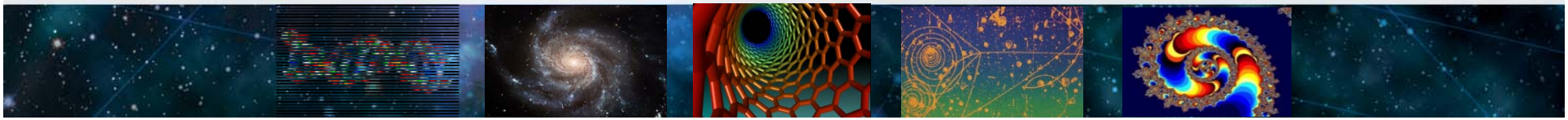
Mathematical and Physical Sciences Advisory Committee (MPS AC)

F. Fleming Crim

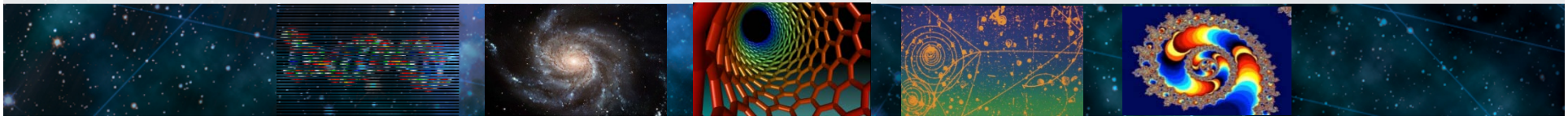
Assistant Director

January 14, 2014



Twin Primes Conjecture

A Science Hors d'Oeuvre



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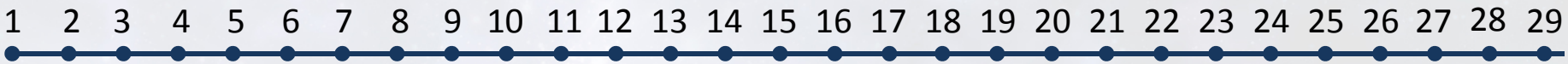

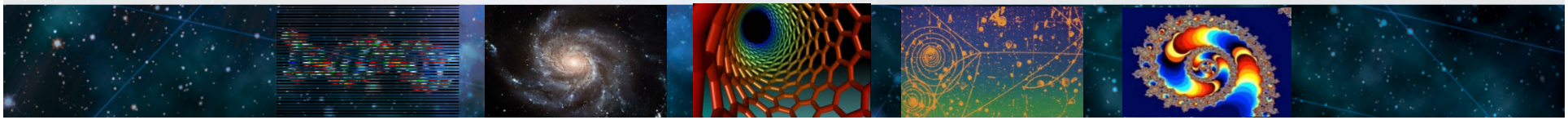

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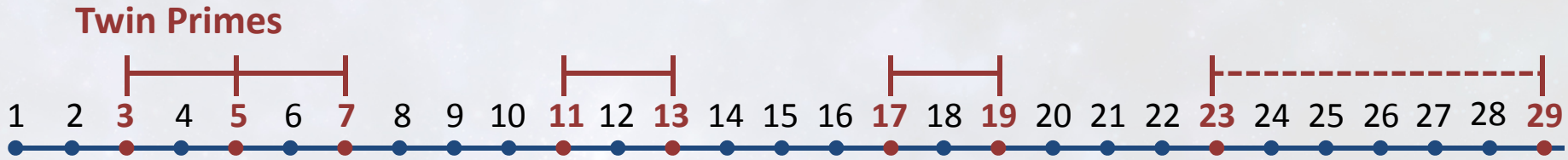
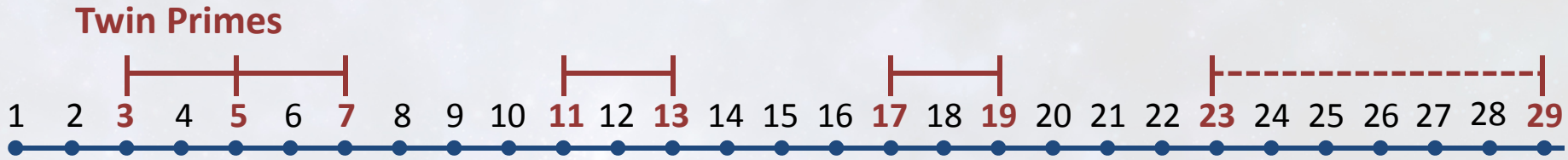


The Conjecture: There are an infinite number of twin primes.

Twin Primes Conjecture



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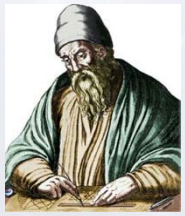


Euclid

Great Wall
210 BC

Fall of Rome
476

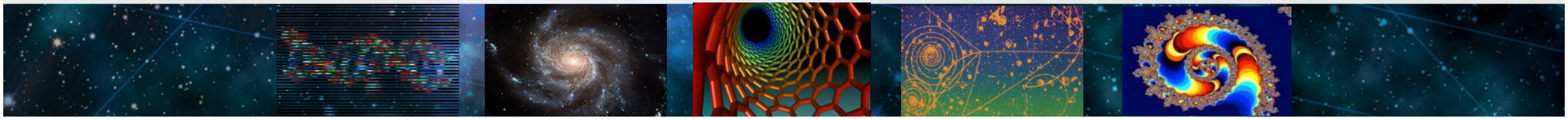
Printing Press
1440

Declaration of Independence
1776

NSF
1950

Yitang Zhang
2013

300 BC 0 300 600 900 1200 1500 1800 2100 AD



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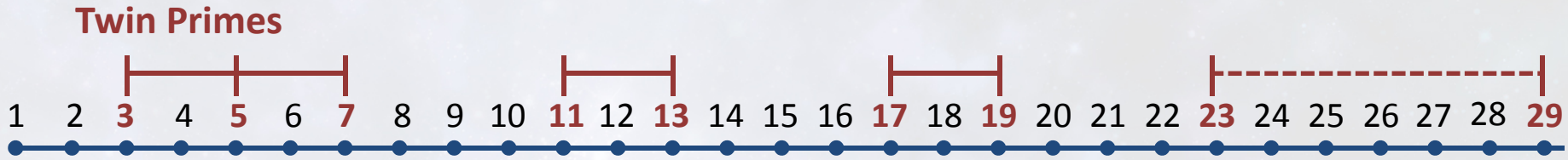


The Conjecture: There are an infinite number of twin primes.

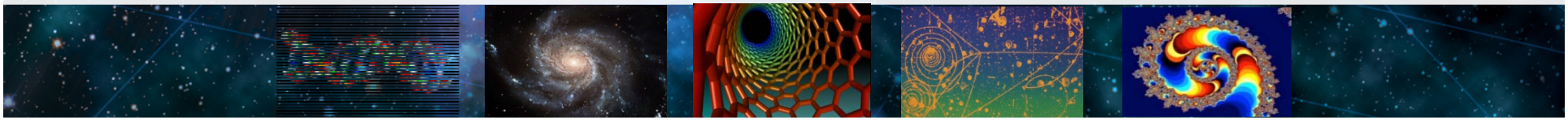
There are an infinite number of primes with bounded gaps (≤ 70,000,000)

Yitang Zhang
2013

Built on work by DMS-supported researchers Goldston, Iwaniec, and others

Daniel Goldston
San Jose State University
(DMS support 1987 –)

Henryk Iwaniec
Rutgers University
(DMS support 1989 –)



Twin Primes Conjecture

PolyMath massively collaborative online mathematical projects

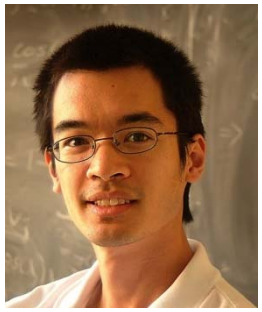
Bounded gaps between primes

This is the home page for the Polymath8 project, which has two components:

- Polymath8a, "Bounded gaps between primes", was a project to improve the bound H=H_1 on the least gap between consecutive primes that was attained infinitely often, by developing the techniques of Zhang. This project concluded with a bound of H = 4,680.
- Polymath8b, "Bounded intervals with many primes", is an ongoing project to improve the value of H_1 further, as well as H_m (the least gap between primes with m-1 primes between them that is attained infinitely often), by combining the Polymath8a results with the techniques of Maynard.

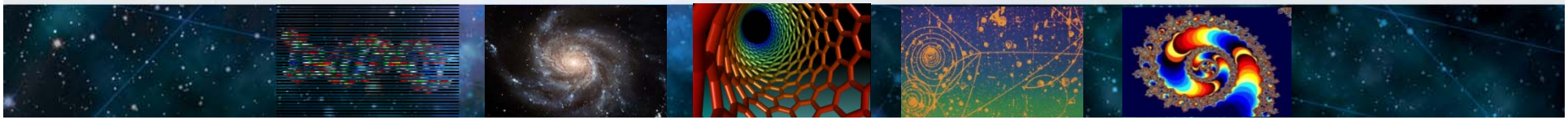
Contents [hide]

Project Leader



Terence Tao
UCLA
(DMS support 1997 –)

NSF Waterman Award (2008)



Twin Primes Conjecture

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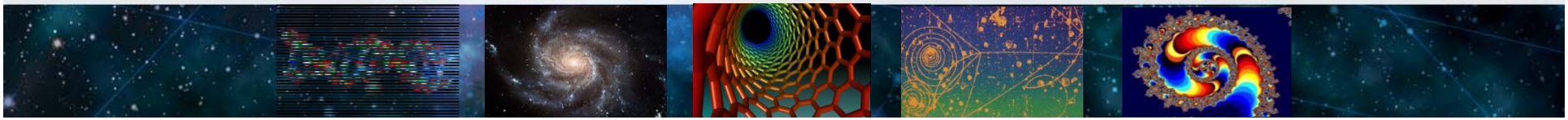
Contents [hide]

April 17, 2013	70,000,000
June 4	5,000,000
June 6	388,000
June 15	61,000
June 23	12,006
July 20	5,414
July 27	4,680
Oct 11	4,422
Nov 19	600
Dec 4	330
Jan 6, 2014	270

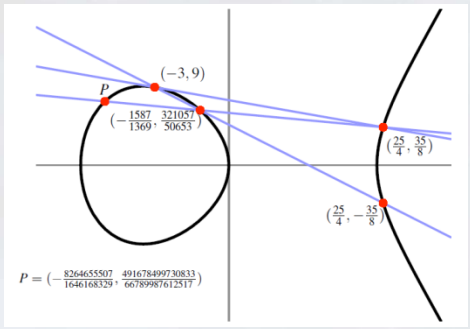


Twin Primes Conjecture

“Broader Impacts”

Fundamental questions in mathematics and physics

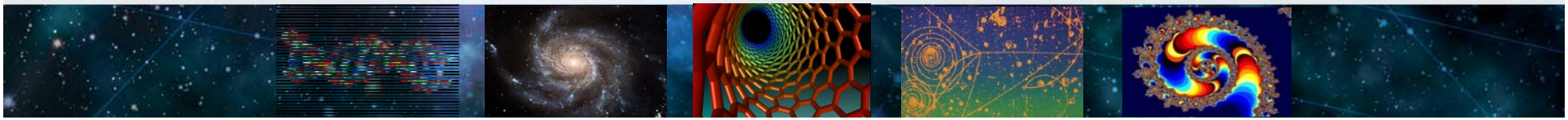
- Random matrix theory
- Number theory
- Statistical physics



Cryptographic Algorithms

The distribution of prime numbers is an evergreen topic that has paid off repeatedly.

Special thanks to Eric Sommers and Hank Warchall



Some Recognition for MPS Researchers

Chemistry Nobel Laureates

Warshel

Karplus

Levitt

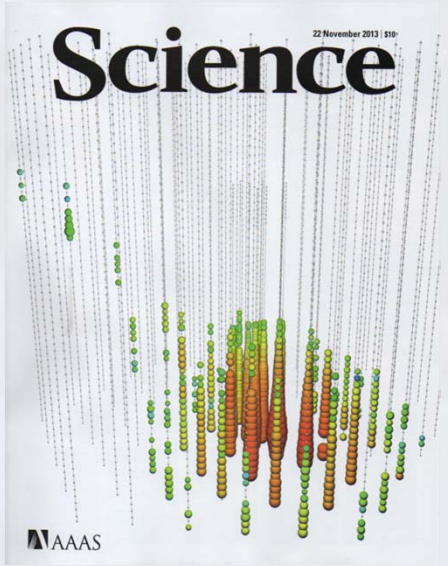
Six MPS-Supported MacArthur Fellows

Baran, Fennie, Katabi, Murphy, Rey, Seager

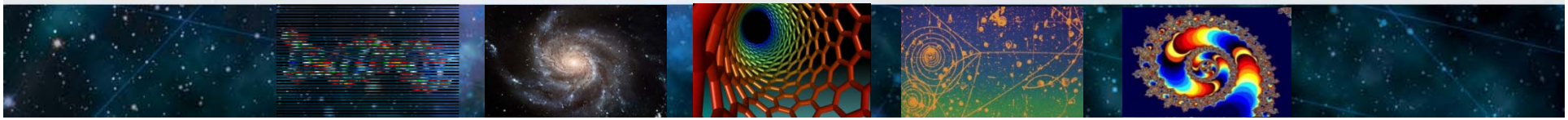
Eight MPS-Supported Medal of Science Recipients

Bard, Faber, Gates, Golomb, Goodenough, Hawthorne, Hood, Mazur

Ice Cube



Physics World
"Discovery of the Year"



Personnel and Plans

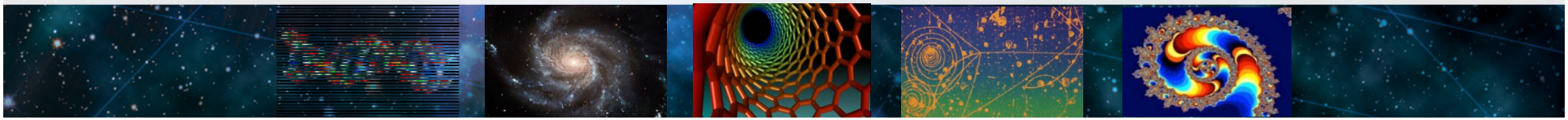
Budget

Program Updates

Facilities

Agenda

Focus on Discussion



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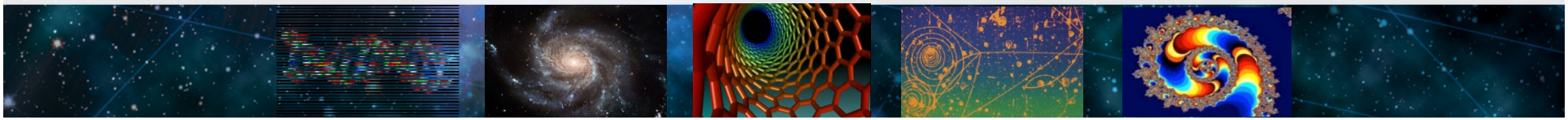


MPS Advisory Committee

Chair

Juan de Pablo
University of Chicago

Quarterly Meetings

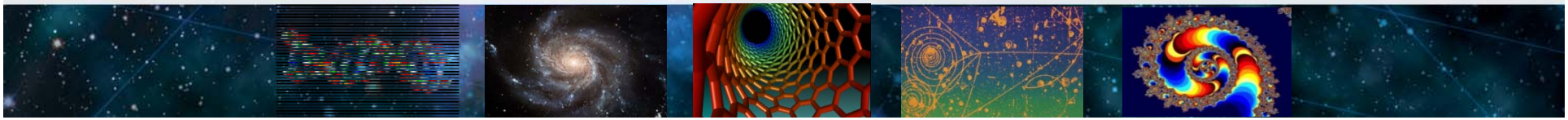
(3 virtual, 1 at NSF)

Next Meeting at NSF
April 3-4, 2014

Rely on Subcommittees

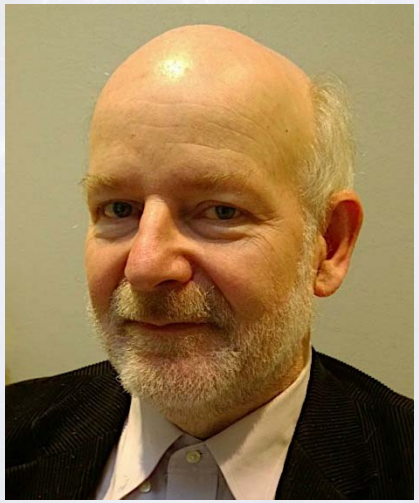
(breadth, expertise)

Goal: Efficient meetings and good advice



Division Leadership and Front Office Personnel

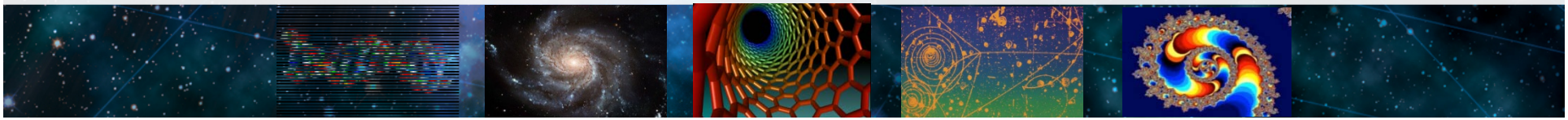
Brad Keister
PHY DDD



Michael Vogellius
DMS DD
(January 27, 2014)

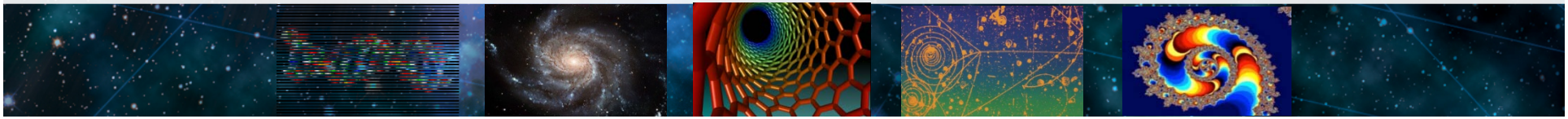
Holly Brown
Science Assistant

Carol Bessel
Budget Officer
(on detail CHE)



New Home for NSF
(2017)

Alexandria, VA



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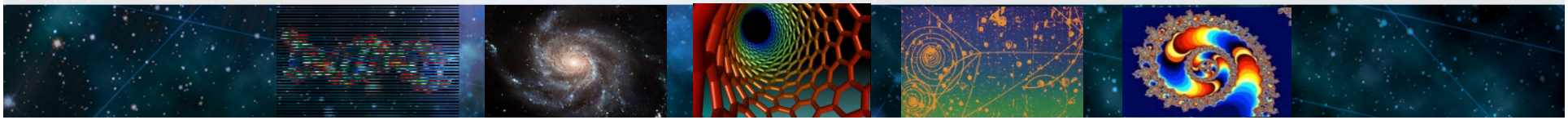
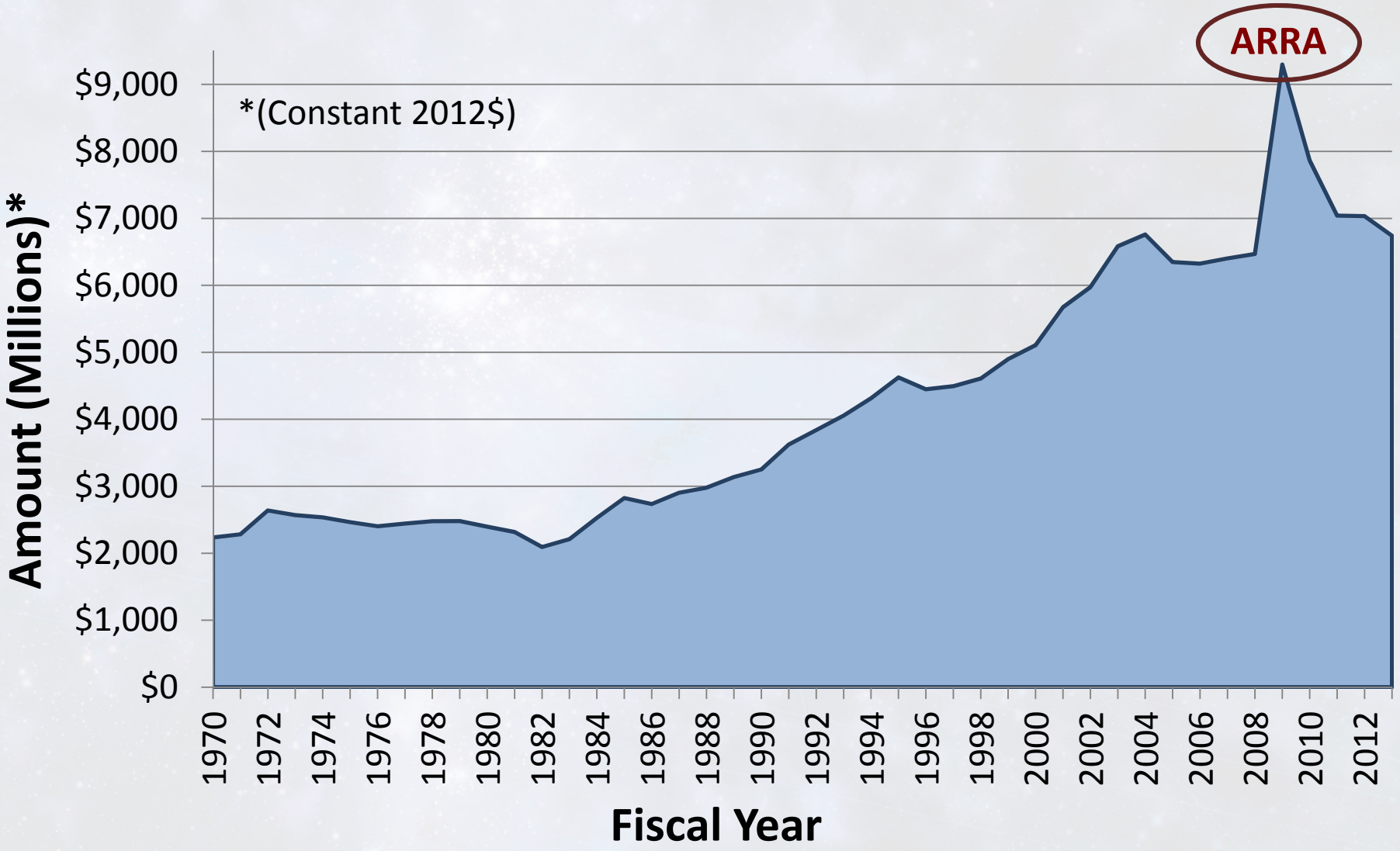
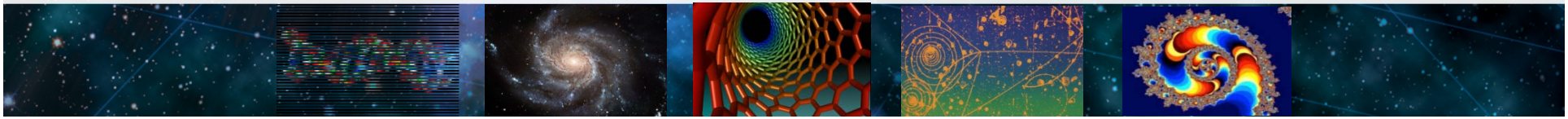


NSF Funding History





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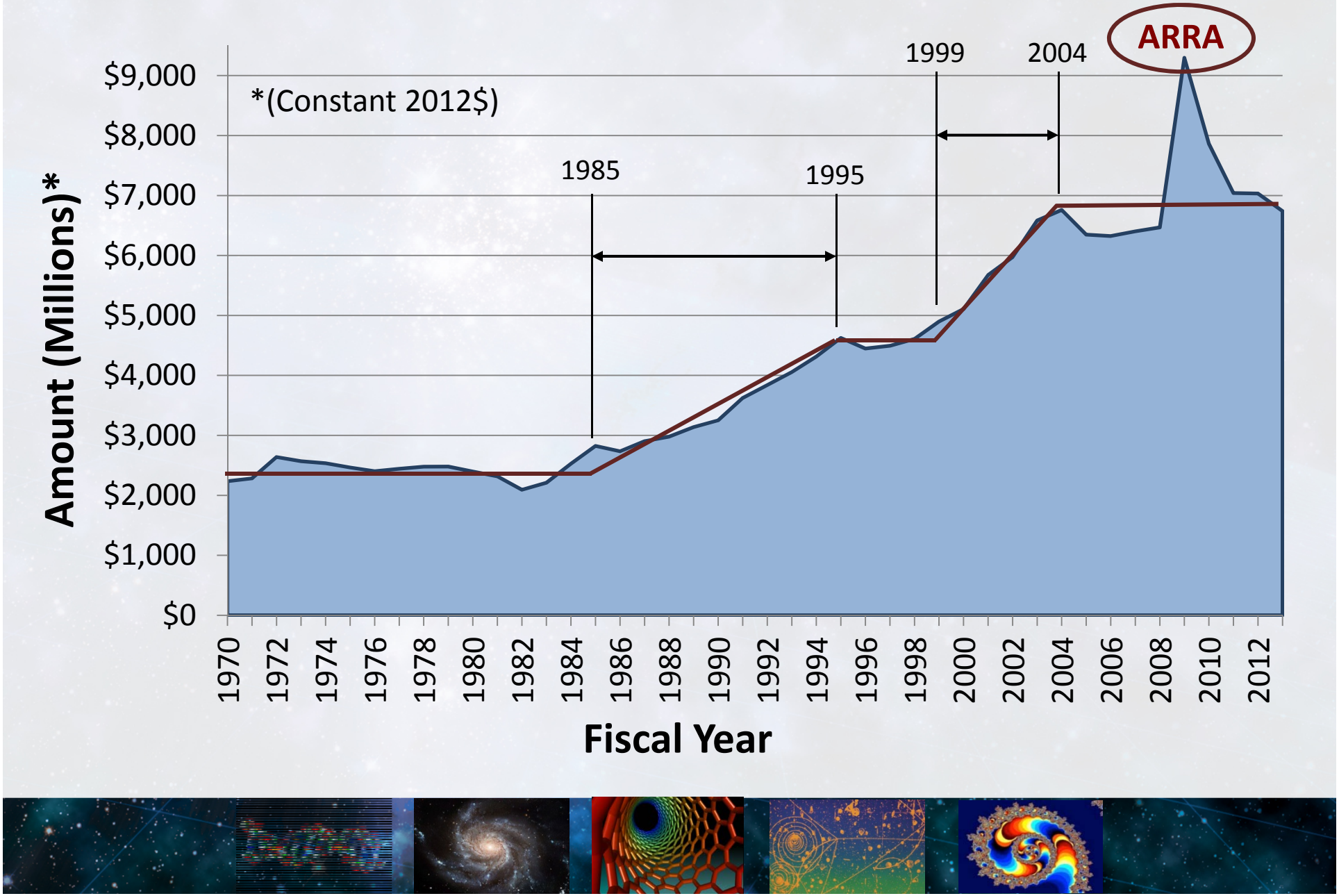
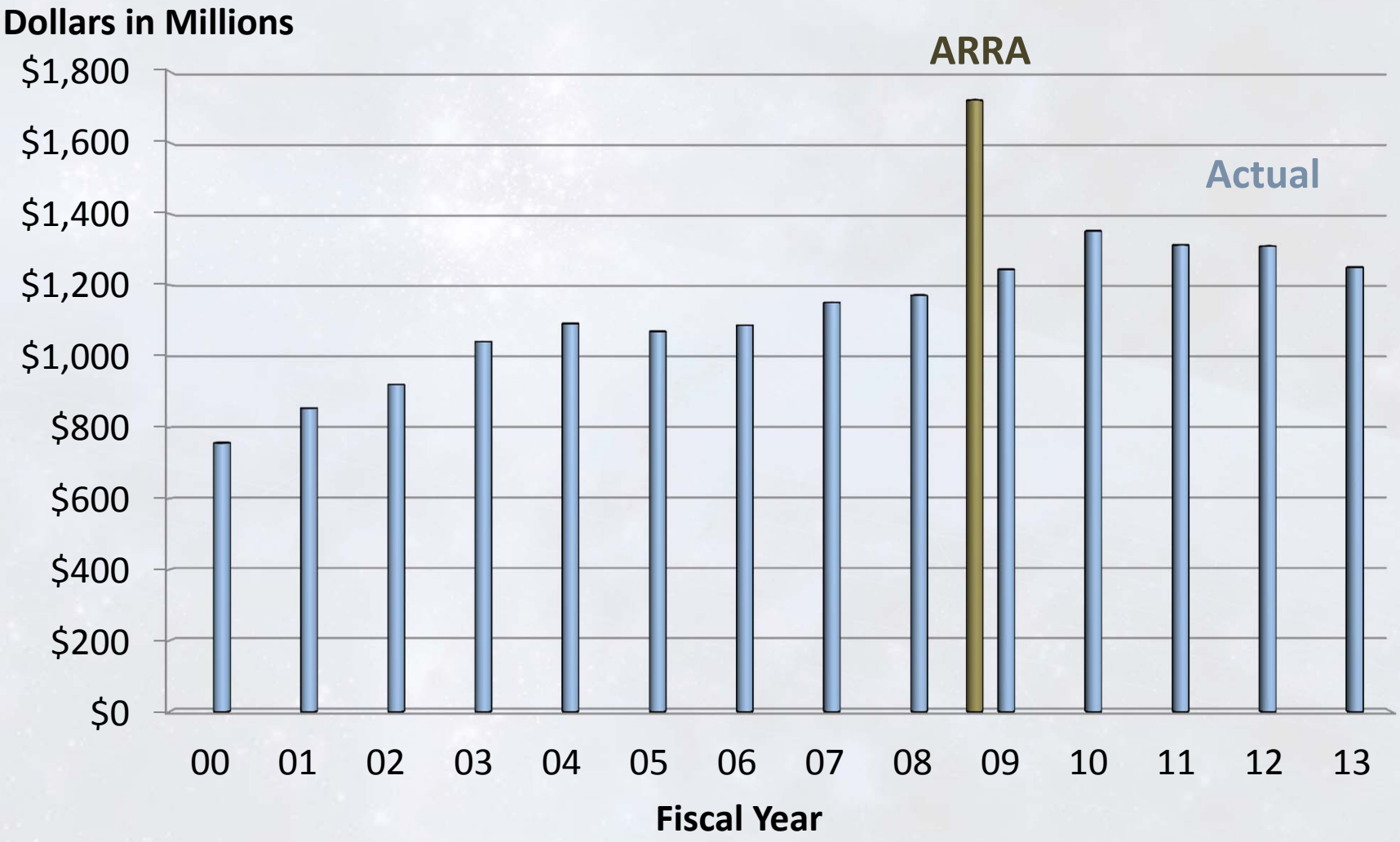


Funding remains “flat” for MPS…



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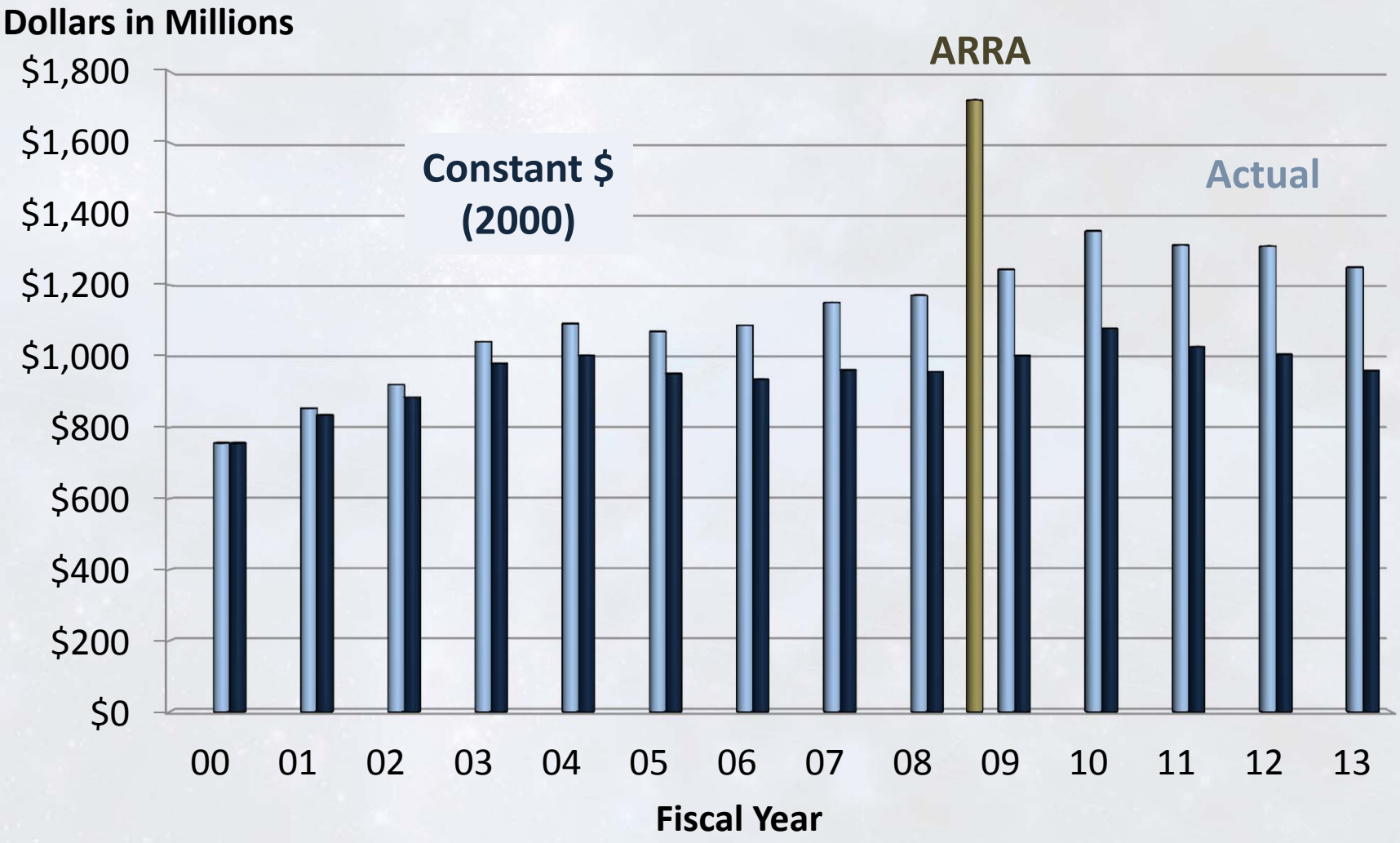
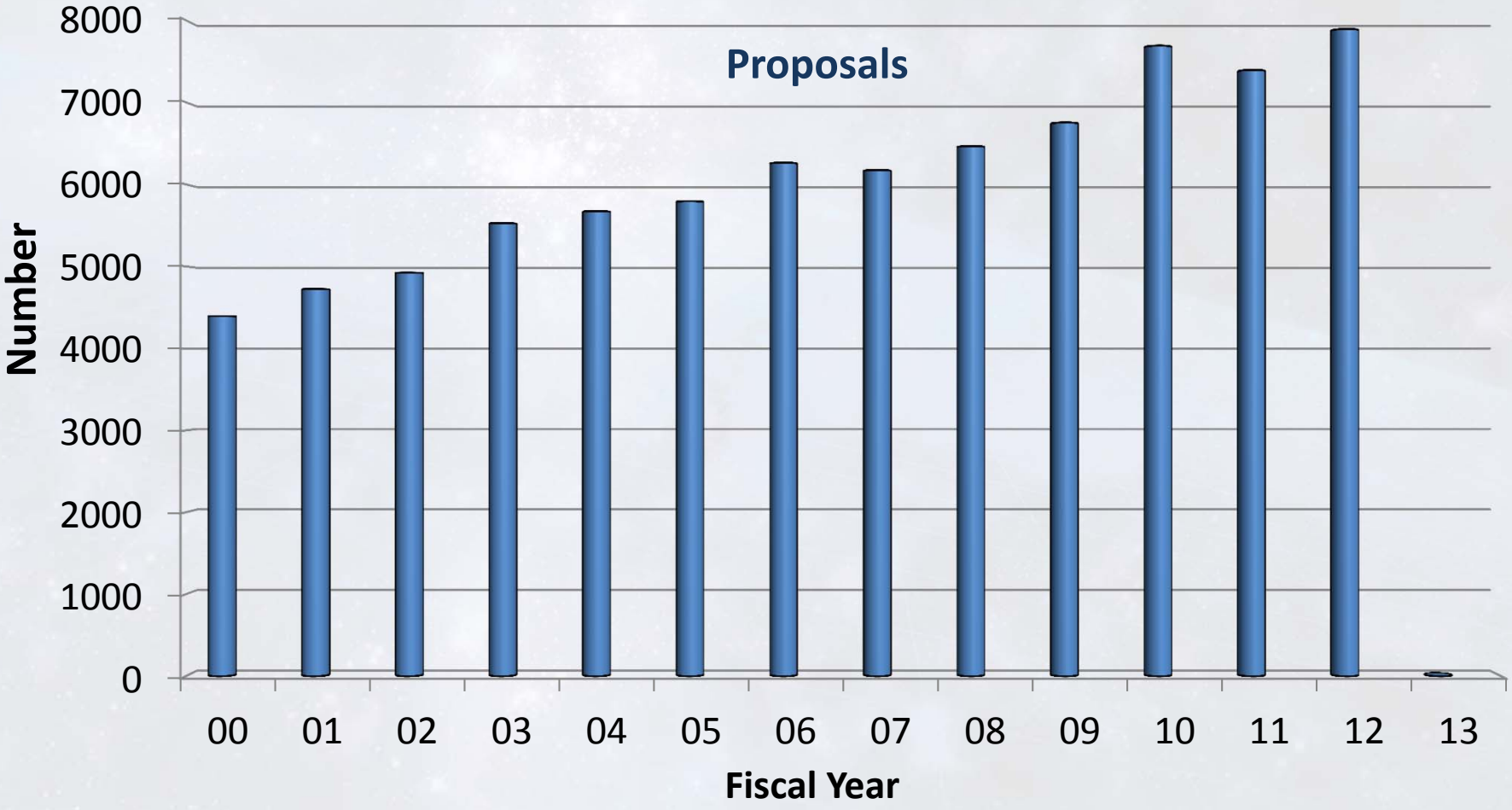
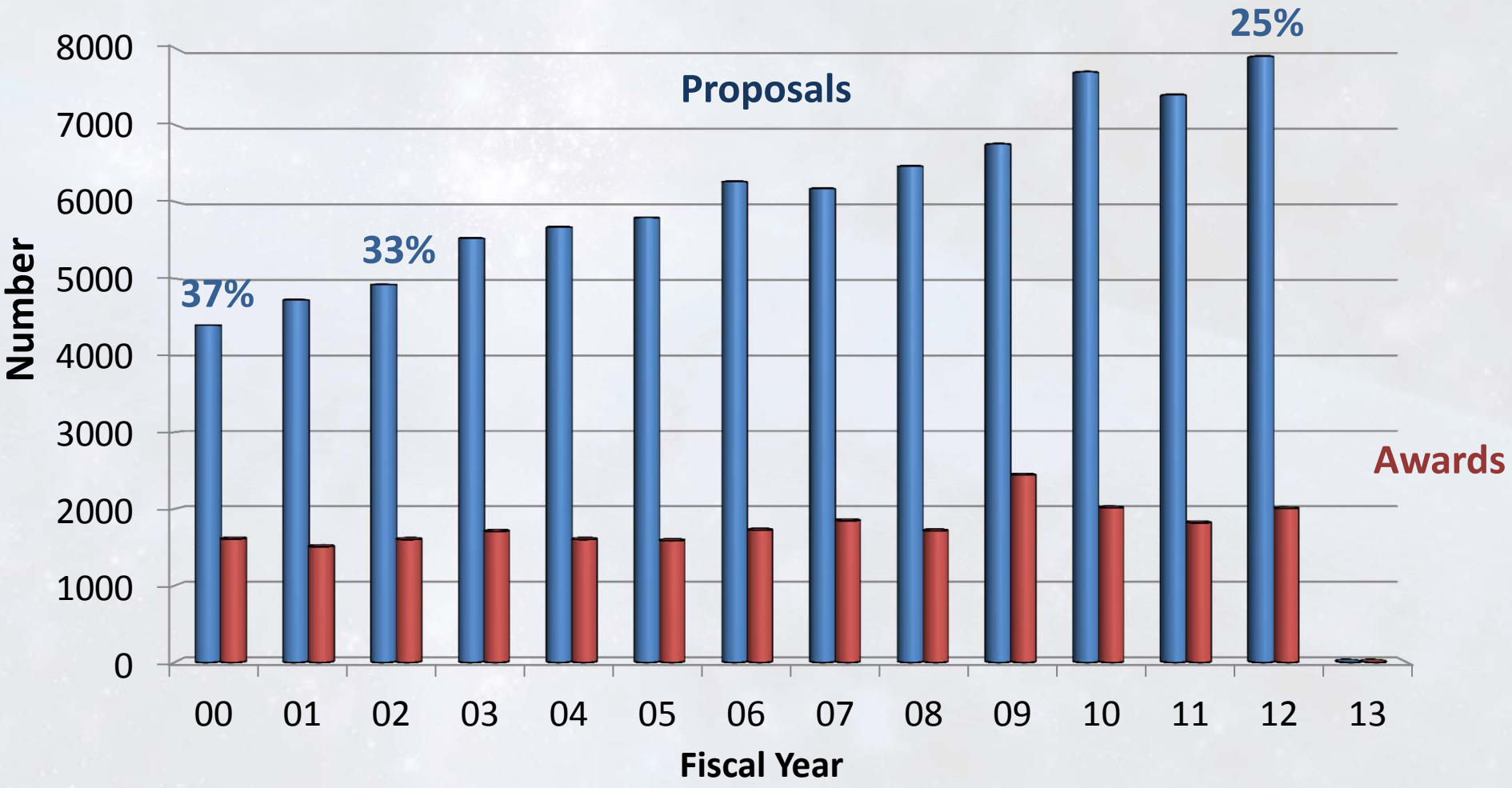


… while the number of proposals rises …

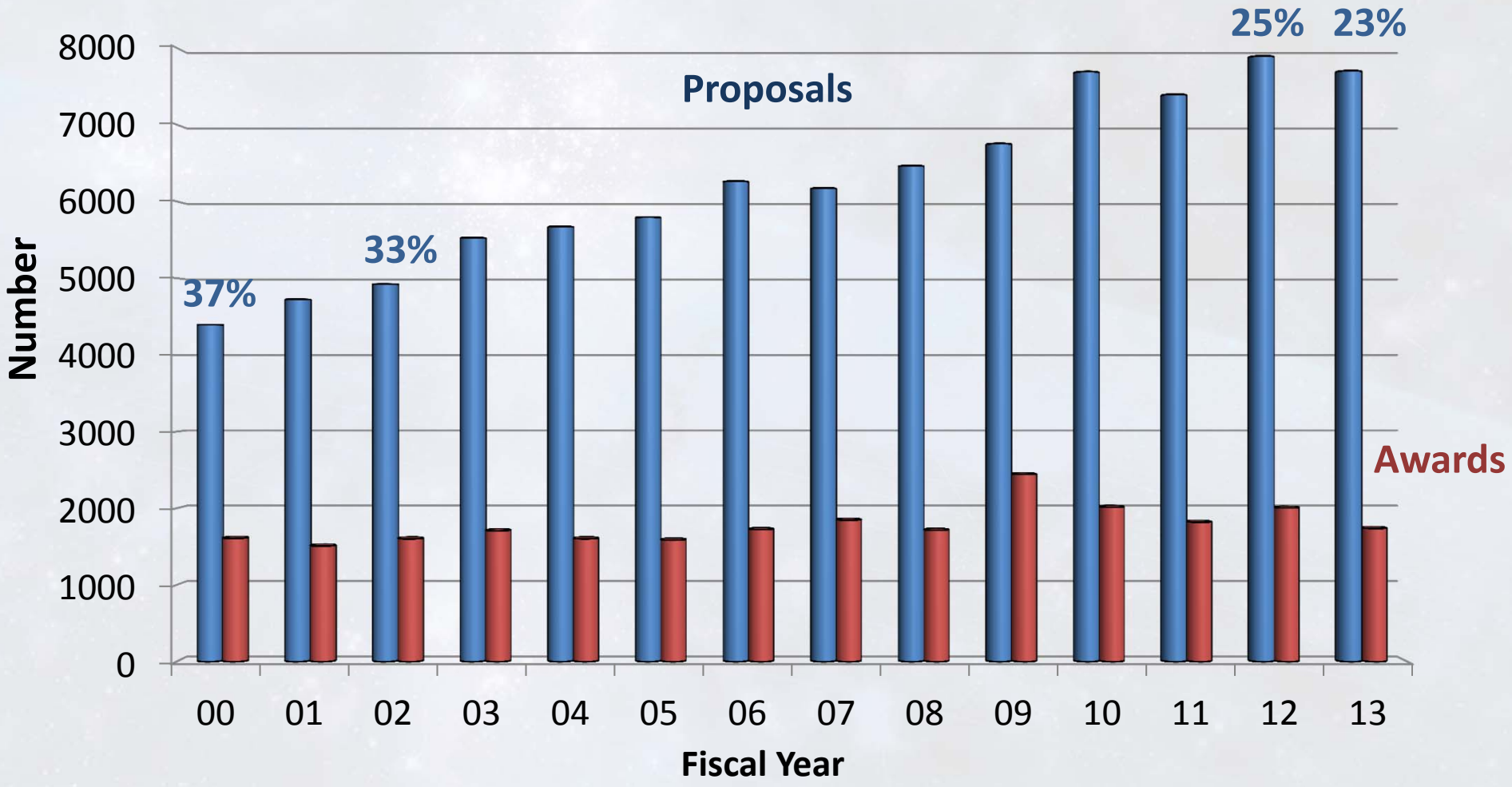


… causing the funding rate to go down …



… and then sequestration reduces the number of awards.

(258 fewer in FY 2013)



Speaking of sequestration and funding lapse (shutdown)

Dear Colleague Letter
NSF 14-026

OFFICE OF THE ASSISTANT DIRECTOR
MATHEMATICAL AND PHYSICAL SCIENCES

4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

NATIONAL SCIENCE FOUNDATION

January 6, 2014

Dear Colleagues,

I know that many of you are curious about the consequences for the Mathematical and Physical Science Directorate (MPS) of the sequestration of funds during FY 2013 and the lapse in funding ("shutdown") during the first 16 days of FY 2014. Now that we have closed the books on FY 2013, we can assess these effects quantitatively and give you some idea about their impact.

The Research and Related Activities (R&RA) budget, through which we fund research awards and facilities, decreased by about 3.5% for the Foundation and by about 4.5% for MPS. The Divisions in MPS did not share the decrease uniformly, and individual investigator awards suffered the largest reduction. This differential arose from a Foundation-wide policy of protecting existing awards, such as those supporting facilities infrastructure, centers, and early-career programs. I expect that any future budget restrictions will affect these previously protected programs.

Sequestration strongly affected our competitive research awards program. MPS made 13% (258) fewer competitive research awards in FY 2013 than in FY 2012, and those awards were 9% smaller on average. The funding rate for competitive research proposals in MPS fell to 22% from 25% in FY 2012, continuing a trend of more than a decade. The future budget picture remains uncertain, but we are committed to supporting excellent research. MPS continues to provide over a billion dollars each year to fund exciting and important fundamental science.

We were delighted to get back in action after the 16-day government shutdown that ended on October 17. Our primary focus has been on our core functions of receiving, reviewing, and acting on proposals along with oversight and management of existing awards. The consequences of the interruption will last much longer than the interruption itself, and we have established priorities for the most important tasks, concentrating on the merit review process. MPS has rescheduled the nine review panels that fell during the shutdown. The hard work and careful planning of our Program Officers and Administrative Staff also allowed us to conduct 15 of the 17 panels scheduled during the first two weeks after our return. This accomplishment was no mean feat and kept us from losing even more ground. I greatly appreciate the dedication and foresight that made it possible. Like all Directorates in the Foundation, we had to cancel our Fall Advisory Committee meeting, but we will resume the regular schedule with a virtual meeting in January, 2014.

Interaction with the scientific community is one of the keys for MPS in dealing with challenging times. I appreciate your participation in the work of the Foundation as you send us your excellent ideas, provide insightful reviews of proposals, and serve on advisory bodies. My colleagues and I are eager to hear your thoughts and suggestions, and we welcome continued communication in these challenging times. With your help, MPS will continue to support excellent, fundamental research across the physical and mathematical sciences.

Sincerely,

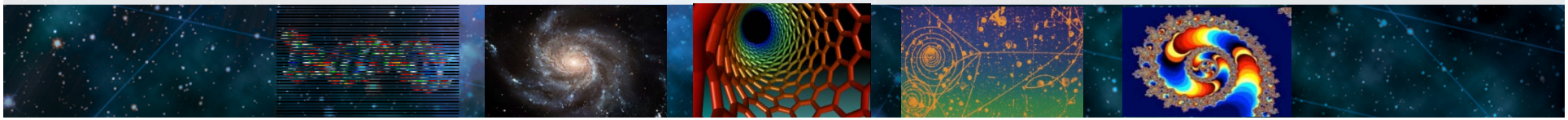
F. Fleming Crim
Assistant Director, National Science Foundation
Directorate for Mathematical and Physical Sciences

Sequestration

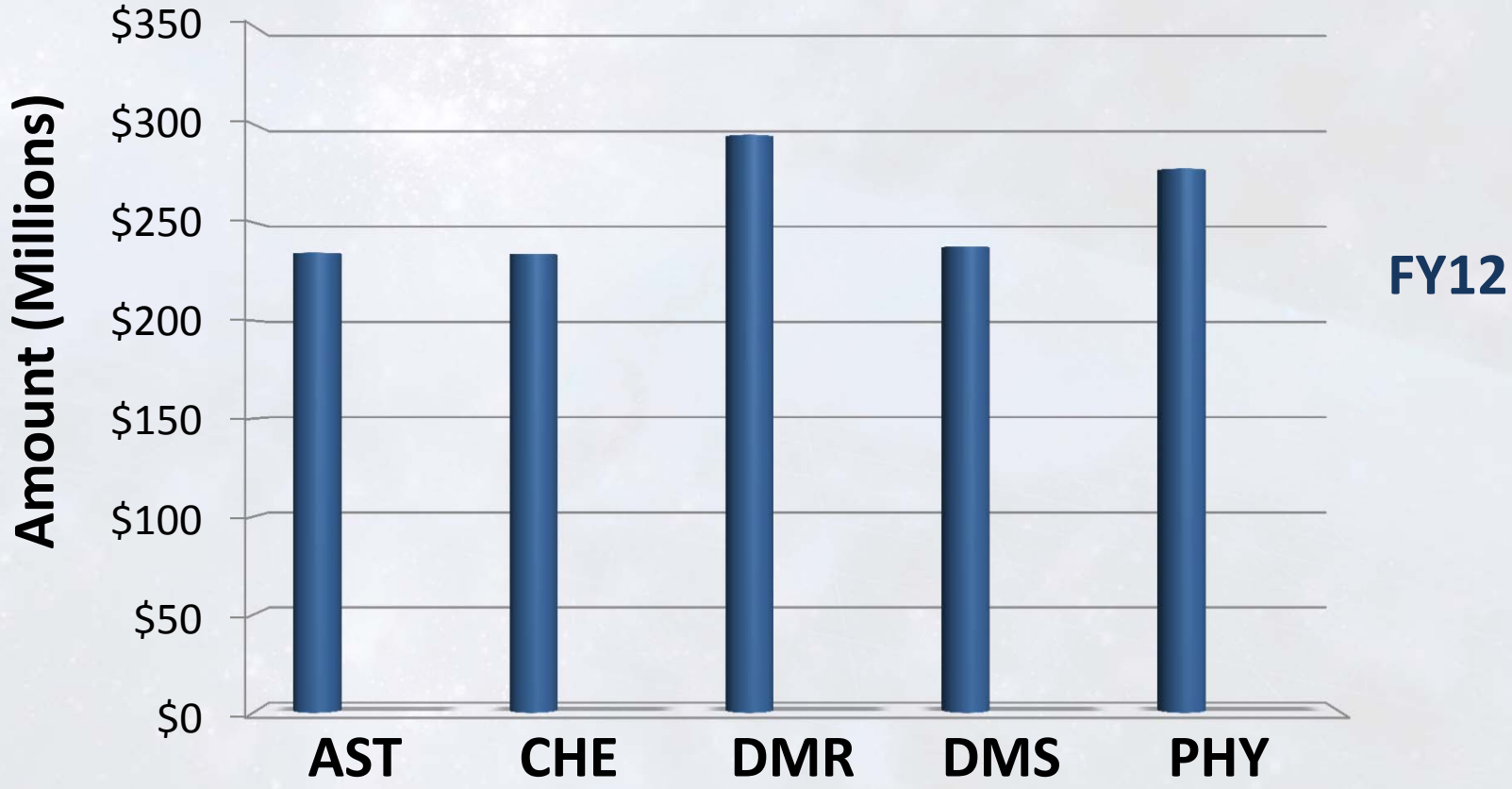
- NSF -3.5%
- MPS -4.5%
- NSF protected existing awards
- 258 fewer awards
- 9% smaller on average

16-Day Funding Lapse

- Missed 9 panels
- Held 15 of 17 first two weeks after return
- Cancelled November AC meeting



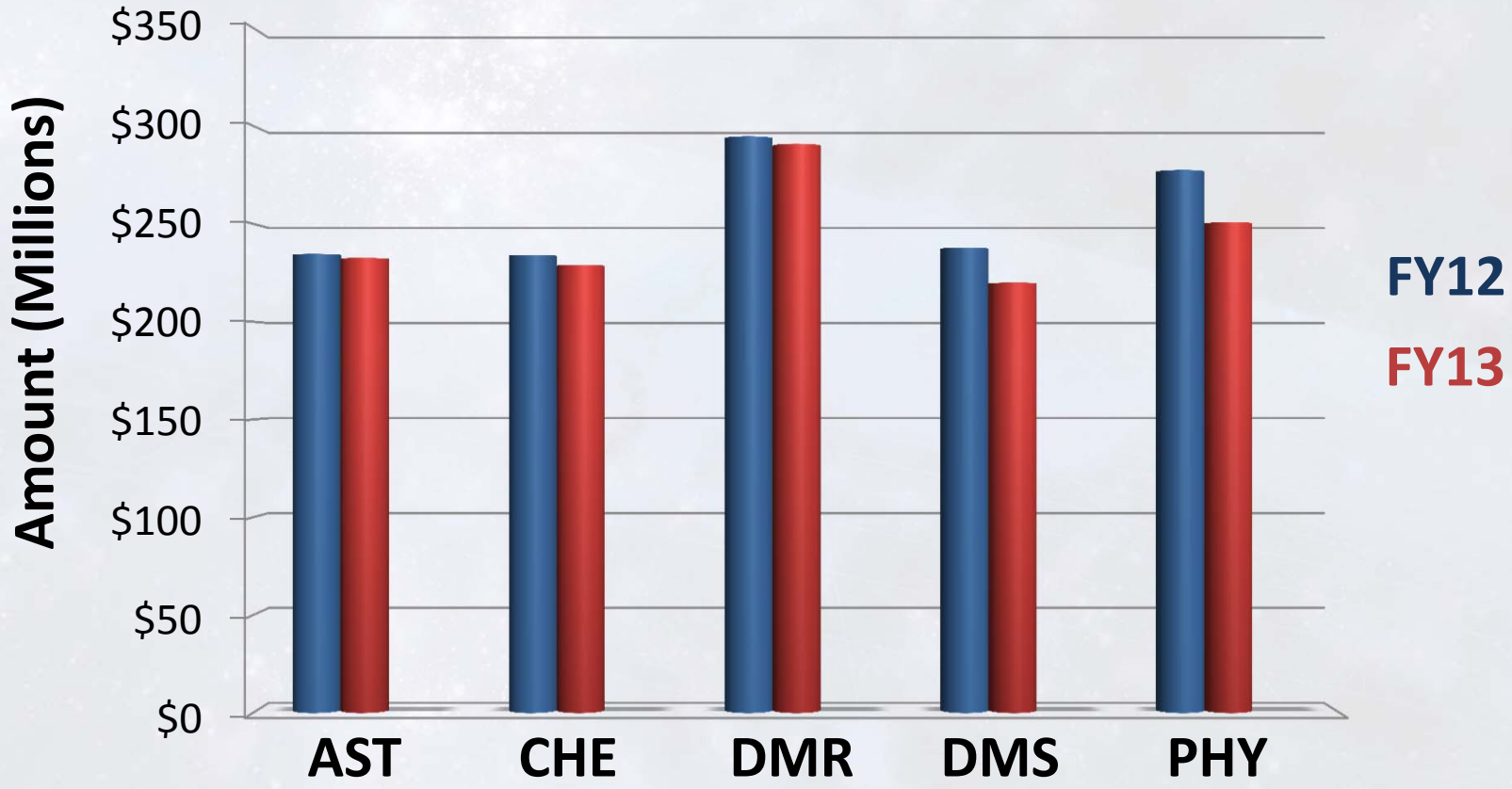
FY 2012
$ 1309 M



FY 2012
$ 1309 M

– 4.5% →

FY 2013
$ 1250 M



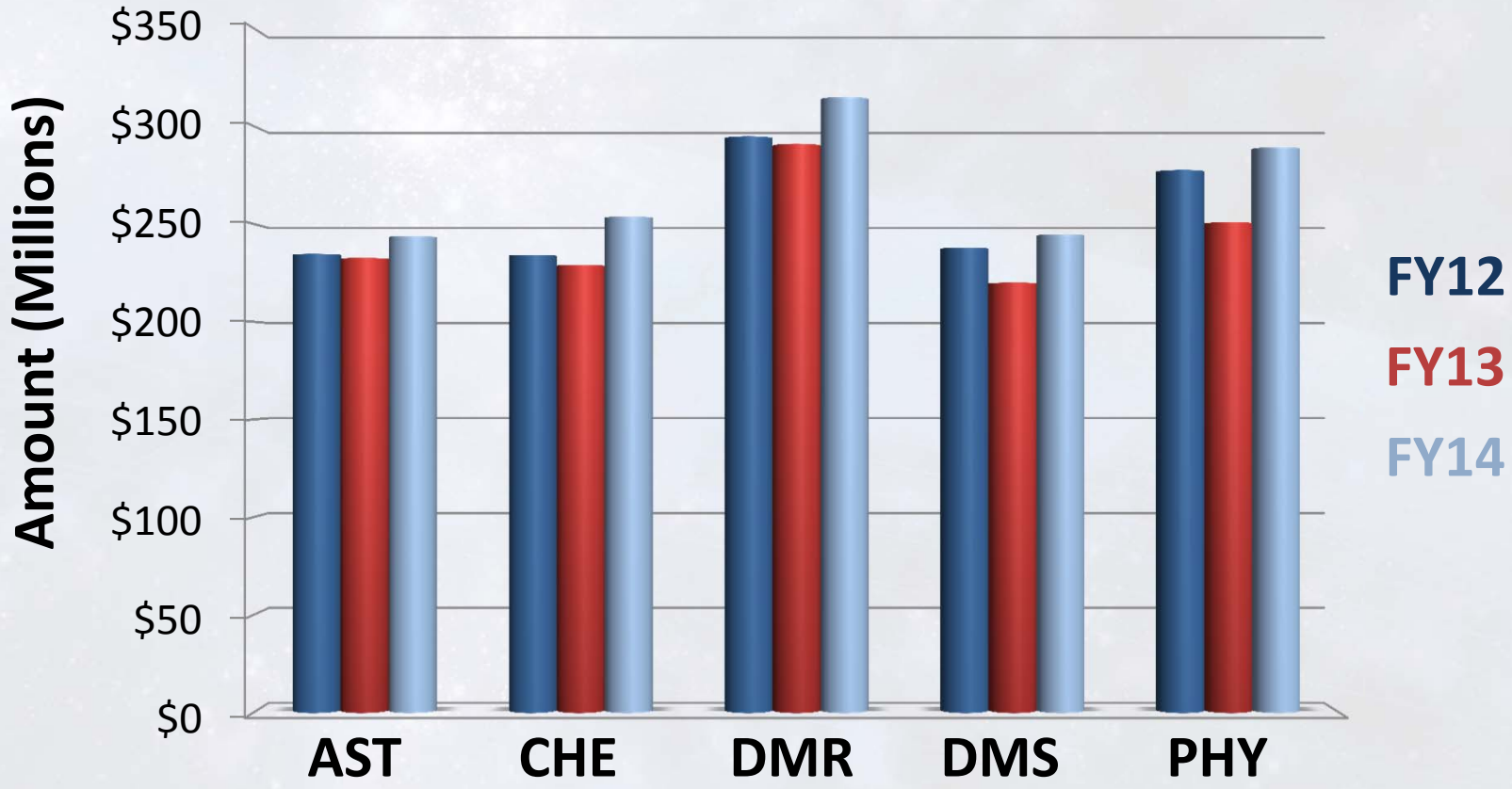
FY 2012
$ 1309 M

– 4.5% →

FY 2013
$ 1250 M

10.9% →

FY 2014
$ 1386 M
(Request)



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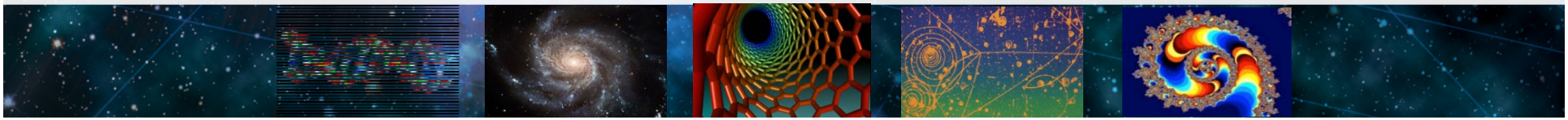
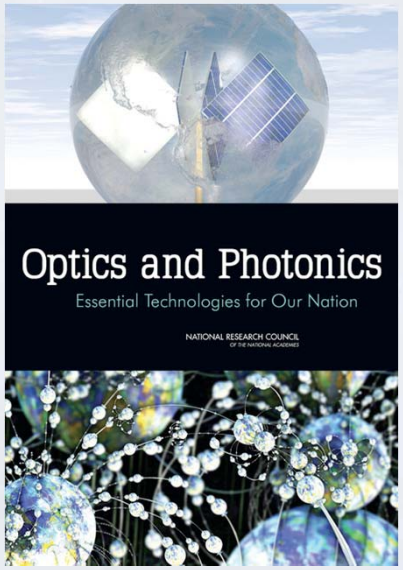




NRC Report

Optics and Photonics

NSF-wide Working Group Report ✓

NSTC Fast-Track Action Committee ✓

MPS AC Subcommittee

Accelerator Science

New in FY14 Budget Request (PHY)

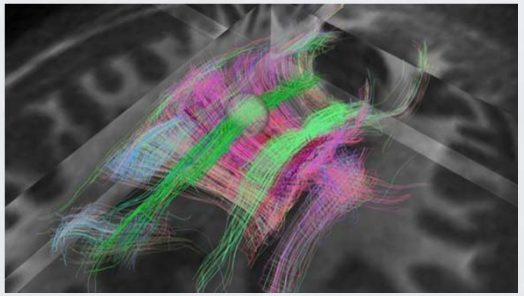
Midscale Infrastructure

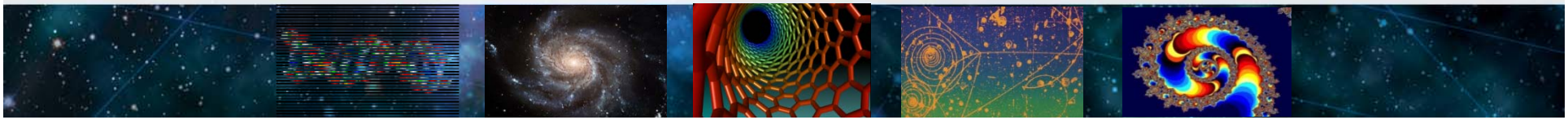
New in FY14 Budget Request (AST, PHY)

BRAIN Initiative

Steering Group

Two Working Groups





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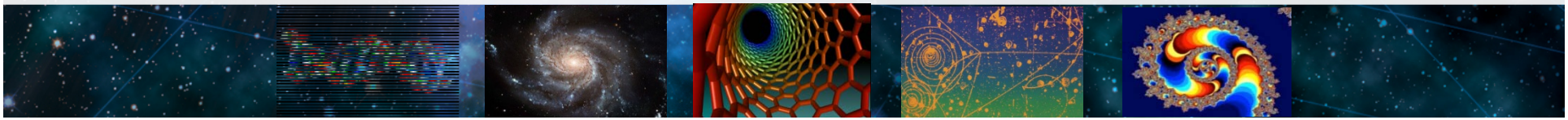
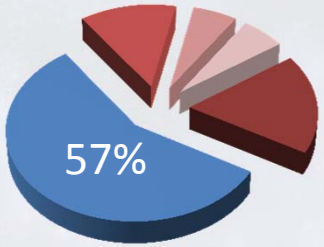




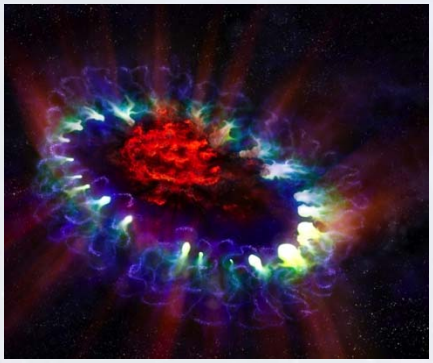
Facilities Activities

Astronomical Sciences (AST)

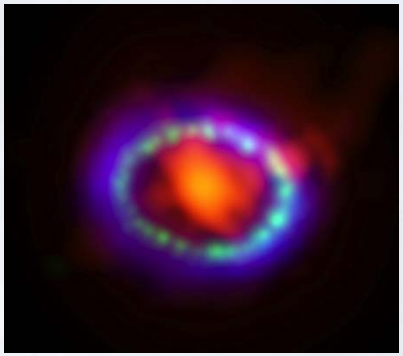
NSB approved new baseline for ATST

ATST renamed DKIST
Daniel K. Inouye Solar Telescope

ALMA 1987A Dust Cloud



Artist's Concept

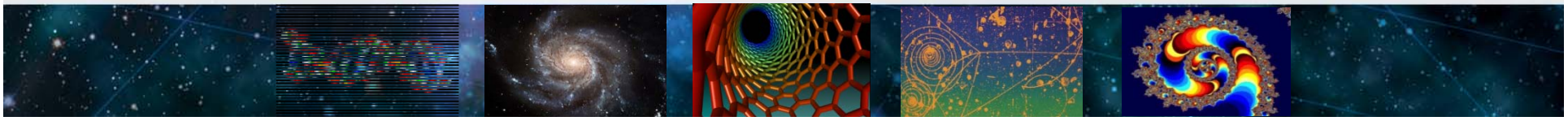


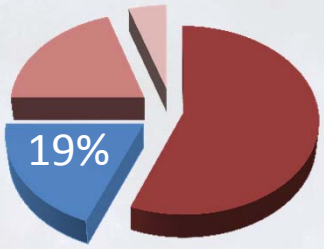
Data

NOAO solicitation issued

Divestment DCL

American Astronomical Society (AAS) Presentations

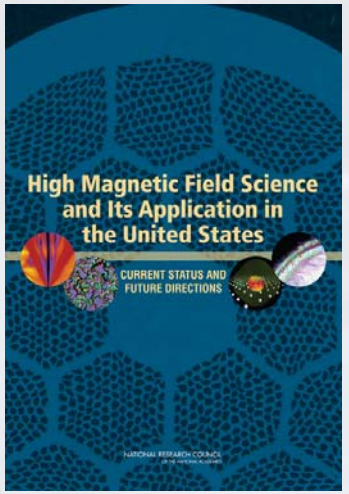




Facilities Activities

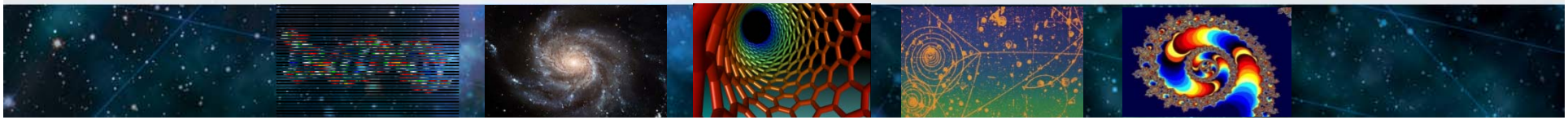
Materials Research (DMR)

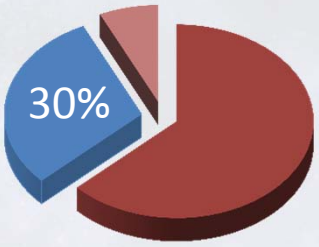
NSB approved Cornell High Energy Synchrotron Source (CHESS) renewal



NRC Published Report on High Magnetic Field Research

MPSAC Subcommittee on Infrastructure Priorities ("Synchrotron Science")





Facilities Activities

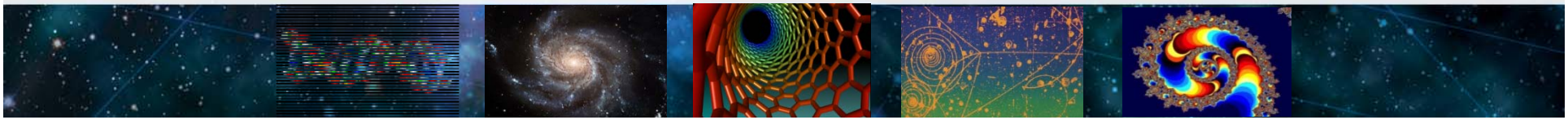
Physics (PHY)

Accelerator Science Program

High Energy Physics Advisory Panel (HEPAP) Presentations

Nuclear Science Advisory Committee (NSAC) Presentations

Particle Physics Project Prioritization Panel (P5)



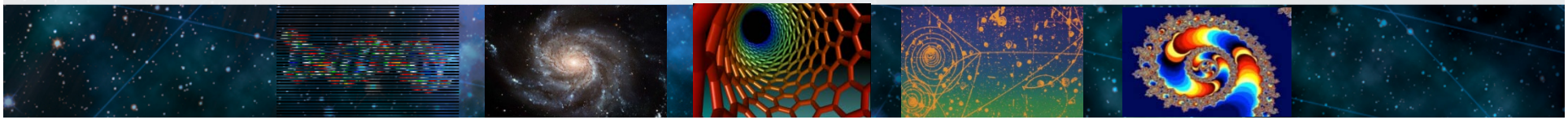
Personnel and Plans

Budget

Program Updates

Facilities

Agenda



Highlights for Today

MPSAC Subcommittee Reports

Stats NSF

Optics and Photonics

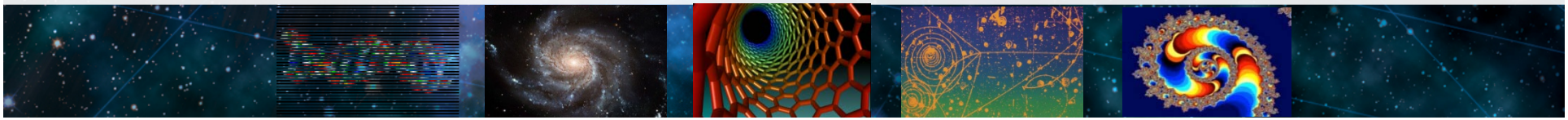
Merit Review "Preparation" for Next AC Meeting

Report on Virtual Panels

Other Items

BRAIN Initiative

Planning for joint meeting with the Advisory Committee for Cyberinfrastructure (ACCI)



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Focus on Discussion