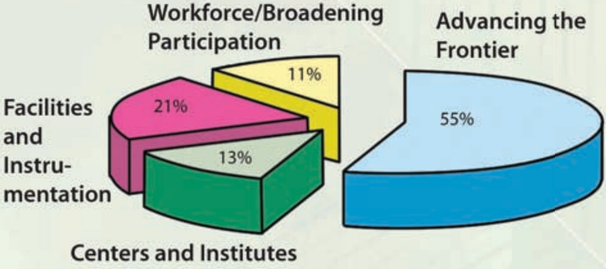
To make discoveries about the Universe and the laws that govern it; to create new knowledge, materials, and instruments which promote progress across science and engineering; to prepare the next generation of scientists through research; and to share the excitement of exploring the unknown with the nation.

Within the broad MPS mission there are important science themes that form the immediate focus of the Directorate:

- Charting the evolution of the Universe from the Big Bang to habitable planets and beyond
- Understanding the fundamental nature of space, time, matter and energy
- Creating the molecules and materials that will transform the 21st century
- Developing tools for discovery and innovation throughout science and engineering
- Understanding how microscopic processes enable and shape the complex behavior of the living world
- Discovering mathematical structures and promoting new connections between mathematics and the sciences
- Conducting basic research that provides the foundation for our national health, prosperity and security

Directorate for Mathematical and Physical Sciences (MPS)

FY 2007 Budget Distribution



The Directorate for Mathematical and Physical Sciences has a budget of $1.15 billion for FY 2007. The budget supports research to advance the frontiers of science, centers and institutes, facilities and instrumentation, and developing workforce and broadening participation in science, technology and mathematics.

MPS Organizational Chart