



# Overview of the Directorate for Mathematical and Physical Sciences

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NSF Regional Grants Conference  
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Nigel Sharp, [nsharp@nsf.gov](mailto:nsharp@nsf.gov)  
Program Director  
Division of Astronomical Sciences



# NSF Grants Conference





# OneNSF



**catalyze** human capital development

**improve**  
organizational  
efficiency

**create**  
networks and  
infrastructure  
for the nation

**spark** greater innovation  
and opportunity for  
scientific discoveries

**address**  
multidisciplinary  
challenges of  
national/global significance

**support**  
fundamental  
research in  
all disciplines





# NSF Vision and Goals

- **Vision**

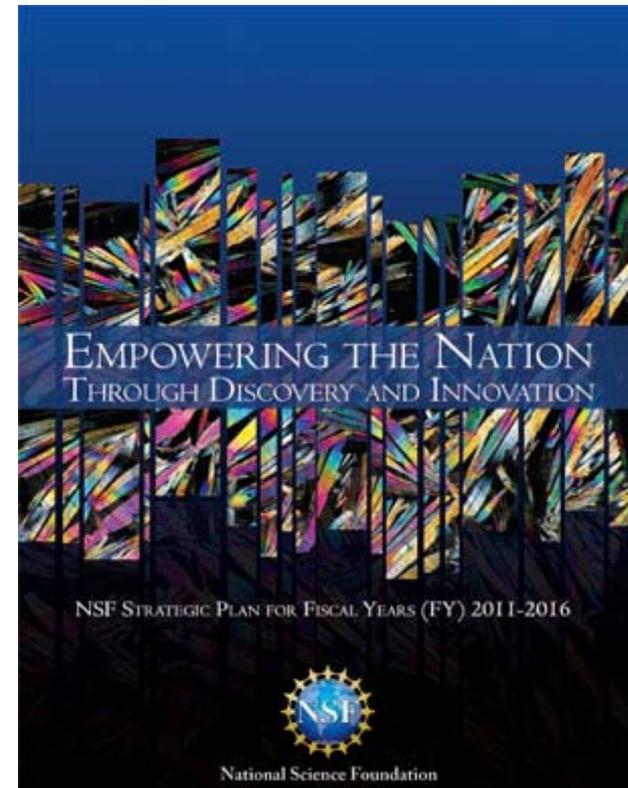
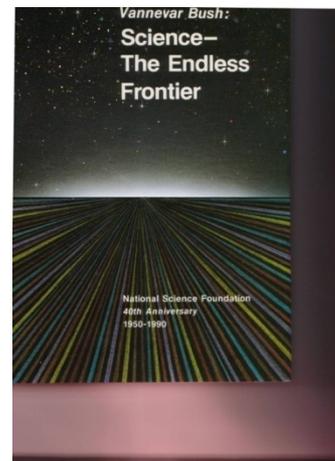
- » NSF envisions a nation that capitalizes on new concepts in science and engineering and provides global leadership in advancing research and education

- **Mission**

- » To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense

- **Goals**

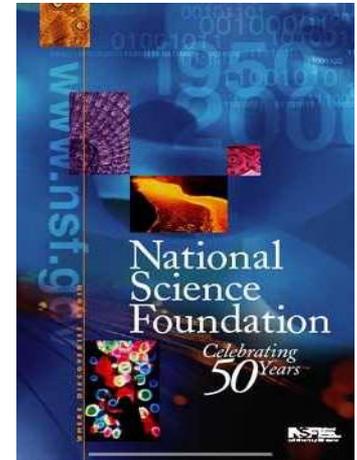
- » Discovery
- » Learning
- » Research Infrastructure
- » Stewardship



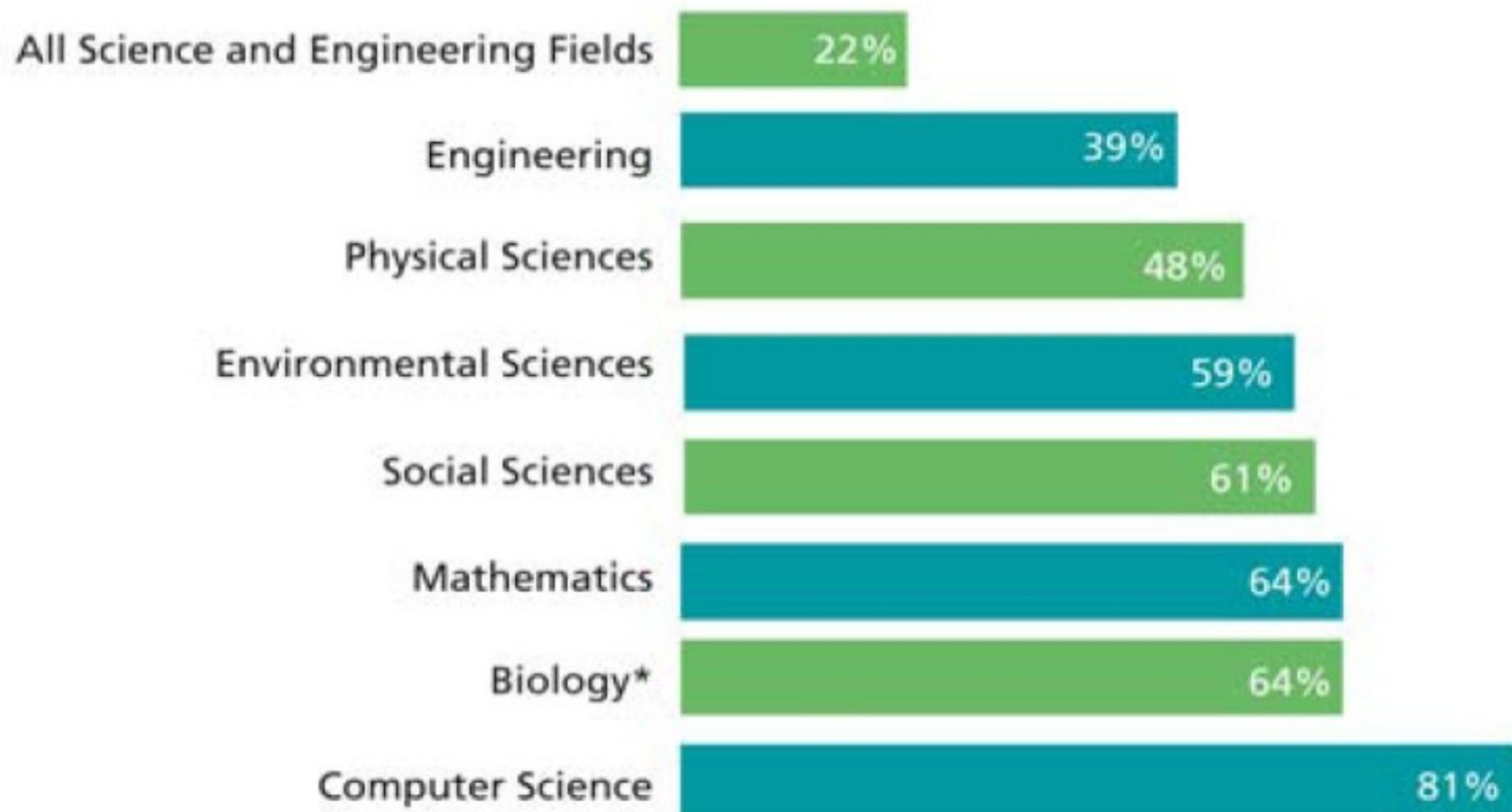


# NSF in a Nutshell

- Independent agency
- Support basic research and education
- Use grant mechanism in two forms:
  - » Unsolicited, curiosity driven (majority of \$)
  - » Solicited, more focused
- Peer reviews: Intellectual Merit & Broader Impacts
- Support all fields of science/engineering
- Discipline-based structure
- Cross-disciplinary mechanisms
- Support large facilities



# NSF Support of Academic Basic Research in Selected Fields (as a percentage of total federal support)

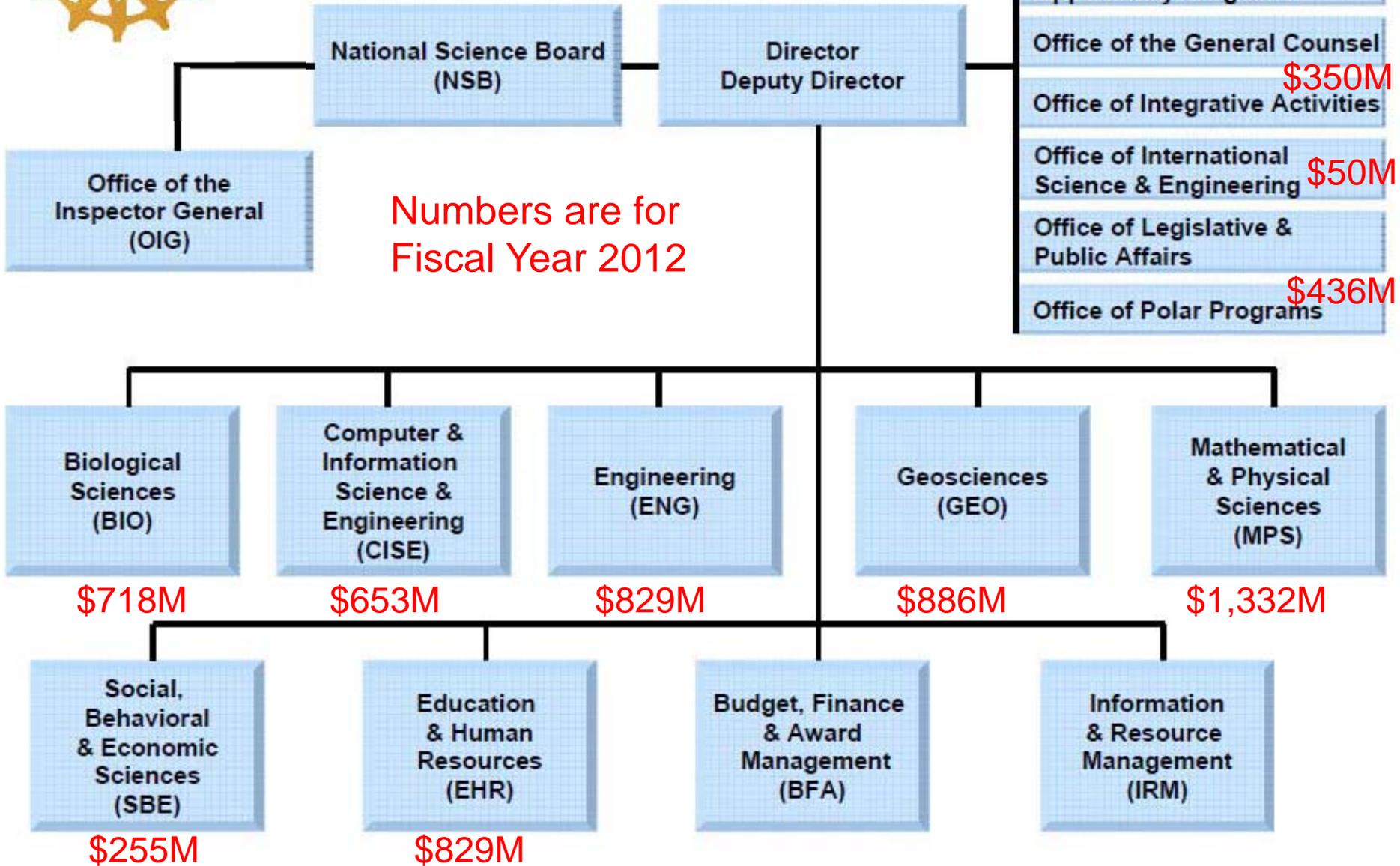


Note: Data shown is for FY 2008, the most recent available at this time.  
\*Includes Biological Sciences and Environmental Biology; excludes NIH.

Source: NSF/National Center for Science and Engineering Statistics, Survey of Federal Funds for Research & Development.



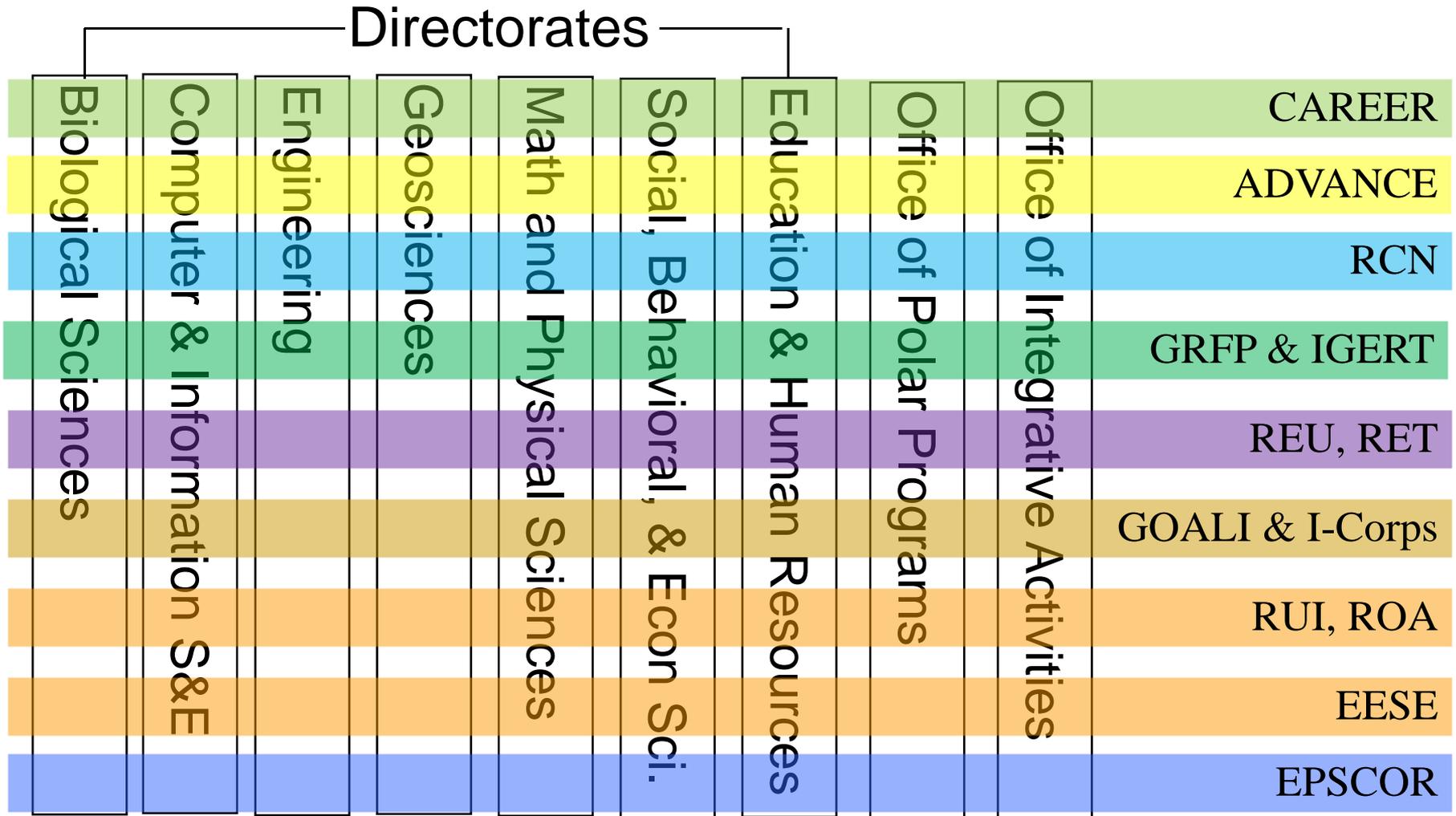
# NSF Organizational Chart







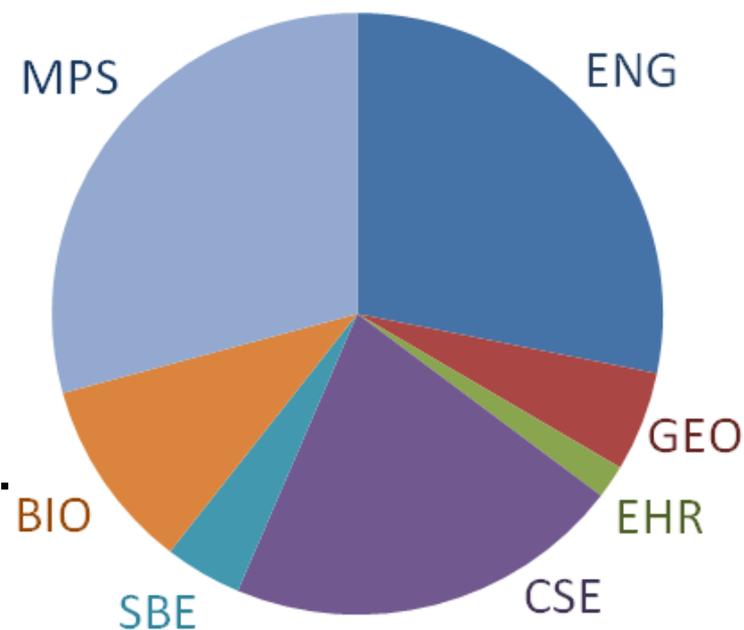
# NSF-Wide Programs





# CAREER Program

- NSF's most prestigious awards for junior faculty.
- Awardees are selected based on their plan of outstanding research, excellent education, and the integration of research and education within the context of the mission of their organizations, building a firm foundation for a lifetime of leadership.
- Increased participation of those traditionally under-represented in science and engineering is encouraged.



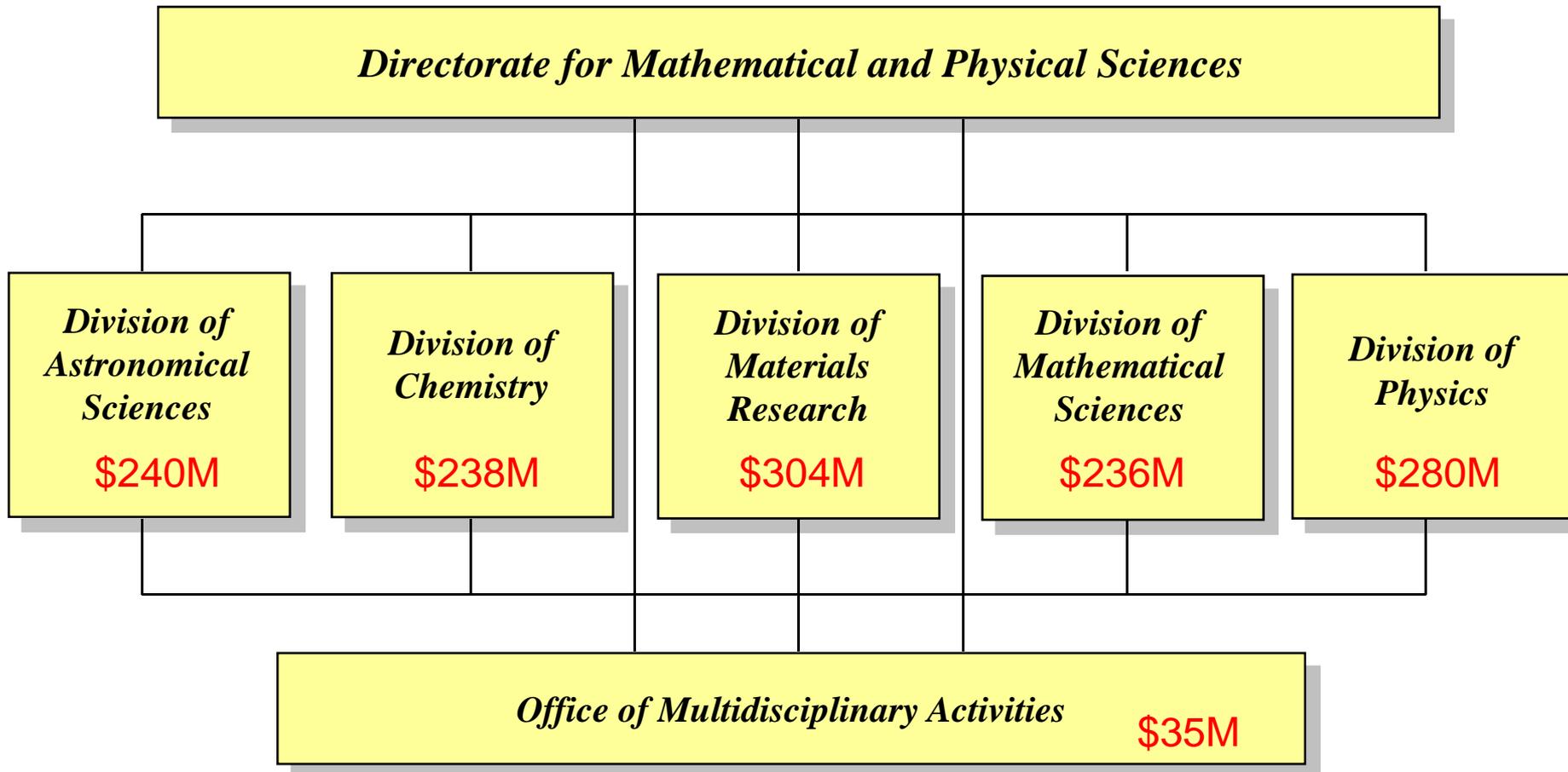


# Directorate for Mathematical and Physical Sciences (MPS)

- **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.**



# Directorate for Mathematical and Physical Sciences (MPS)

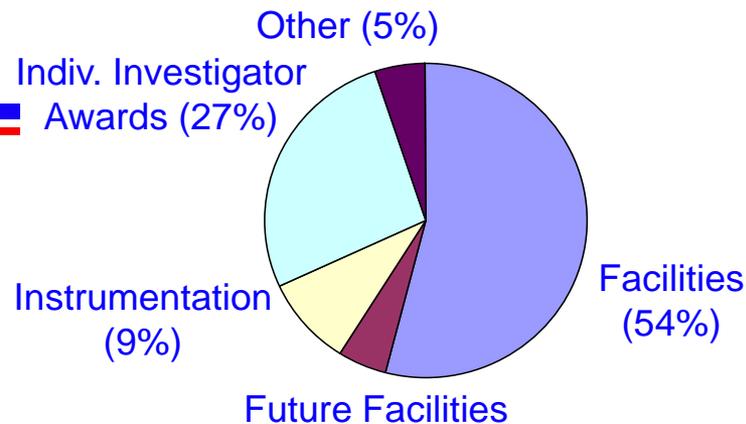


Numbers are for Fiscal Year 2012



# Astronomical Sciences (AST)

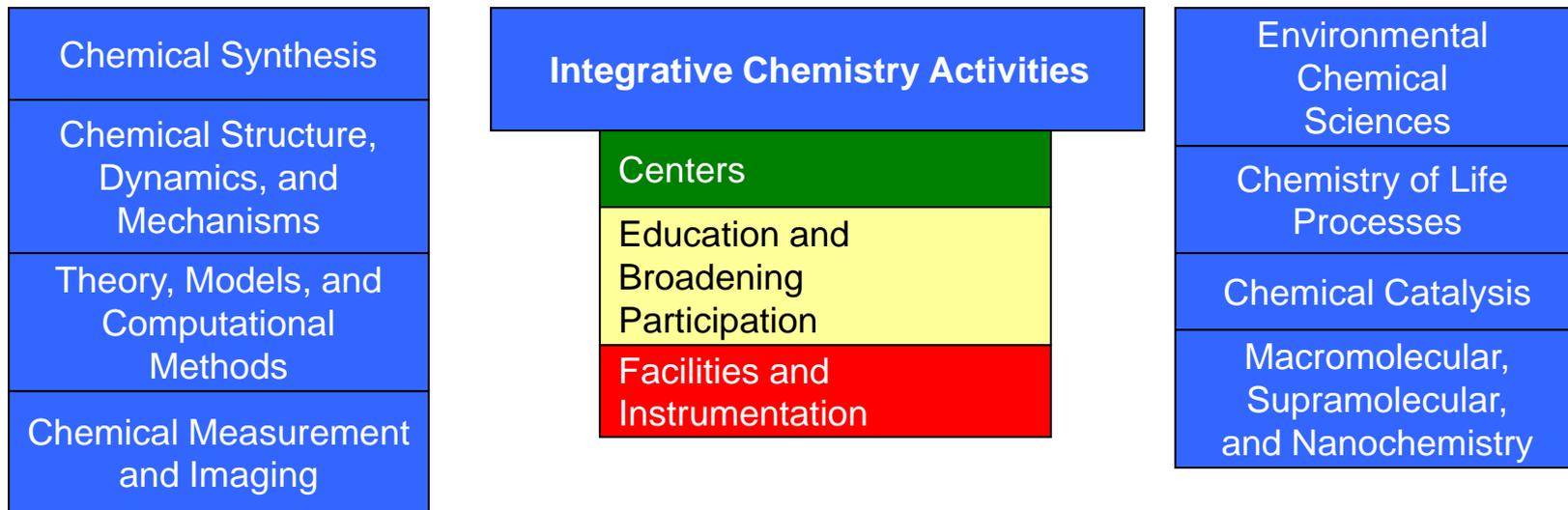
- From the Big Bang to DNA
  - » Origin and evolution of the Universe
  - » Origin and evolution of galaxies
  - » Origin and evolution of planetary and stellar systems
- National astronomy portfolio
  - » Three agencies – NSF, NASA, and DoE – and international partnerships
  - » Strong tradition of private funding
  - » NSF assigned federal stewardship of ground-based astronomy
  - » **Includes open-access facilities and mission-free unrestricted grants**



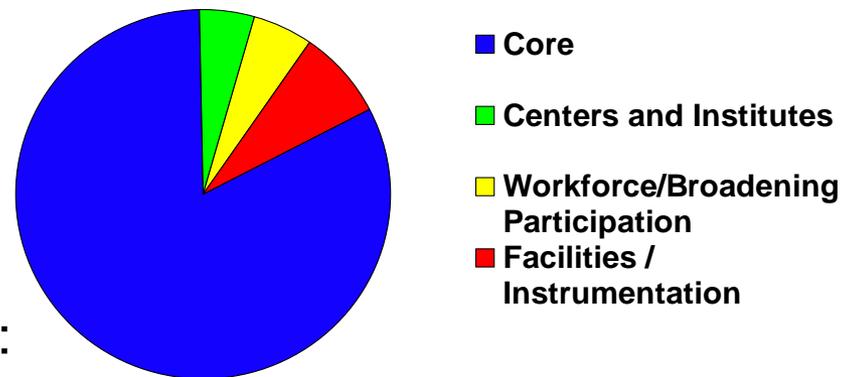
AST has a strong program in Education and Special Programs (including a major investment in post-docs)



# Chemistry (CHE)



- Major CAREER and REU support
- Centers program growing
- Collaborations with NIH and DOE
- Critical areas of research for FY 2010:  
Energy, Element and Molecule Recycling, Designed Emergent Behavior, Imaging the Ultrasmall





# Materials Research (DMR)

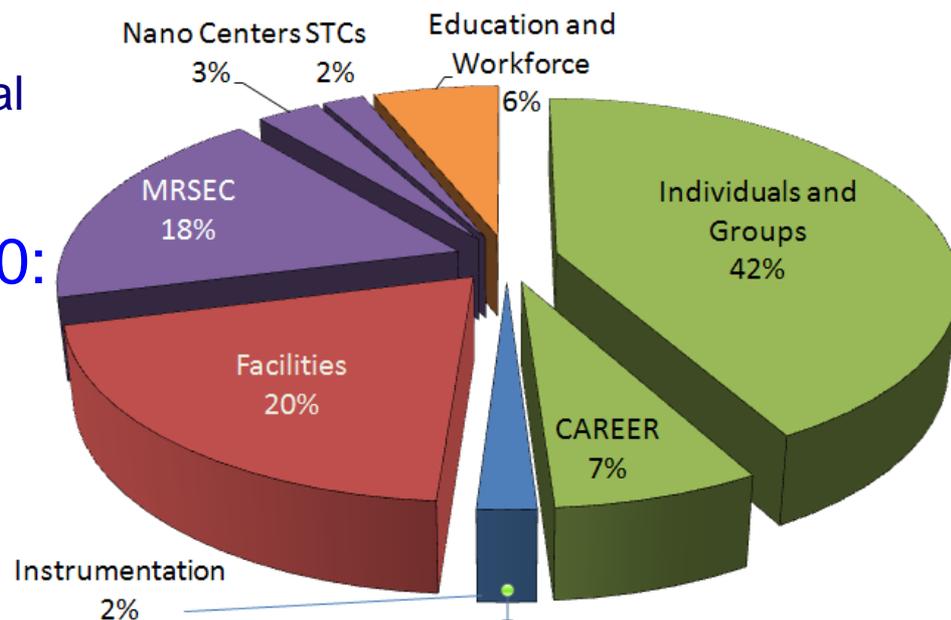
## DMR Programs:

- Ceramics, Electronic and Photonic Materials, Metals and Metallic Nanostructures
- Condensed Matter Physics, Condensed Matter and Materials Theory
- Biomaterials, Polymers, Solid-State and Materials Chemistry
- **Materials Research Science and Engineering Centers**
- **National Facilities and Instrumentation**
- Office of Special Programs (international collaboration; education)

DMR supports a wide breadth of science – fundamental research to the development of technological applications.

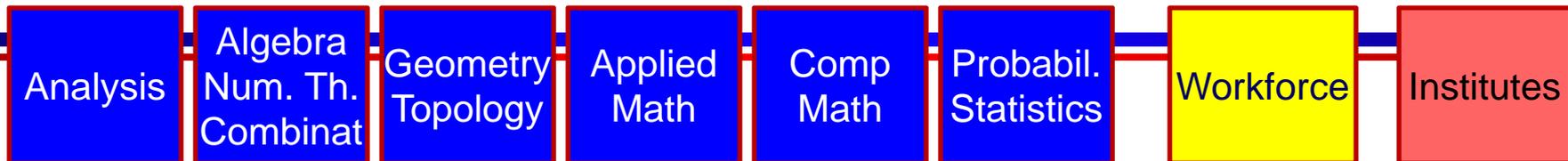
## Key Research Areas for FY 2010:

- » Environmental, energy, and economic sustainability
- » Matter by design
- » The quantum realm
- » Physical-chemical-biological interfaces





# Mathematical Sciences (DMS)



“Core business:” single investigator and group proposals through targeted solicitations

Covers the entire mathematical spectrum

Institutes: 5 NSF-initiated, support for 3 others

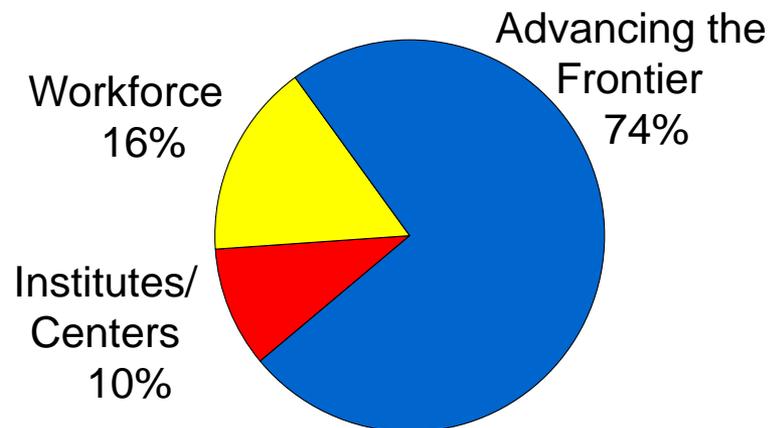
» Visitors to long term programs, workshops

Workforce: responding to a major challenge.

» EMSW21 training grants

» Postdoctoral fellowships

» Research for Undergraduates



In addition to the fundamental research in mathematical sciences, DMS plays an enabling role of all other sciences; DMS has been successful in partnering with other NSF Divisions and Directorates and with other government agencies.



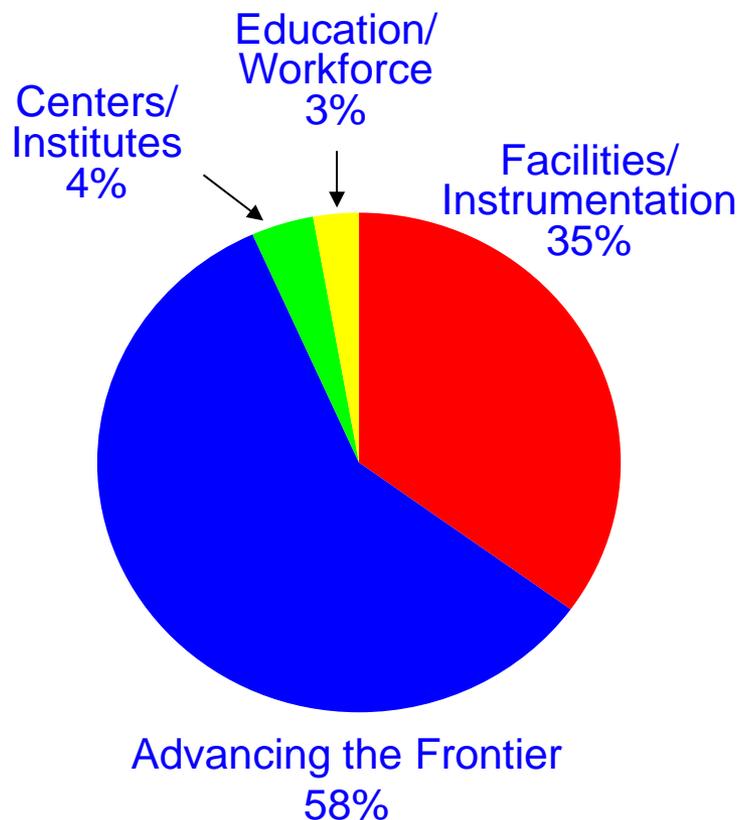
# Physics (PHY)

## Facilities:

LHC, LIGO, IceCube, NSCL, ...

## Programs:

- Atomic, Molecular, Optical, and Plasma Physics
- Biological Physics
- Elementary Particle Physics
- Gravitational Physics
- Nuclear Physics
- Particle and Nuclear Astrophysics
- Physics at the Information Frontier
- Physics Frontiers Centers
- Theoretical Physics
- Education and Interdisciplinary Programs



PHY collaborates closely with DOE and international partners to support science at large facilities. NSF's physics portfolio is more diverse than physics portfolios at any other federal agency.



# MPS in a (different) Nutshell

- Largest directorate
  - » ~25% of R&RA, ~18% of proposals, FY13 request \$1345m
- Nearly half of NSF's large facilities
- Responsible for the three “core” university disciplines – Physics, Chemistry, Mathematics – and Astronomy and Materials Research
- Over 40% of university federal funding in the physical sciences
  - » More than 80% in mathematics, and (was) growing
  - » Federal steward for ground-based astronomy
- Science scope - extension on every scale
  - » Femtoseconds and attoseconds to petaseconds and exaseconds
  - » From the Planck size to the Cosmic size
  - » From nanoKelvin to GigaKelvin
  - » From fundamental research to marketable technologies
  - » Every mental horizon from n-dimensions to infinity and beyond ...



# MPS Scientific Opportunities

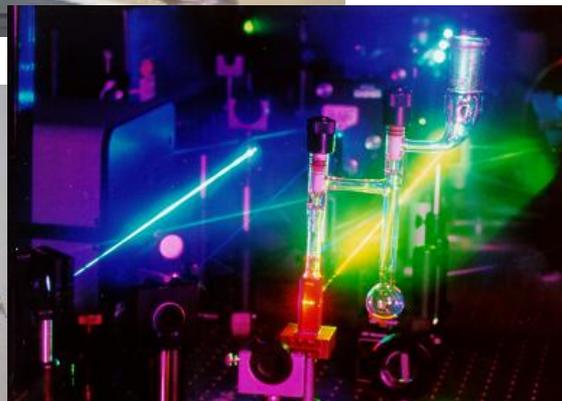
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- Physical sciences at the nanoscale
- Science beyond “Moore’s Law”
- Physics of the Universe
- Complex systems (multi-scale, emergent phenomena)
- Fundamental mathematical and statistical science
- Sustainability (energy, environment, climate)
- Interface between the physical and life sciences
- Computational and data-enabled science and engineering (CDS&E)



# Instrumentation

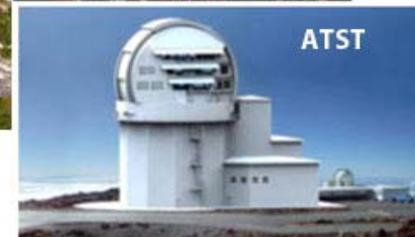
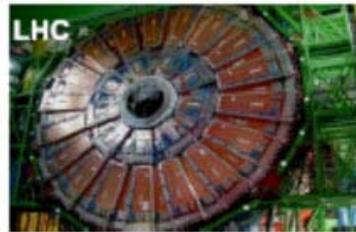
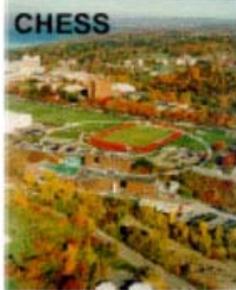
- Both acquisition and development
- Major Research Instrumentation (MRI)
- Divisional instrumentation programs
- Research grants





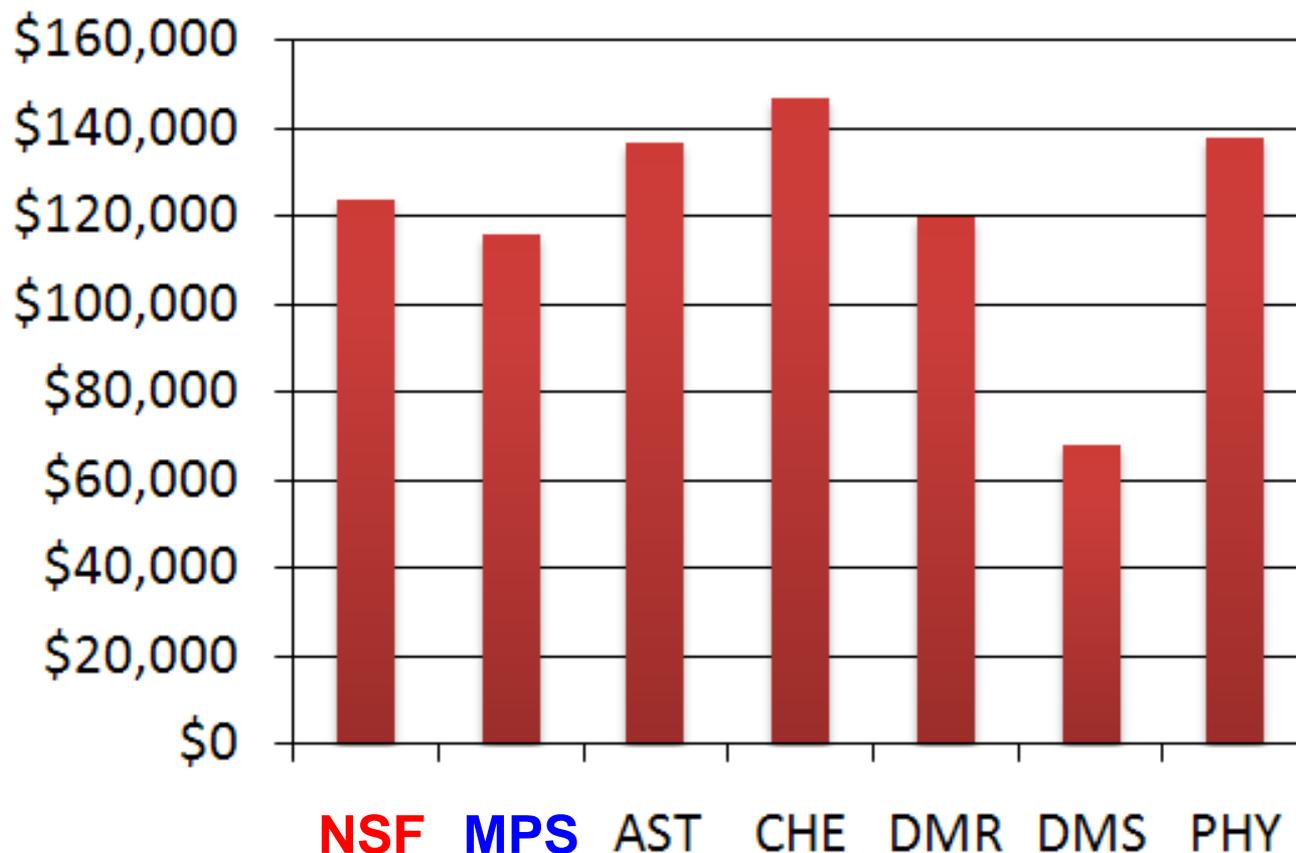
# World Class Major Facilities

## Keeping Researchers at the Frontier





# Median Annualized Award Size (2010)



Award duration ranges from one to five years (even, though rarely, more), with a mean around three years



# Funding Rates (2010)

Overall MPS Funding Rate: 26%

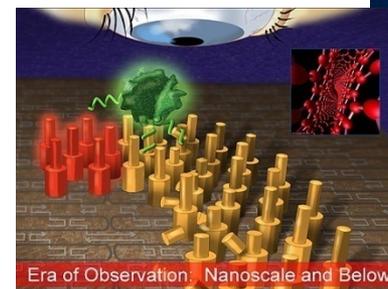
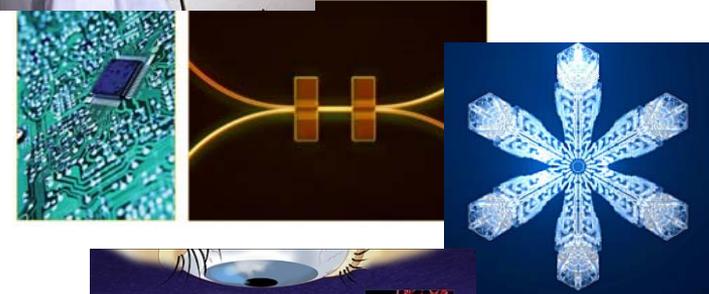




# Merit Review Criteria:

## Intellectual Merit

- How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
- How well qualified is the proposer (individual or team) to conduct the project?
- To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts?
- How well conceived and organized is the proposed activity?
- Is there sufficient access to resources?





# Merit Review Criteria:

## Broader Impacts

- How well does the activity advance discovery and understanding while **promoting teaching, training, and learning**?
- How well does the proposed activity broaden the participation of **underrepresented groups**?
- To what extent will it enhance the **infrastructure** for research and education, such as facilities, instrumentation, networks, and partnerships?
- Will the **results be disseminated** broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to **society**?





# What Makes a Strong Proposal?

- New and original ideas (**what?**)
- Sound, succinct, detailed focused plan (**how?**)
- Preliminary data and/or feasibility calculations
- Relevant experience (**why me/us?**)
- Important & timely within field (**why now?**)
- Clarity concerning future direction (**so what?**)
- Well-articulated broader impacts



# NSF Proposal Preparation

- **ASK EARLY, ASK OFTEN**
- Read the paperwork (descriptions, solicitations etc.) with care; ask a Program Director for clarifications
- Contact the Program Director(s) to discuss your project: email with 1-2 page description and questions, call, visit
- Be familiar with programs and funded projects
  - Guide to Program:  
[http://www.nsf.gov/funding/browse\\_all\\_funding.jsp](http://www.nsf.gov/funding/browse_all_funding.jsp)
  - Award information, including abstracts:  
<http://www.nsf.gov/awardsearch>
- Know the audience for your proposal review - it **really** is a **competition!**



# NSF Proposal Submission

- Know and follow the **current** Grant Proposal Guide (GPG) - it changes! (data management, postdoc mentoring, bio.sketch contents ... *ad infinitum*)
- **Explicitly** address Intellectual Merit **and** Broader Impacts in both the Project Summary **and** Project Description
- Match and justify the budget to the scope of the proposed work - ask for what you need
- Submit proposals **before the last day/hour !!**
- Download your completed proposal back to you to check it's what you sent



# www.nsf.gov

The image shows a screenshot of the National Science Foundation (NSF) website homepage. The main navigation bar at the top includes links for FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT NSF, and FASTLANE. The 'FUNDING' link is circled in red. Below the navigation bar is a large banner image with the text 'Last Orbit Around a Black Hole' and a 'FULL STORY' button. The main content area features several news items with images and titles, such as 'VMI Researchers Uncover Life Cycle of Blue Crab Parasite' and 'A Material Long In 3-D'. A sidebar on the right contains a search bar and a 'FUNDING OPPORTUNITIES' section with a search form and a 'VIEW ALL FUNDING OPPORTUNITIES' button. A red circle highlights a smaller version of this sidebar on the main page.



# Get Involved

- Volunteer to be a reviewer and panelist
- Participate in NSF-funded events, workshops, meetings
- Proposals: send your best ideas to NSF
- Get to know your Program Directors
- Keep us informed of your accomplishments
- Work to support collaborative, interdisciplinary research
- Call our attention to things that need improvement
- Suggest strategies to go from basic research to production
- Serve as a program officer (“rotator”) or division director

For information on a particular MPS division and program:

<http://www.nsf.gov/home/mps>

**Contact NSF Program Directors for questions & suggestions**



# Some Useful Web Sites

- NSF: [www.nsf.gov](http://www.nsf.gov)
- MPS: <http://www.nsf.gov/home/mps>
- Guide to Program:  
[http://www.nsf.gov/funding/browse\\_all\\_funding.jsp](http://www.nsf.gov/funding/browse_all_funding.jsp)
- Award information: <http://www.nsf.gov/awardsearch>
- FastLane: <https://www.fastlane.nsf.gov>
- Broader impacts:  
<http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf>
- Data management plan:  
<http://www.nsf.gov/bfa/dias/policy/dmp.jsp>
- CAREER: <http://www.nsf.gov/CAREER>



# NSF Regional Grant Conference

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**Ask Early, Ask Often**

Nigel Sharp  
703-292-4905  
[nsharp@nsf.gov](mailto:nsharp@nsf.gov)