



Opportunities for Young Researchers

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Director, Division of Mathematical Sciences
National Science Foundation

October 11, 2012
SACNAS Meetings



ABCs

- ◆ ATD
- ◆ BioMaPS
- ◆ CDS&E-MSS
- ◆ DMREF
- ◆ EXTREEMS QED
- ◆ FRG
- ◆ GRFP, IGERT, REU

MCTP
MSPRF
RTG
SaTC
UWP
SEES
E²





Outline

1. Opportunities at DMS
 2. Other opportunities at NSF
 3. Some New and Future Priorities
 4. Q & A
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Office of the Division Director

Division of Mathematical Sciences FY 2013

Administrative Staff



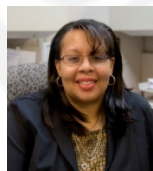
Sastry Pantula
Division Director



Henry Warchall
Deputy Division Director



Patricia Page
Program Support Manager



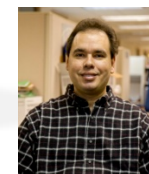
Sharon Alston
Operations Specialist



Jennifer Connell
Secretary



Onica Andrews
Program Specialist



Robert Cruz
Program Assistant



Antoinette Dedmon
Program Technology Analyst



Carmen Franceschi
Program Assistant



LaWanda Myers
Lead Program Assistant

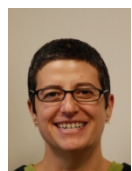


Camelita Sellars-Wright
Lead Program Assistant

Analysis



Wilfrid Gangbo
Program Director



Loredana Lanzani
Program Director



Edward Taylor
Program Director



Bruce Palka
Program Director

Topology & Geometric Analysis



Joanna Kania
Bartoszynska
Program Director



Noel Brady
Program Director



Linda Chen
Program Director



Christopher Stark
Program Director

Applied Mathematics



Pedro Embid
Program Director



Annalisa Calini
Program Director



James Curry
Program Director



Michael Steuerwalt
Program Director

Algebra & Number Theory



Tara Smith
Program Director



Tie Luo
Program Director

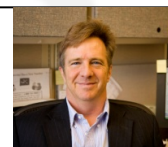


Andrew Pollington
Program Director



Eric Sommers
Program Director

Computational Mathematics



Leland Jameson
Program Director

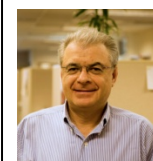


Junping Wang
Program Director



Dalin Tang
Program Director

Statistics



Gabor Szekely
Program Director



Haiyan Cai
Program Director



Nandini Kannan
Program Director



Jia Li
Program Director

Probability, Combinatorics and Foundations



Tomek Bartoszynski
Program Director



Qing Xiang
Program Director

Mathematical Biology



Mary Ann Horn
Program Director

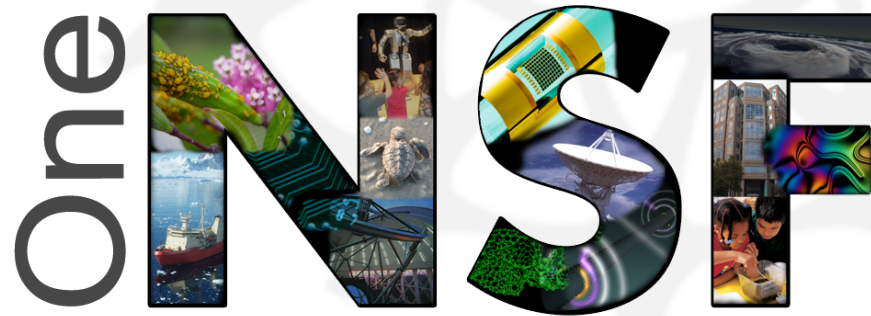


Anthony Macula
Program Director

Infrastructure



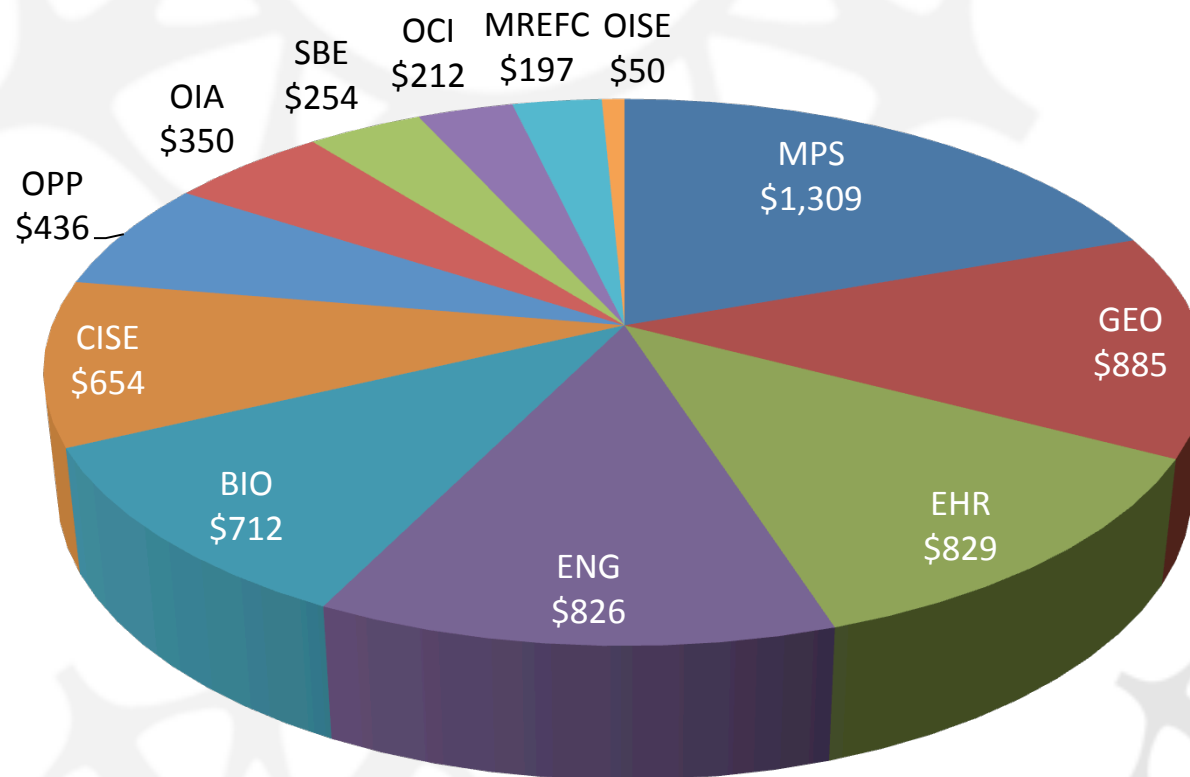
Jennifer Pearl
Program Director



- CEMMSS
- CIF21
- E²
- INSPIRE
- I-Corps
- SaTC
- SEES

- Transform the Frontiers
- Innovate for Society
- Perform as a Model Organization

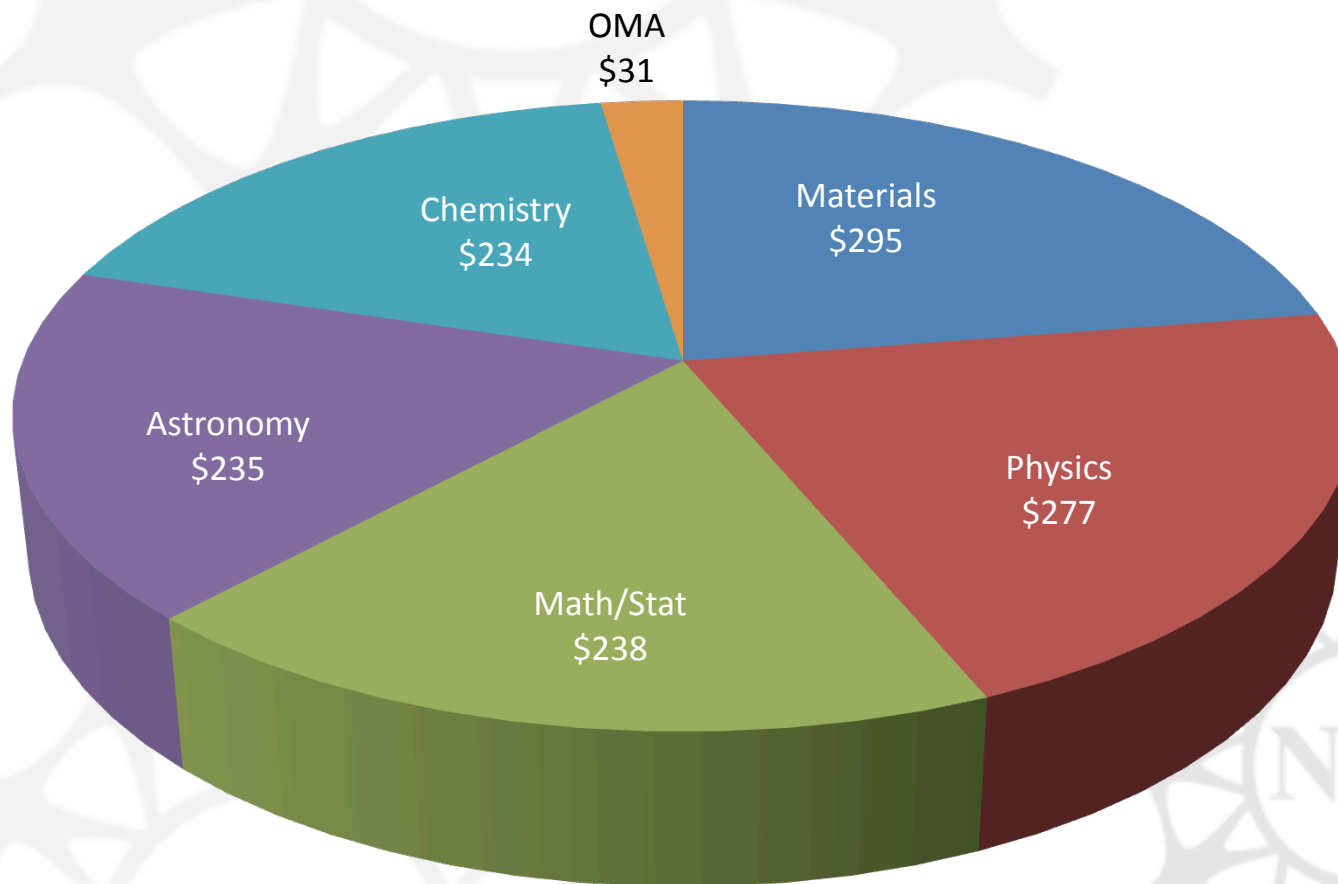
2012 NSF Budget (\$M)

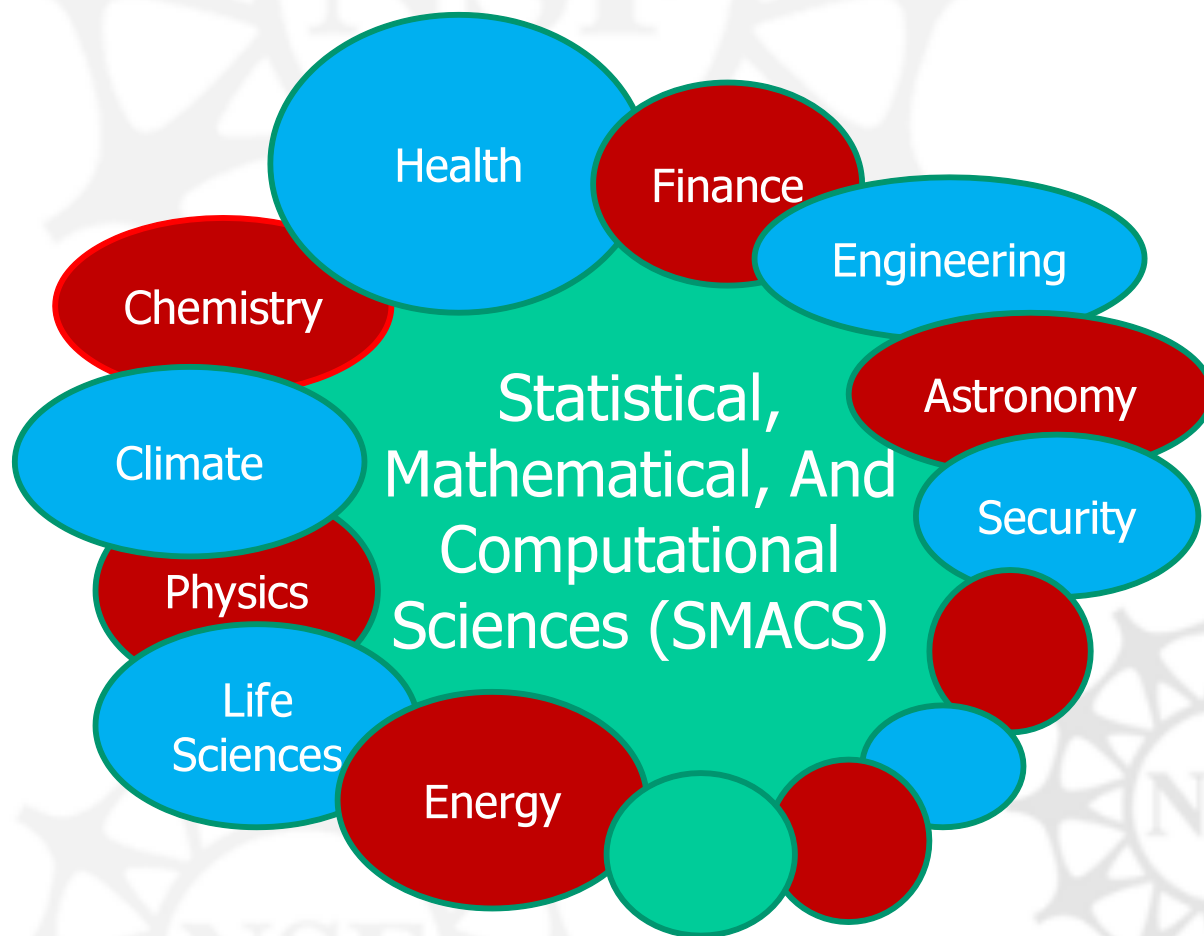


BIO: Biological Sciences
CISE: Computer & Information Science & Engineering
EHR: Education and Human Resources
ENG: Engineering
GEO: Geosciences
MPS: Mathematical and Physical Sciences

MREFC: Major Research Equipment Facilities & Construction
OCI: Office of Cyberinfrastructure
OIA: Office of Integrative Activities
OISE: Office of International Science & Engineering
OPP: Office of Polar Programs
SBE: Social, Behavioral & Economic Sciences

2012 MPS Budget (\$M)





Mathematical Sciences (DMS) FY 2012

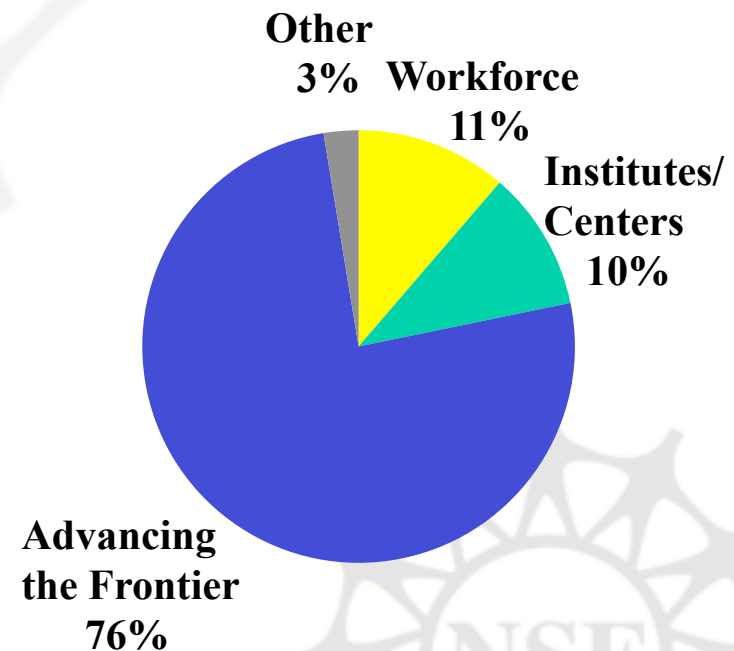
Analysis / Foundations	ANTC	Geometry Topology	Applied Math	Bio / Comp Math	Probability Statistics	Workforce	Institutes
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- “Core business:” single investigator and group proposals through targeted solicitations
Covers the entire mathematical and statistical spectra

- Institutes: 8 within US, support 3 others internationally
Visitors to long term programs, workshops

- Workforce: responding to a major challenge
 - RTG, MCTP training grants
 - Postdoctoral fellowships
 - Research for Undergraduates

In addition to the fundamental research in mathematical and statistical 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.



Take Advantage of...

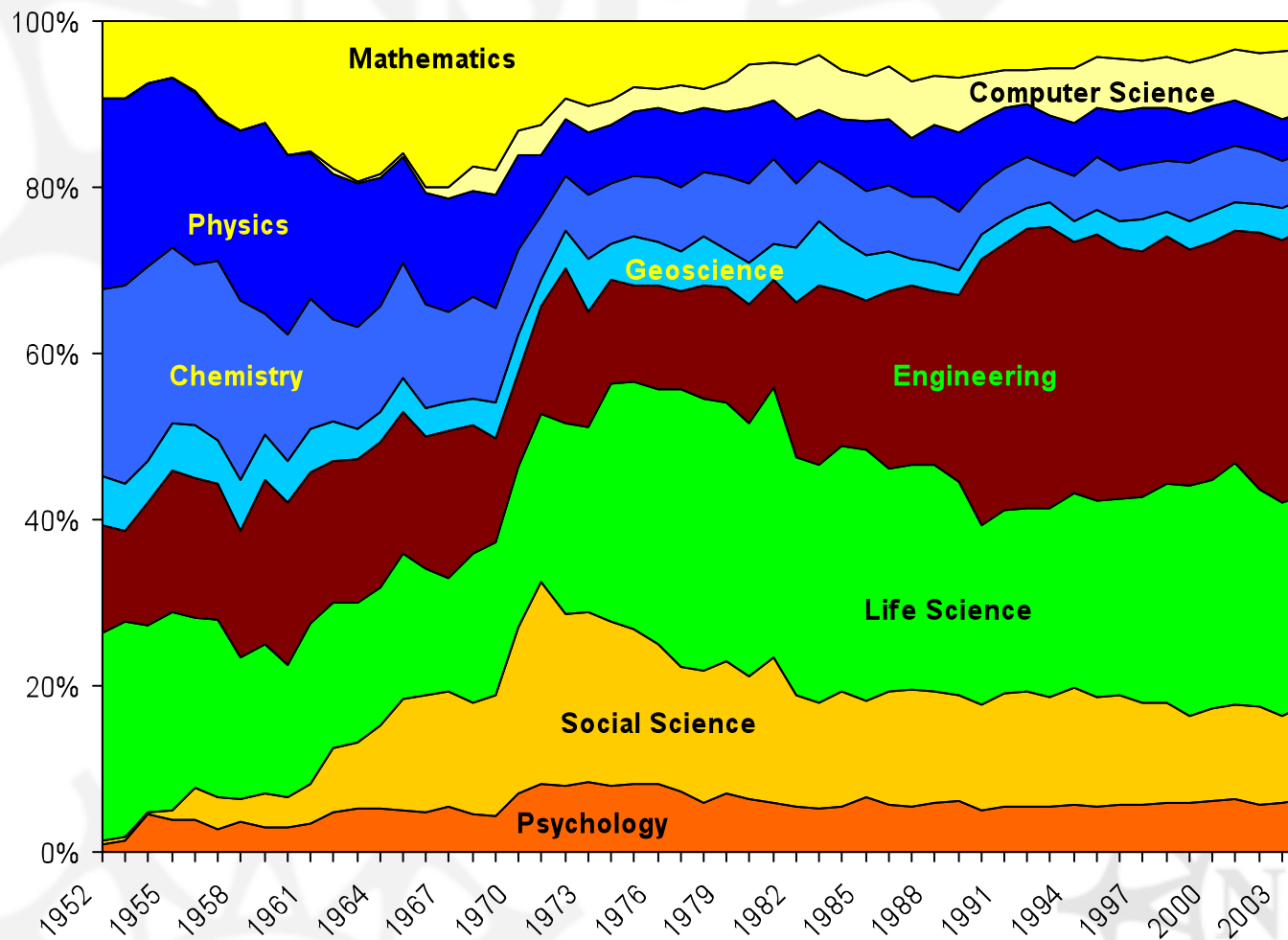
- ◆ If you are an undergraduate:
 - REU Sites
 - SIBS
 - Graduate Research Fellowships
 - Institutes
 - RTG
 - MCTP
 - Conferences



REU Sites

- ◆ http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5044
- ◆ **Bard College**
[Summer Research in Mathematics & Computation](#)
- ◆ **Primary:** Lauren Rose mathreu@bard.edu
- ◆ **Research Topics/Keywords:** algebraic combinatorics and discrete geometry, graph theory and coding theory, computational neuroscience, mathematical ecology
[Abstract of Award](#)

GRF Awards by Discipline



NSF-Wide Graduate Research Fellowship Program

Year	Total # of GRF Applications	# Of Math Science Applications	% of Math Science Applications	Total # of GRF Awards	# of Math Science Awards	% of Math Science Awards
2012	12,669	453	3.6%	2,000	75	3.8%
1952	2,418	259	11%	532	52	10%
1960	3,433	546	16%	555	100	18%
1970	5,733	880	15%	1,015	156	15%
1980	2,911	222	8%	414	28	7%
1990	5,207	382	7%	870	67	8%
2000	4,393	203	5%	848	34	4%
2010	12,103	386	3%	2,051	63	3%
2011	12,719	520	4%	2,077	83	4%

Tips for Applicants

- ◆ Amstat News; SIAM News
- ◆ <http://magazine.amstat.org/blog/2012/10/01/masters-oct-12/>
- ◆ Intellectual Merit
- ◆ Broader Impact
- ◆ Previous Research Experience
- ◆ Three letters of reference
- ◆ Make it easy for the reviewers

Institutes

1. American Institute of Mathematics*
2. Institute for Advanced Study*
3. Institute for Computational and Experimental Mathematics
4. Institute for Mathematics and its Applications
5. Institute for Pure and Applied Mathematics
6. Mathematical Biosciences Institute
7. Mathematical Sciences Research Institute
8. Statistical & Applied Mathematical Sciences Institute
9. National Institute for Mathematical and Biological Synthesis
10. Banff International Research Station
11. Institute des Hautes Études Scientifiques
12. Mathematisches Forschungsinstitut Oberwolfach
13. Science Across Virtual Institutes (SAVI)

RTG, MCTP, Conferences

- ◆ Research Training Groups
- ◆ Mentoring Through Critical Transition Points
- ◆ Support a large number of Conferences
 - Support specifically for
 - Students
 - Postdocs
 - Women and underrepresented minorities

If you are a graduate student

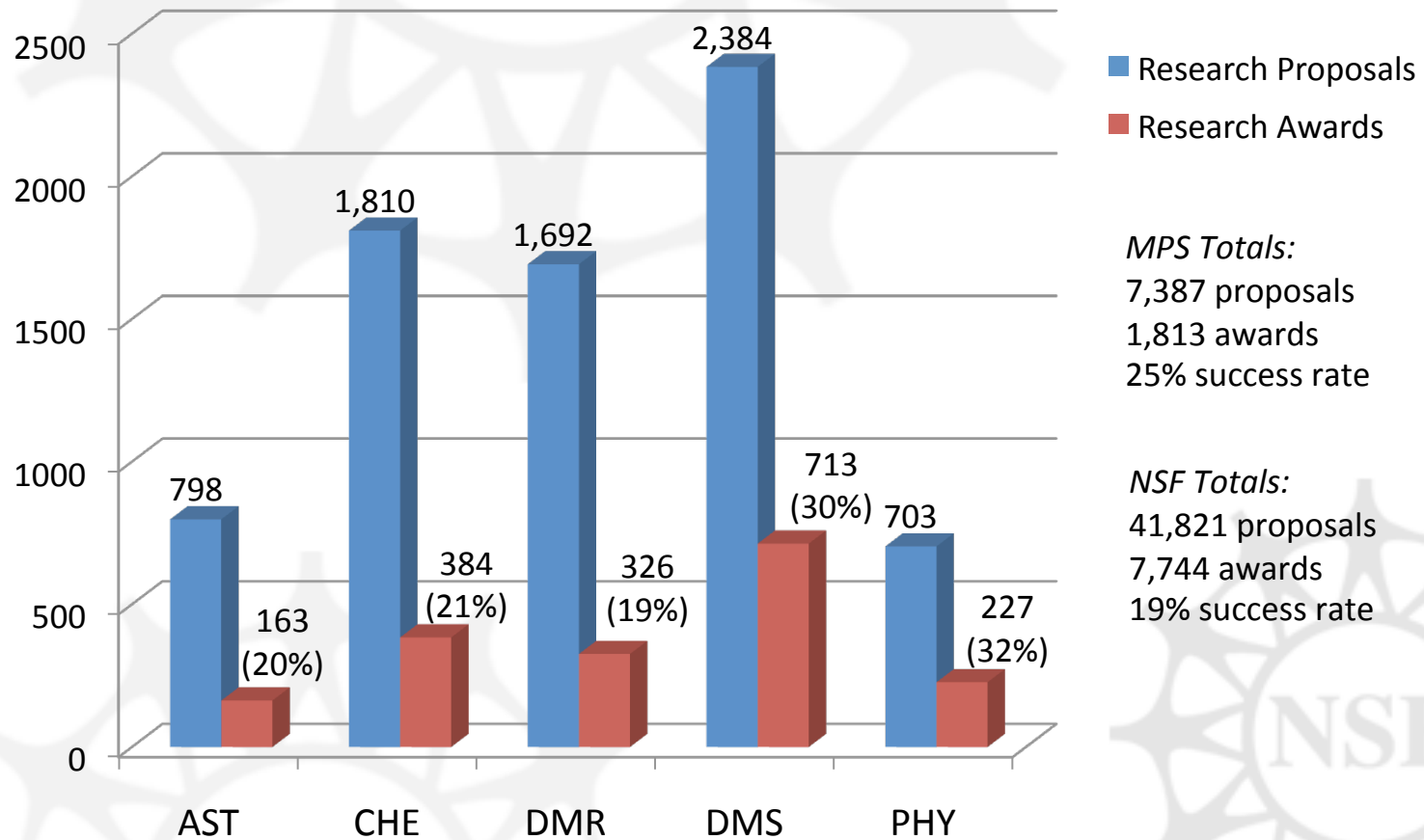
- ◆ RTG, MCTP
- ◆ Conferences- Network!
- ◆ Postdoctoral Research Fellowships
 - MSPRF
 - Institutes
 - Universities
 - International

If you are a postdoc or junior faculty...

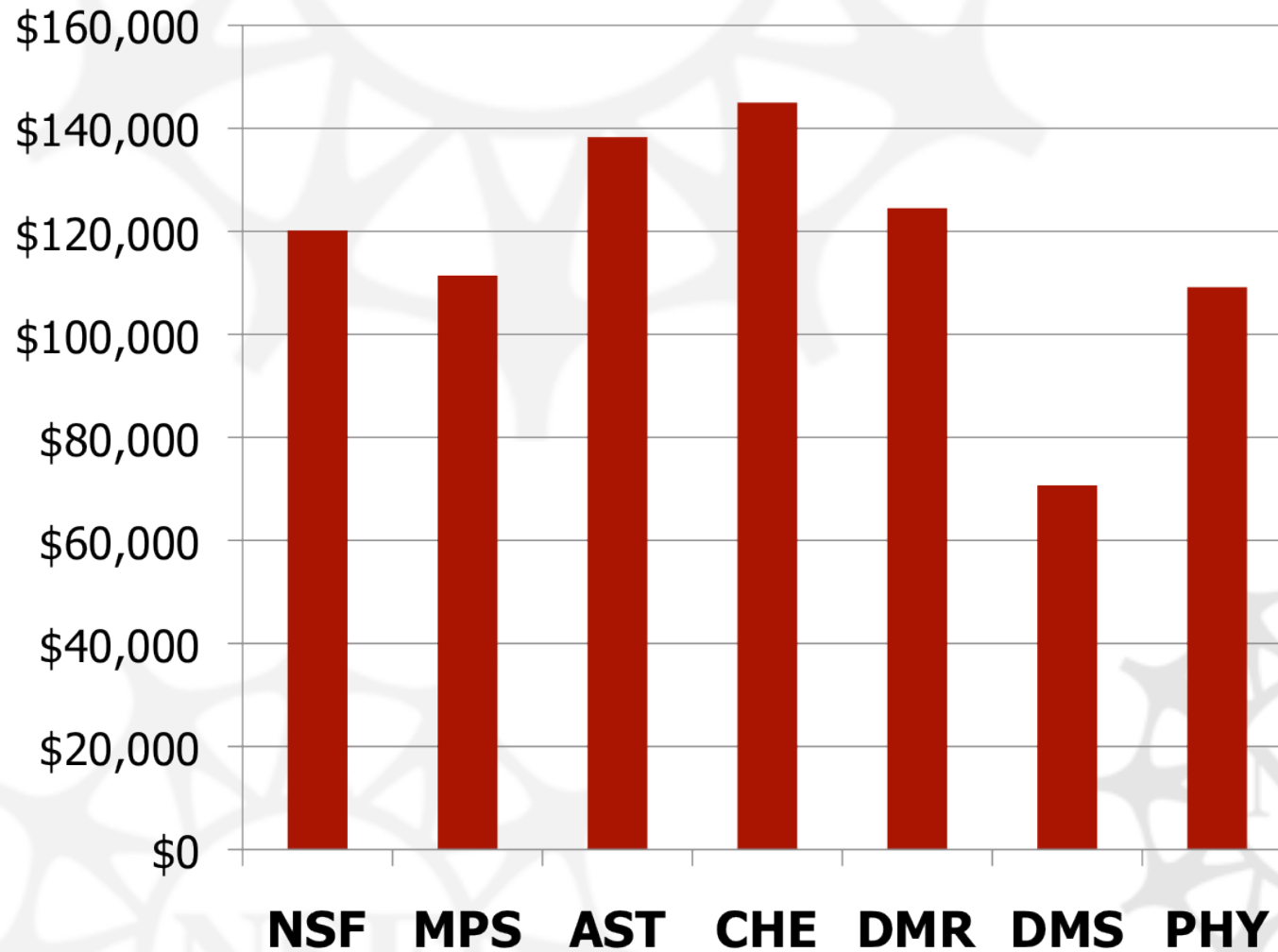
- ◆ RTG, MCTP
- ◆ Institutes
- ◆ Conferences
- ◆ CAREER grants
- ◆ Get Mentoring!



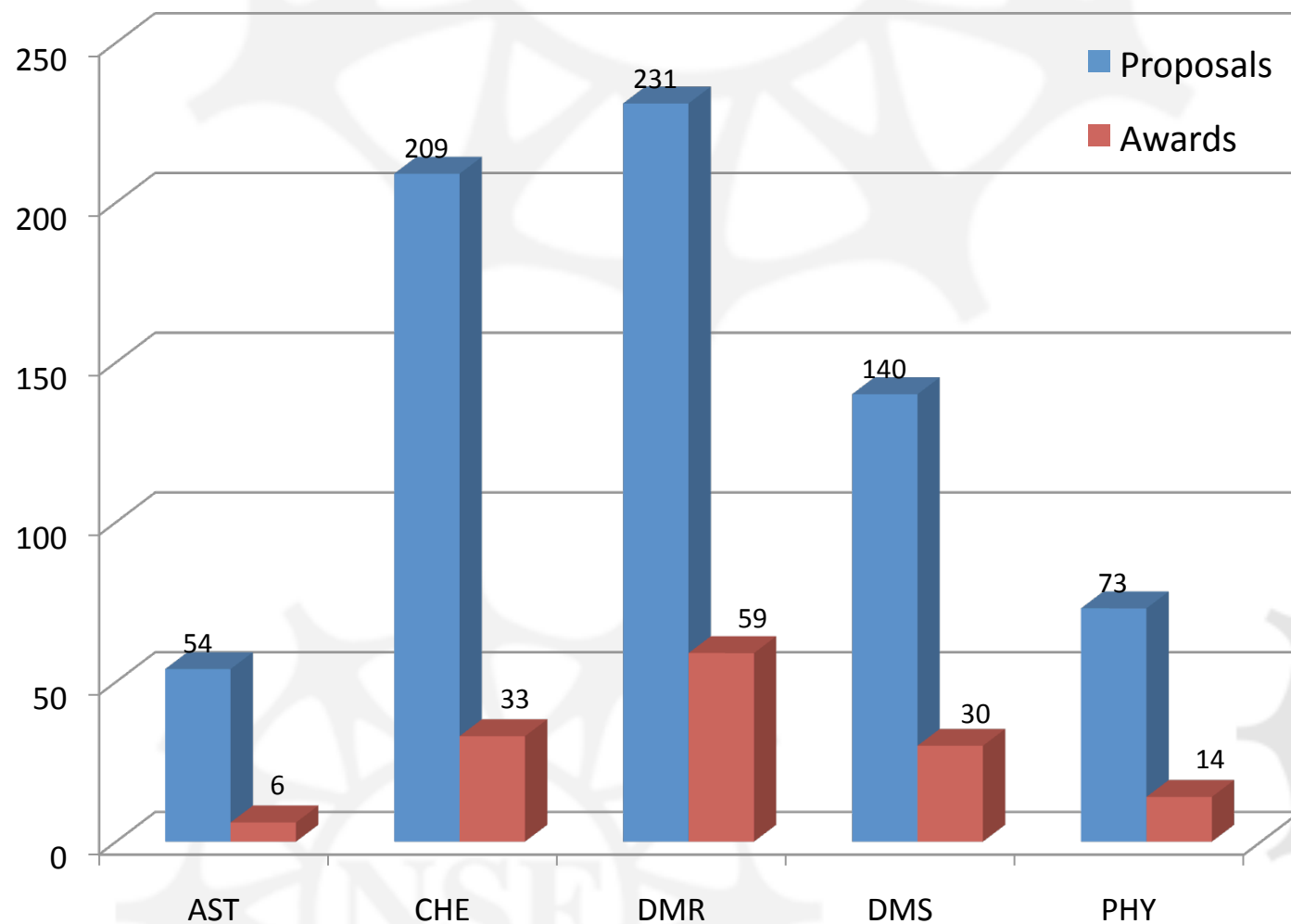
Funding Rates (2011)



Median Annualized Award Size Comparison (2011)



2011 CAREER Awards in MPS



MPS totals:
707/142/20%

NSF totals:
2748/490/18%

Multidisciplinary/Infrastructure

- ◆ Foundations of Data and Visual Analytics (CISE, DHS)
- ◆ Algorithms for Threat Detection (DOD/DTRA)
- ◆ Collaboration in Mathematical Geoscience (GEO)
- ◆ Research Networks
- ◆ Joint Initiative in Mathematical Biology (NIH/NIGMS)
- ◆ Secure and Trustworthy Cyberspace (SaTC)
- ◆ Big Data – Core Technologies
- ◆ Conferences (CBMS, SIAM, AMS, etc.)
- ◆ Instrumentation
- ◆ One-of-a-kind proposals, etc.

Budget Priorities

- ◆ Core Programs
- ◆ CDS&E-MSS
- ◆ Big Data
- ◆ CEMSS/Materials Genome Initiative
- ◆ BIOMaPS
- ◆ SEES/Hazards
- ◆ E²

Cyber Infrastructure Framework for 21st Century Science and Engineering (CIF21)

- ◆ Cyberinfrastructure to transform research, innovation, and education

- ◆ Major components

- Computational and Data-enabled Science
- Core Technologies, Tools, Algorithms
- Big Data Projects
- Workforce Development
- Partnerships: internal/external



MPS: \$19.5M in
FY 2013

CDS&E in Mathematical and Statistical Sciences

- ◆ Sophisticated computational/statistical modeling for simulation, prediction, and assessment in computation-intensive and data-intensive scientific problems.
- ◆ State-of-the-art tools and theory in statistical inference, statistical learning, and data mining for knowledge discovery from massive, complex, and dynamic data sets.

CDS&E-MSS

- ◆ Study of mathematical, statistical, and stochastic properties of networks.
- ◆ Development of numerical, symbolic, and statistical theory and tools to uncover and study analytical, topological, algebraic, geometric, and number-theoretic structures relevant for large-scale data acquisition, data security, and cybersecurity.

Big Data Core Technologies

- ◆ Computational models and the underlying mathematical and statistical theory needed to capture important performance characteristics of computing over massive data sets;
- ◆ Computational, mathematical and statistical techniques for modeling physical, engineering, social or other processes that produce massive data sets;

Press Release 12-187 (Oct 3, 2012)

- ◆ ***NSF invests nearly \$15 million in new Big Data research projects, and the start of an idea-generating challenge***
- ◆ Distribution-based Machine Learning for High-dimensional Datasets
- ◆ Develop new statistical and algorithmic approaches to natural generalizations of a class of standard machine learning problems.

IGERT-CIF21

- ◆ Partnerships between **computational, mathematical and statistical**, and computer and information sciences on the one hand and the science and engineering domains on the other, that drive interdisciplinary research in cyberinfrastructure (software, data and visualization, networks, advanced computational infrastructure, etc.);

EXTREEMS-QED

- ◆ **Research:** CDS&E-centered undergraduate research and hands-on activities.
- ◆ **Education and Training:** Enhancements to the undergraduate curriculum that train math/stat majors in CDS&E.
- ◆ **Faculty Professional Development or Outreach.** CDS&E-centered training activities for college faculty or K-12 teachers.

Secure and Trustworthy Cyberspace (SaTC)

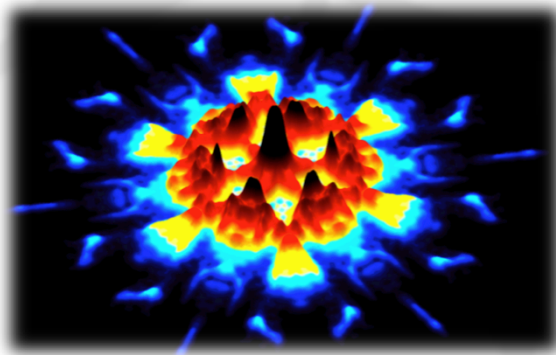
MPS: \$2.0M in
FY 2013

- Cross-foundation partnership to build a cybersecure society
- Produce high-quality digital systems and a well-trained cybersecurity workforce
- *Strategic Plan for the Federal Cybersecurity Research and Development Program*
- Comprehensive National Cybersecurity Initiative (CNCI)



Cyber-Enabled Materials Manufacturing and Smart Systems(CEMMSS) **\$50M/MPS**

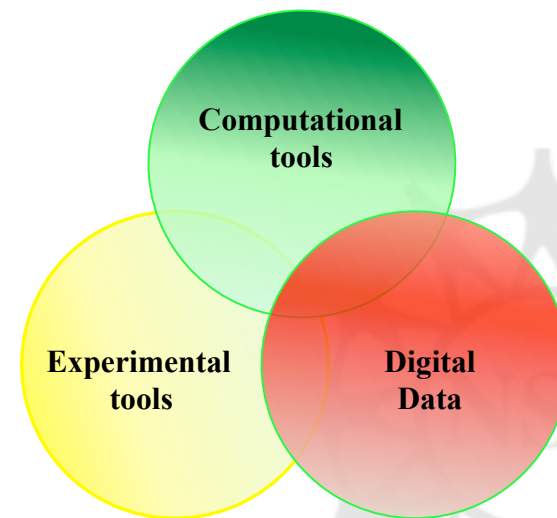
Topological Insulators



- ◆ Partnership with ENG and CISE
- ◆ Advanced Manufacturing
- ◆ DMREF

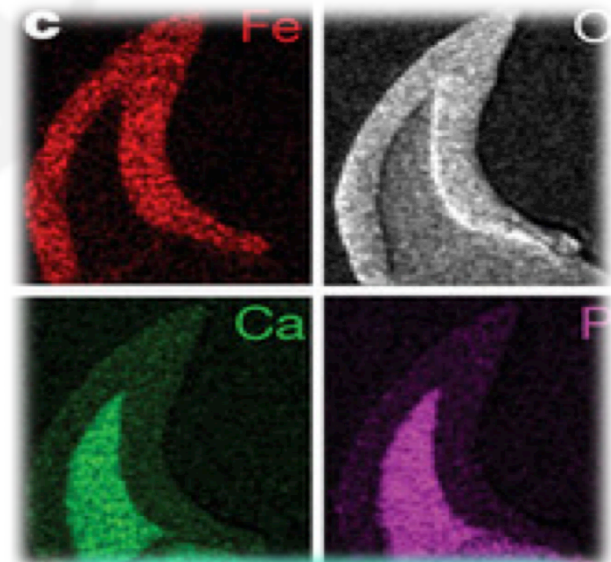
- Fundamental research for discovering, modeling, making, optimizing and manufacturing with new materials and material systems

Materials Innovation Infrastructure



Research at the Interface of Biological, Mathematical, and Physical Sciences (BioMaPS)

- ◆ Adaptive network models
- ◆ Biological design strategy for better composite materials
- ◆ Computational, Mathematical and Statistical modeling

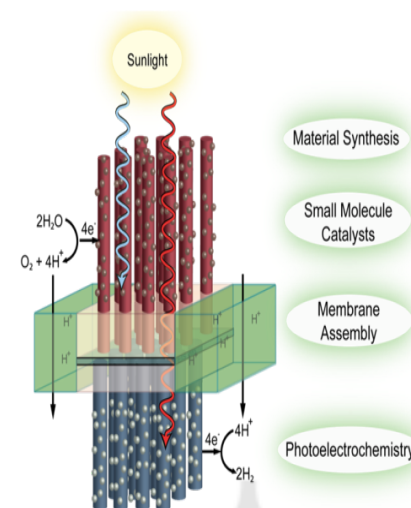


MPS: \$11.6M in
FY 2013


Science, Engineering, and Education for Sustainability (SEES)

To advance science, engineering, and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being

- Institutes
- Research Networks
- Math Geosciences
- Decadal and Regional Climate Prediction using Earth System Models (EaSM)
- Hazards/SEES



MPS: \$27.2M in
FY 2013



MATHEMATICAL AND STATISTICAL



CHALLENGES FOR SUSTAINABILITY



NSF

What to apply for?

- ◆ Individual PI grants- During Fall
- ◆ CAREER grants- July
- ◆ Number of Multidisciplinary grants!!!
 - CREATIV; SAVI; NIGMS; CDS&E-MSS, SaTC, Hazards/SEES, ATD, BIG DATA
- ◆ Postdoctoral Fellowships
- ◆ Graduate Research Fellowships
- ◆ Conference support
- ◆ Undergraduate research; REU sites!
- ◆ RTG, FRG, MCTP, EXTREEMS QED

DMS @ NSF...

- ◆ a key to innovation
- ◆ a catalyst for discoveries
- ◆ a home for diversity

Some Useful Web Sites

- NSF: www.nsf.gov
- MPS: <http://www.nsf.gov/dir/index.jsp?org=MPS>
- Guide to Program: 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/funding/pgm_summ.jsp?pims_id=503214