



**The National Science Foundation's
Directorate for Mathematical
and Physical Sciences (MPS)**

**CUNY Workshop on NSF Funding
Opportunities**

ALVIN THALER athaler@nsf.gov

1 February 2007



MPS at a Glance

- **Largest Directorate**
 - **25% of R&RA**
 - **20% of research proposals**
 - **FY07 Request: \$1.15B**
- **Nearly half of NSF's Large Facilities**
- **Responsible for the three Core University Disciplines: Chemistry, Math, and Physics ... as well as Astronomy and Materials**



MPS at a Glance - more

- **Science scope**

- **Space: “From Quarks to the Cosmos”**
- **Time: “From the Incredibly Short to Unimaginably Long”**
- **Character: “From the Very Abstract to Almost Ready for the Marketplace”**

- **Provides 40% of university federal funding in physical sciences**

- **More than 80% in Math and growing**
- **Federal steward for ground-based astronomy**



Numbers of People Involved in MPS Activities

	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
Senior Researchers	6,373	6,400	6,500
Other Professionals	1,954	1,950	1,900
Post-Doctorates	2,076	2,080	2,150
Graduate Students	7,042	7,100	7,200
Undergraduate Students	5,616	5,650	5,750
K - 12 Students	250	275	320
K - 12 Teachers	400	450	500
Total Number of People	23,711	23,905	24,320

MPS spends more than \$300 million annually on Graduate and Post-doctoral training!



FY 2006 Budget

- **Five Divisions**

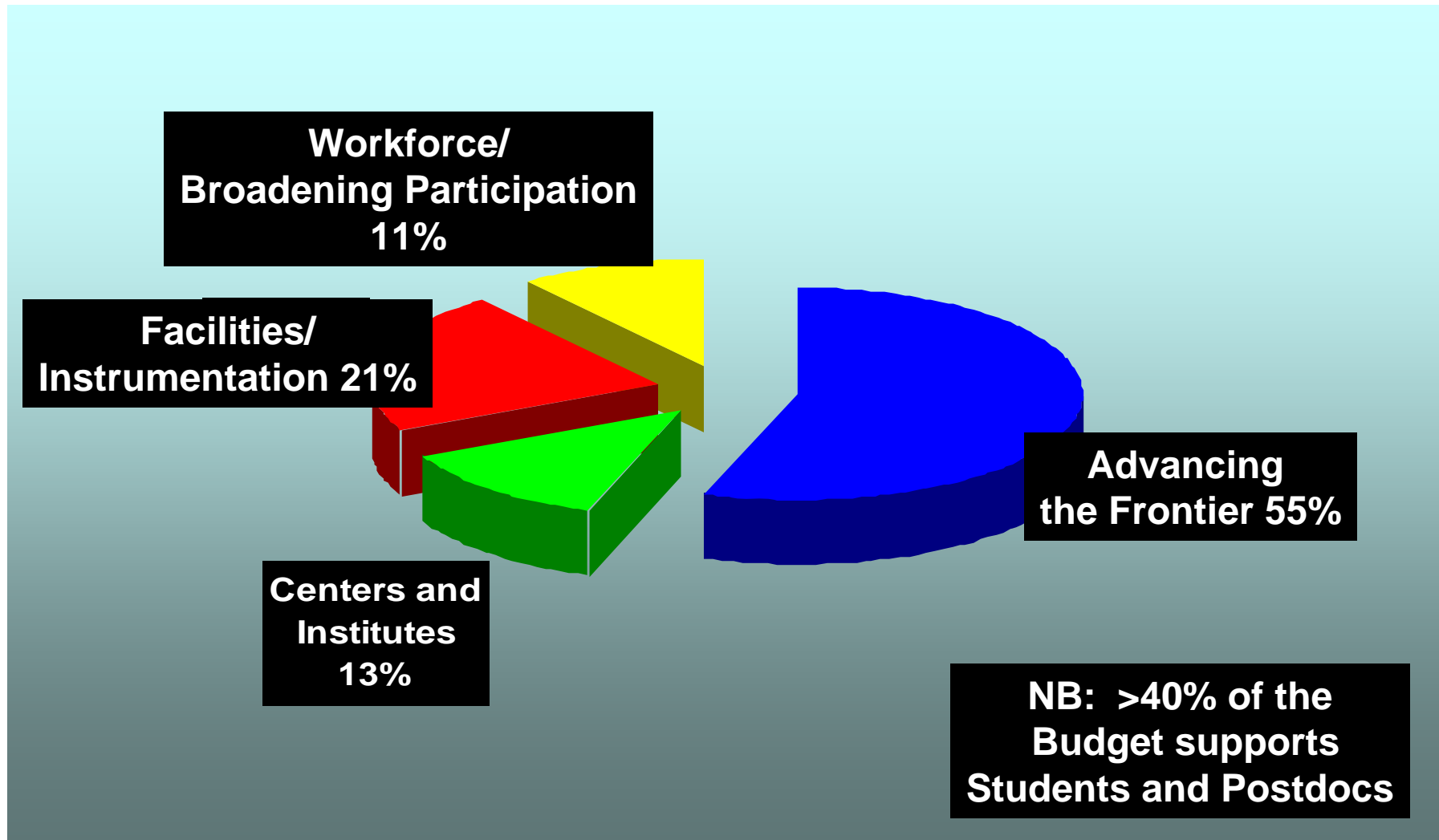
- **Materials (DMR): \$246M**
- **Physics (PHY): \$230M**
- **Math (DMS): \$200M**
- **Astronomy (AST): \$199M**
- **Chemistry (CHE): \$181M**

- **One Office**

- **Office of Multidisciplinary Activities: \$30M**
- **Facilitates Interdisciplinary Activities and champions Broadened Participation**



Distribution





MPS is Internationally Engaged

(More than 15% of the MPS Budget)

- **Partnerships & Large Scale Projects:**
 - e.g., ALMA, GEMINI, LIGO, LHC, ICECUBE, ...
- **Individual Investigators & Groups:**
 - e.g., **M**aterials **W**orld **N**etwork (~50 countries), **I**nternational **M**aterials **I**nstitutes, Cooperative Activities in CHE, Math Institutes, REU Sites, ...
- **Foreign Travel**
 - e.g., International Travel Grants, ...
- **Conferences & Workshops**



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**
- **Multi-agency partnerships: NSF, NASA, DOE**
- **NSF is steward of ground-based astronomy**



Chemistry (CHE)

Creating molecules and instruments that
are transforming the 21st century

- **Molecular basis of life processes**

- Learning and memory
- Chemical reaction networks and complexity

- **Sustainability**

- Next-generation energy sources
- Green chemistry for manufacturing
- Environmental molecular science

**CHE funds ~20% of
academic research
(NSF funds ~40%)**

- **Tools for discovery and innovation**

- Multi-scale chemical imaging and modeling
- Nanoscience
- Cyber-enabled chemistry



Materials Research (DMR)

Creating the materials that will transform the 21st century
The basic research which will provide the foundation for national prosperity - New tools make this possible

- **Fundamental understanding of materials only a few years to products**
- **Current hot areas within DMR**
 - **Nanoscale Science**
 - **Cyberscience/Cyberinfrastructure**
 - **Learning from biology**
 - **Global activities**
- **DMR accounts for ~50% of academic funding**
- **Connections within NSF and with DOE and NIH**



Mathematical Sciences (DMS)

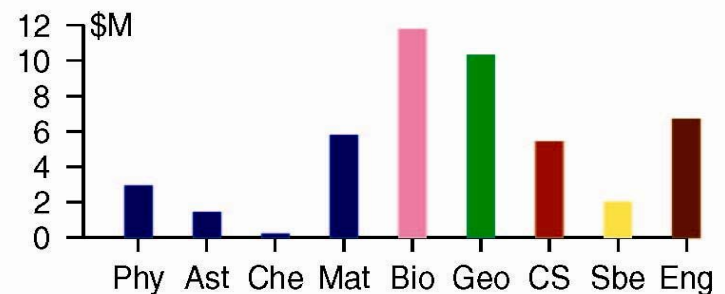
Investigating Patterns and Structures
and the Relationships between them

- **Large data sets:** Analyzing their complexity and patterns
- **Stochastic behavior:** From deterministic to probabilistic models
- **Multiscale phenomena:** Over several magnitudes of time & space

DMS provides 80% of the federal support for academic research in the mathematical sciences

- **DMS Partnerships**

- Joint awards with all NSF Divisions
- Joint PA's with NIH, DOE, DARPA





Physics (PHY)

Advancing the intellectual frontiers of physics from the discovery of new fundamental particles to understanding the biological cell and the cosmos

- **The Great Discovery Machine**

- **Physics of the Universe**
- **Renaissance in Atomic, Molecular, and Optical Physics**
- **Portfolio of discovery tools**

- **Stewardship**

- **Gravitational Physics (90%); AMOP, Theory (50%)**
- **Important sponsor of university faculty and students in nuclear and particle physics**

- **Connections**

- **Intra-agency; interagency; international**

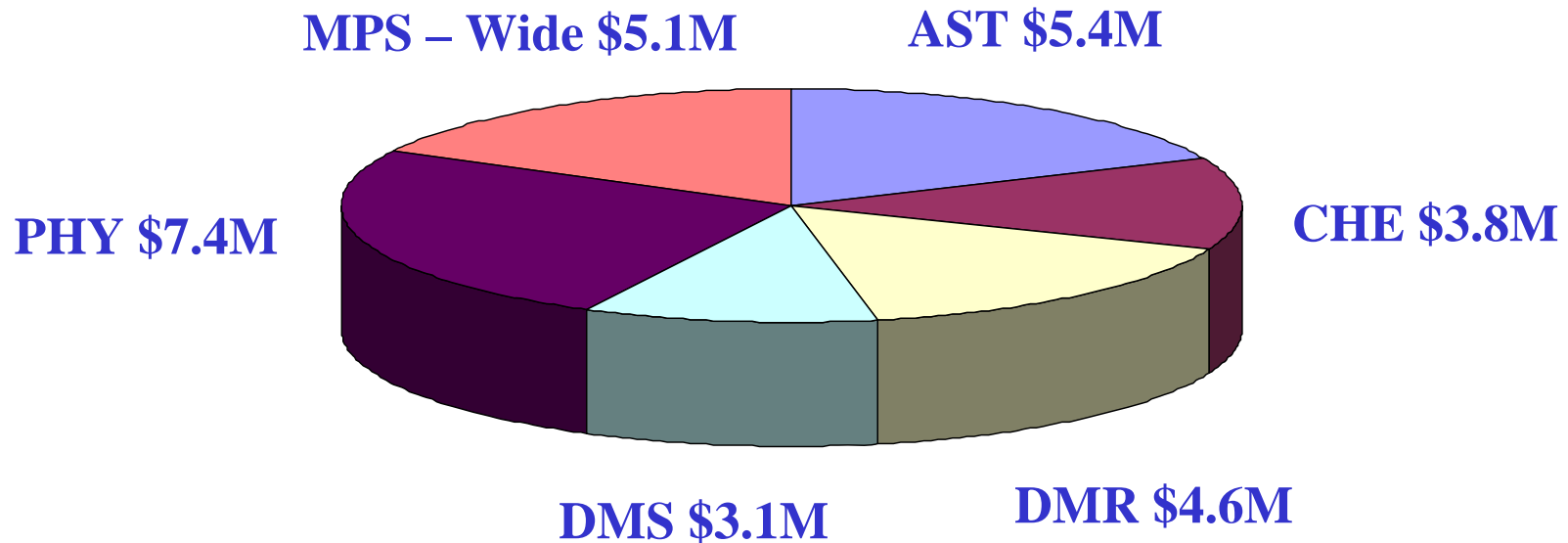


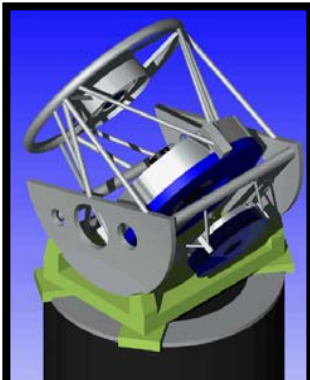
Office of Multidisciplinary Activities (OMA)

- **Catalyze and Support Emerging, Cross-Cutting Areas**
- **Champion Broadened Participation**
 - Strategy: Enable and Facilitate**
 - **Multidisciplinary, crosscutting projects**
 - **Partnerships**
 - **Diverse and globally competitive workforce**
 - **Innovative models for education**
 - **Broadly enabling infrastructure**
 - **New research support modalities**
 - **Integration of research and education**
 - ** OMA Does not accept or review proposals ****

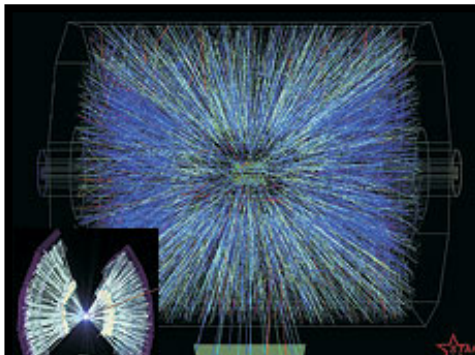


OMA Co-Investment with MPS Divisions – FY05





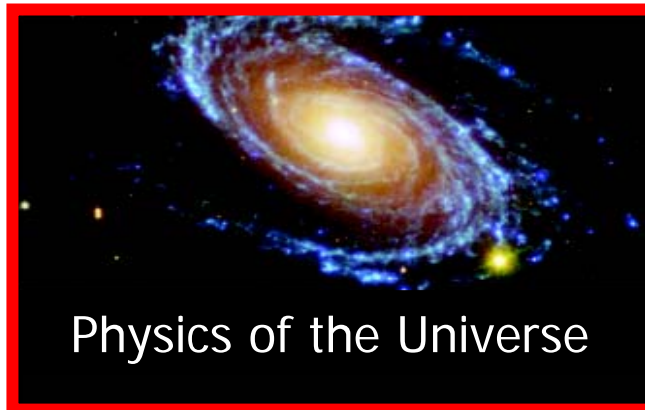
Dark Energy
\$3M/\$11M



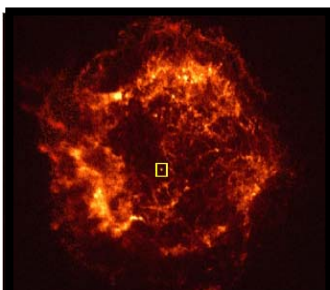
High Density and
Temperature Physics
\$1M/\$9M



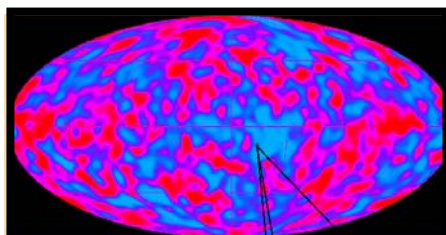
High Energy
Cosmic Rays
\$5M/\$3M/\$3M



Physics of the Universe



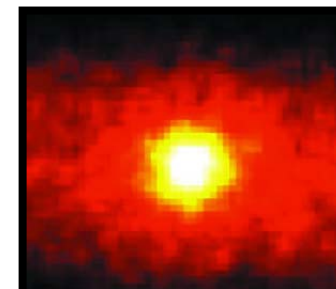
Origin of
Heavy
Elements
\$1M/\$9M



Birth of the
Universe using CMB
\$5M/\$4M/\$17M



Gravity
\$3M/\$6M



Dark Matter,
Neutrinos,
Proton Decay
\$5/\$3/\$3

February 2007

Research workshop





Broadening Participation

MPS Strategy

- **Robust MPS presence in Foundation-wide activities**
- **Research based; embedded throughout MPS**
- **Build capacity through partnerships**



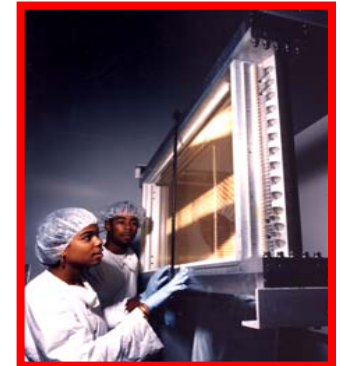
LA-STEM



PREM



LIGO



Hampton



Broadening Participation

The Greatest Threat to American Science

The Face of American Science



Is Not the Face of America



NSF at a Glance

- **Independent federal agency – 1950**
'to promote the progress of science; to advance the national health, prosperity, and welfare; to ensure the national defense...'
- **Mission includes support for all fields of fundamental science and engineering except for medical sciences**



NSF at a Glance - more

- **Annual budget ~ \$5.5 B; Source of ~20% of all federally funded basic research at America's colleges and universities**
- **No intramural research program**
- **Supports ~200,000 scientists, engineers, educators, and students annually**
- **NSF funded researchers have won > 160 Nobel Prizes**



The NSF Vision

Enabling the nation's future
through discovery, learning
and innovation



NSF's Strategic Goals

- ◆ **People** - A diverse, internationally competitive and globally-engaged workforce
- ◆ **Ideas** - Discovery across frontiers and connections in service to society
- ◆ **Tools** - Accessible, state-of-the-art information bases and shared tools

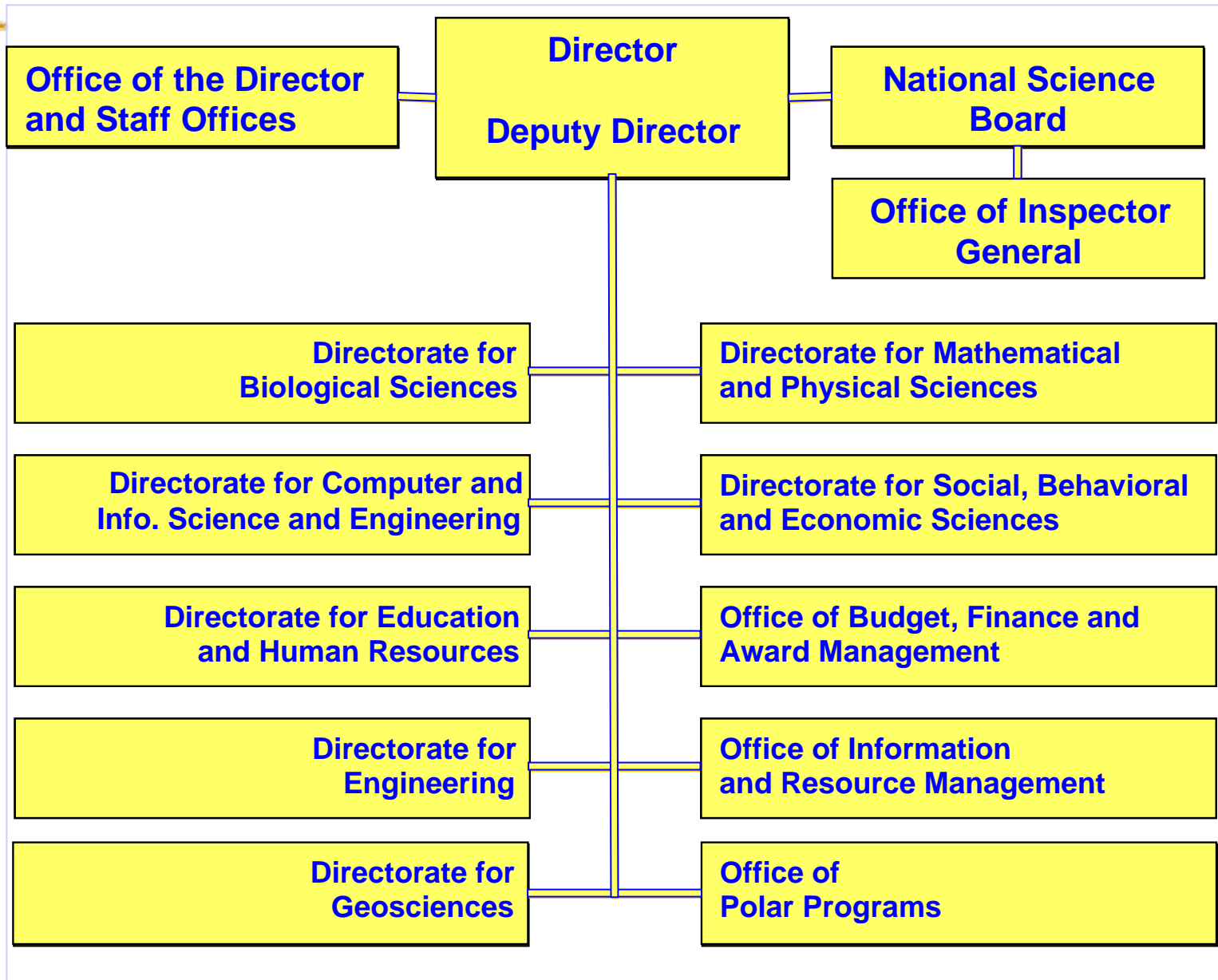


NSF's Review Criteria

- **Scientific Merit**
 - **how good is the stuff?**
- **Broader Impacts**
 - **so what?**

NSF invests in the best ideas from the most capable people, determined by competitive merit review

NSF Organizational Structure





Directorate for Mathematical and Physical Sciences

