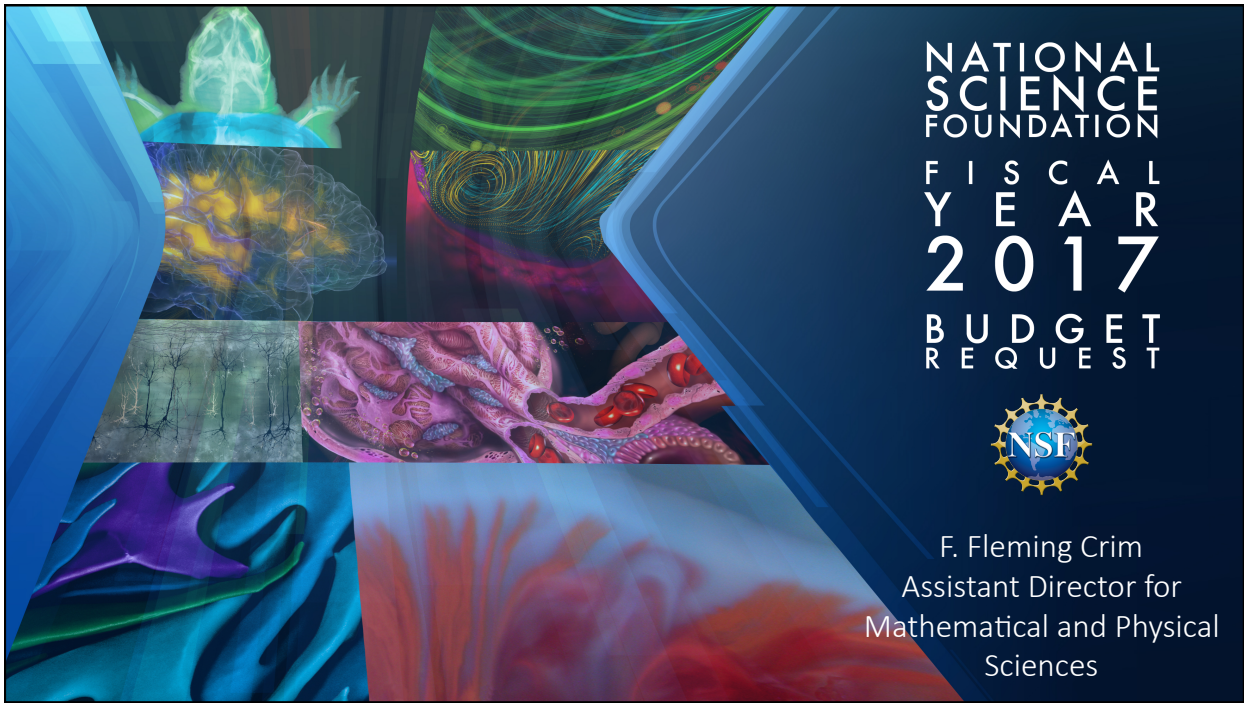


NSF Core Mission: Fundamental Research

Strategic Goals

Transform the Frontiers

Innovate for Society

Perform as a Model Organization

Transforming and Innovating

National Medal of Science

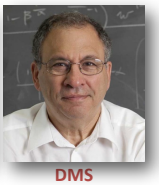
Alivisatos

DMR

Artin

DMS

Levin



DMS

Richmond

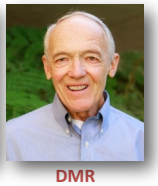
CHE

National Medal of Technology and Innovation

DeSimone

DMR/CHE

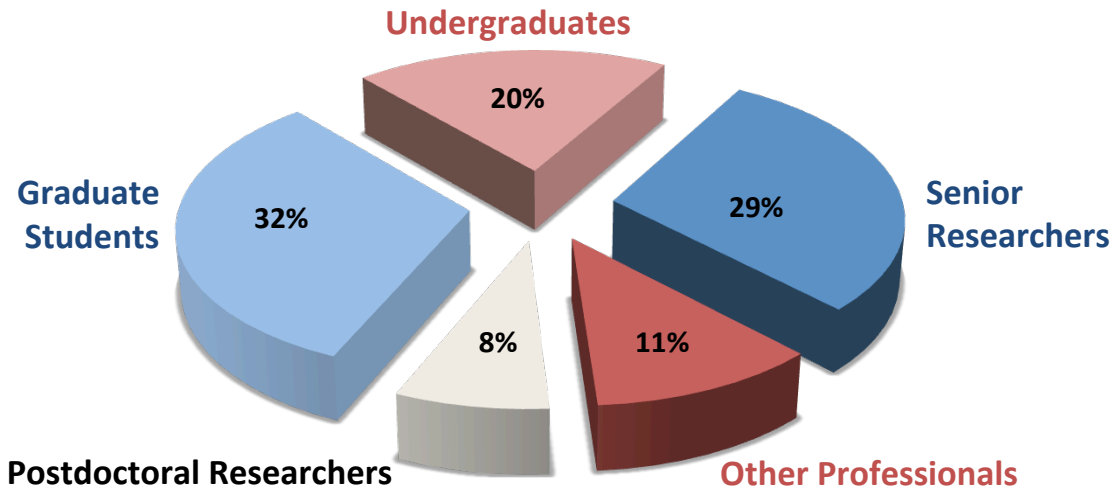
Gossard



DMR

Mathematical and Physical Sciences

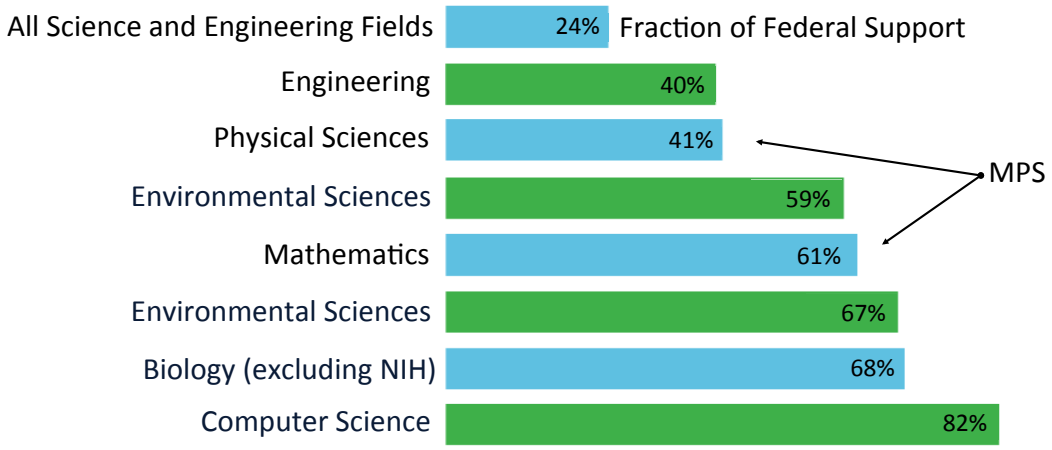
People Do Science: 29,300 People in MPS Activities*



*Estimated for FY 2017

Mathematical and Physical Sciences

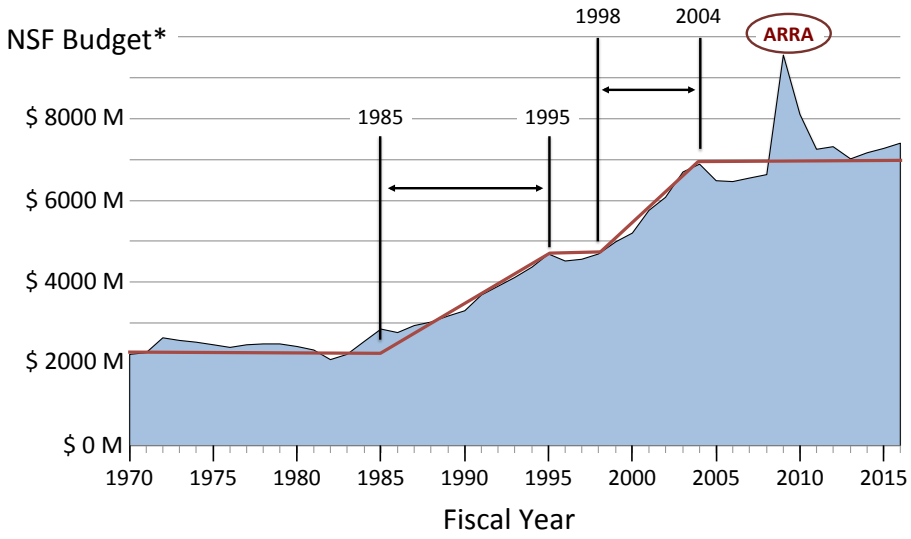
NSF Supports Academic Research



Source: NSF/ Center for National Science and Engineering Statistics, FY 2014

Mathematical and Physical Sciences

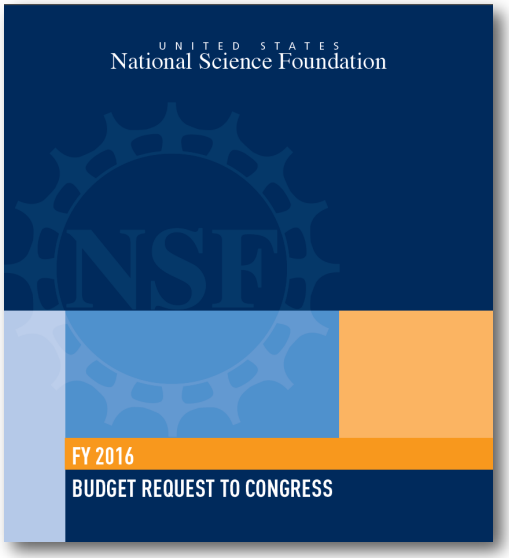
NSF Funding History



*Constant 2014$

Mathematical and Physical Sciences

FY 2016 Omnibus Bill



	FY 2015	FY 2016 (request)	
NSF	$ 7344 M	$ 7724 M	5.2%
R&RA	$ 5934 M	$ 6186 M	4.2%

	FY 2016 (estimate)	
NSF	$ 7463 M	1.6%
R&RA	$ 6034 M	1.7%

Mathematical and Physical Sciences

The President's Request to Congress

	FY 2016 (Estimate)	FY 2017 (Total Request)	
NSF	$ 7463 M	$ 7964 M	6.7%
R&RA	$ 6034 M	$ 6425 M	6.5%
	Two Components to R&RA		
Discretionary	$ 6034 M	$ 6079 M	0.8%
Mandatory*	--	$ 346 M	--
Total	$ 6034 M	$ 6425 M	6.5%

*Direct spending (not subject to discretionary caps)
One-year duration

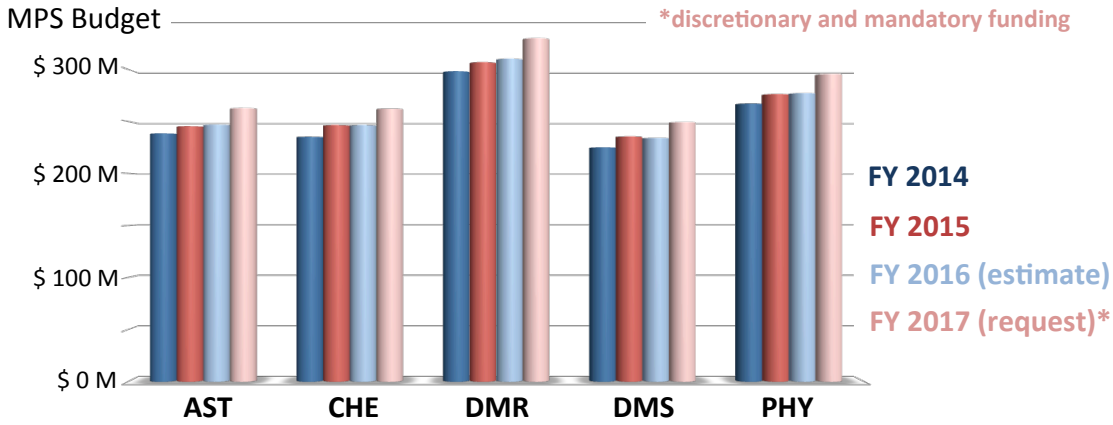
FY 2017 Request by Appropriation

	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
Research & Related Activities	$ 6034	$ 6079	0.8%	$ 346	$ 6425	6.5%
Education & Human Resources	880	899	2.1%	54	953	8.3%
Major Res Equip & Facilities Const.	200	193	-3.6%		193	-3.6%
Agency Operations & Award Mgmt.	330	373	13%		373	13%
National Science Board	4	4			4	
Office of the Inspector General	15	15			15	
Total NSF	**$ 7463**	**$ 7564**	**1.3%**	**$ 400**	**$ 7964**	**6.7%**

Totals may not add because of rounding ($ in millions)

MPS Budgets by Divisions

FY 2014 $ 1300 M → 3.5% → FY 2015 $ 1345 M → 0.3% → FY 2016 $ 1349 M (estimate) → 6.5% → FY 2017 $ 1436 M (request)*



Mathematical and Physical Sciences

MPS FY 2017 Request by Division

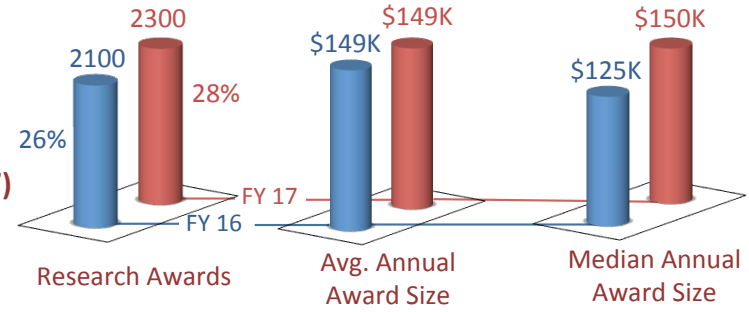
	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
Astronomical Sciences (AST)	$ 246.73	$ 247.73	0.4%	$ 14.88	$ 262.61	6.4%
Chemistry (CHE)	246.31	247.31	0.4%	14.85	262.16	6.5%
Materials Research (DMR)	310.03	311.03	0.3%	18.68	329.71	6.3%
Mathematical Sciences (DMS)	234.05	235.05	0.4%	14.12	249.17	6.5%
Physics (PHY)	277.03	278.53	0.5%	16.73	295.26	6.6%
Multidisciplinary Activities (OMA)	35.00	35.41	1.2%	2.13	37.54	7.3%
Total MPS	**$ 1349.15**	**$ 1355.06**	**0.4%**	**$ 81.39**	**$ 1436.45**	**6.5%**

Totals may not add because of rounding ($ in millions)

Mathematical and Physical Sciences

Mandatory Spending Category $ 81 M

Individual investigators
Early career investigators
Unsolicited proposals ("core")
Computation and data



Three Promising Topics

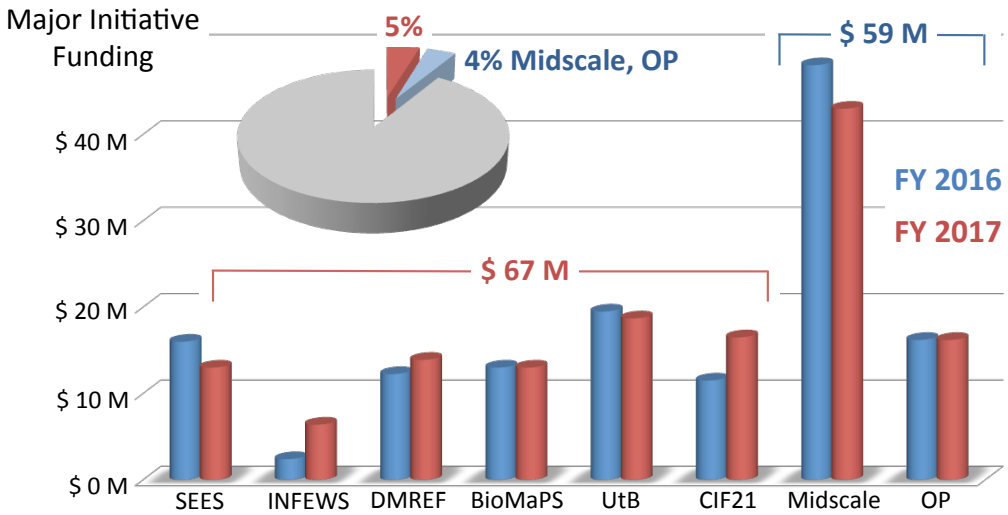
Quantum Information Science
Optics and Photonics
Clean Energy

National Strategic Computing Initiative (NSCI)

Presidential Priority

Mathematical and Physical Sciences

Selected Investments in Initiatives



Mathematical and Physical Sciences

MPS Participation in NSF-Wide Initiatives

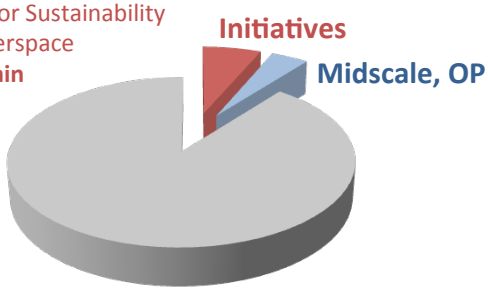
- Biology, Mathematical, and Physical Sciences Interface
- Cyberinfrastructure Framework for the 21st Century
- Designing Materials to Revolutionize and Engineer our Future
- Innovation Corps
- **INCLUDES**
- **Innovations at the Nexus of Food, Energy, and Water Systems**
- National Science Foundation Research Traineeship
- **Risk and Resilience**
- Science, Engineering, and Education for Sustainability
- Secure and Trustworthy Cyberspace
- **Understanding the Brain**

BioMaPS, CIF21, DMREF, I-Corps, INCLUDES, INFEWS, NRT, R&R, SEES, SaTC, UtB

$ 92.5 M

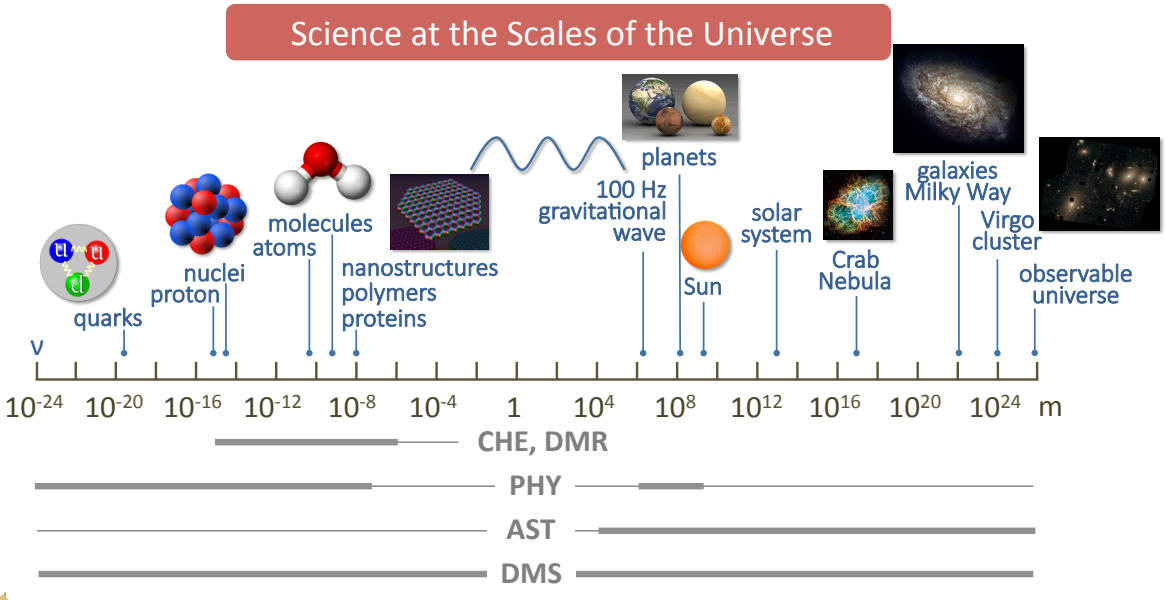
⬇

6.4% of MPS Request



Mathematical and Physical Sciences

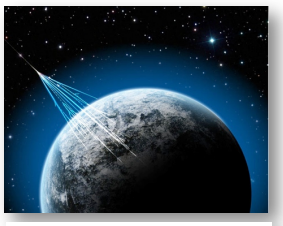
Science at the Scales of the Universe

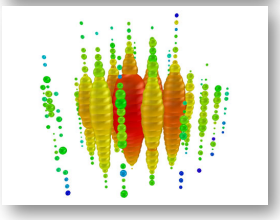


Images from Wikipedia Commons

Mathematical and Physical Sciences

Science Hors d'Oeuvres





Ice Cube
High Energy Neutrinos

Twin Primes Conjecture

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

Ab Initio Prediction of Molecular Crystal Structures

Mathematical and Physical Sciences

Science Hors d'Oeuvres

How Round is the Electron ?
Measuring the Electric Dipole Moment of the Electron

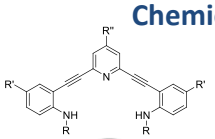
ACME

Advanced Cold Molecule EDM

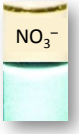
Order of Magnitude Smaller Limit on the Electric Dipole Moment of the Electron

Science 343, 269 (2014)

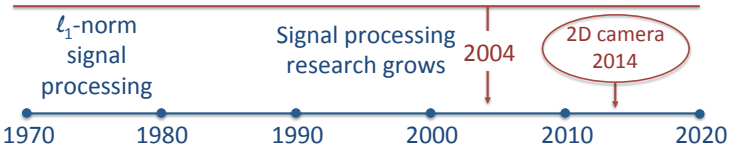
Supramolecules, Scaffolds, and Chemical Sensors



NO_3^-



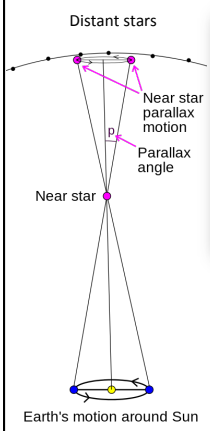
Theory of Compressed Sensing World's Fastest 2-D Camera

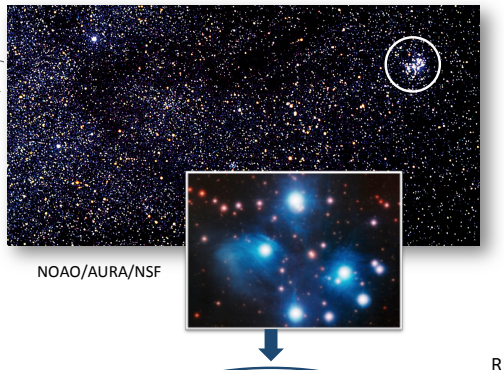


Mathematical and Physical Sciences

Science Hors d'Oeuvres

One Good Cosmic Measure:
Radio Telescopes Resolve Pleiades Distance Debate



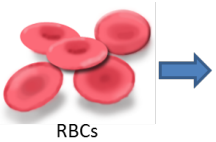


NOAO/AURA/NSF

Distance 444.0 light years

Wikipedia Commons

Stealthy Nanomaterials for Biomedical Use

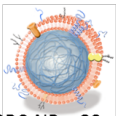


RBCs

RBC Membrane Detail

+

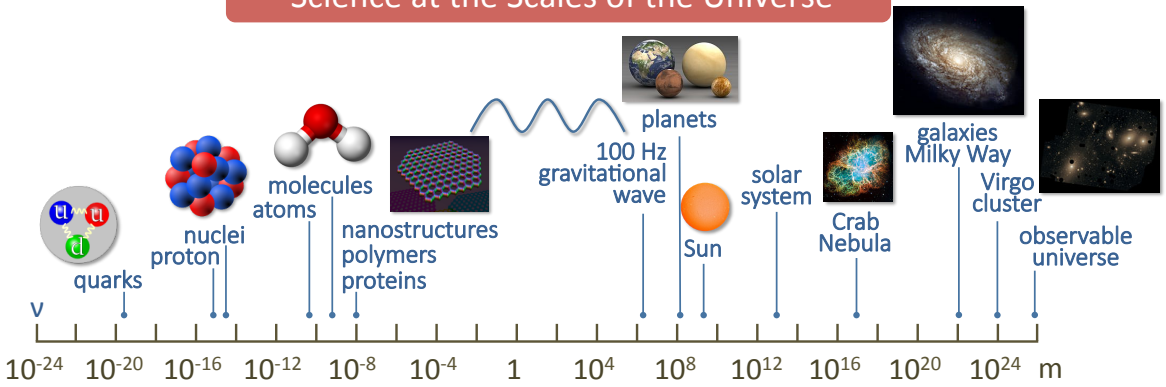
PLGA Polymer Nanoparticle



RBC-NP ~ 80nm

Mathematical and Physical Sciences

Science at the Scales of the Universe



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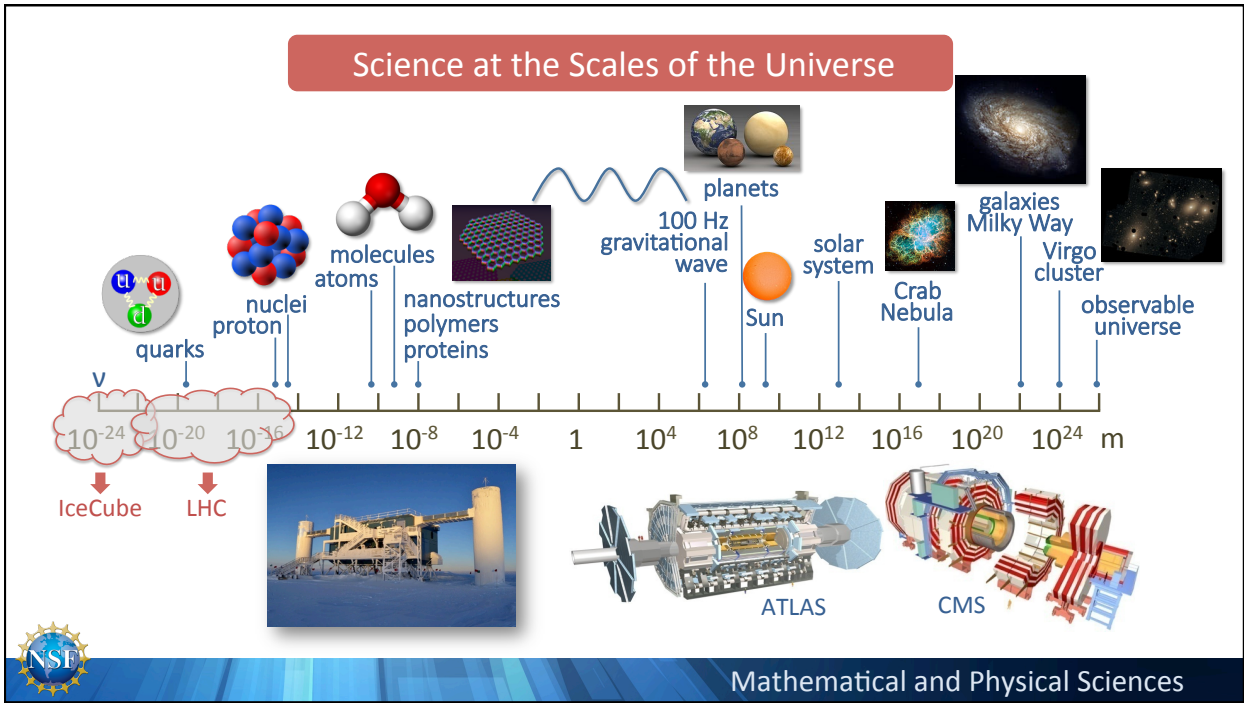
Mathematical and Physical Sciences


Science at the Scales of the Universe
planets
100 Hz
gravitational
wave
galaxies
Milky Way
solar
system
Virgo
cluster
molecules
atoms
nanostructures
polymers
proteins
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Crab
Nebula
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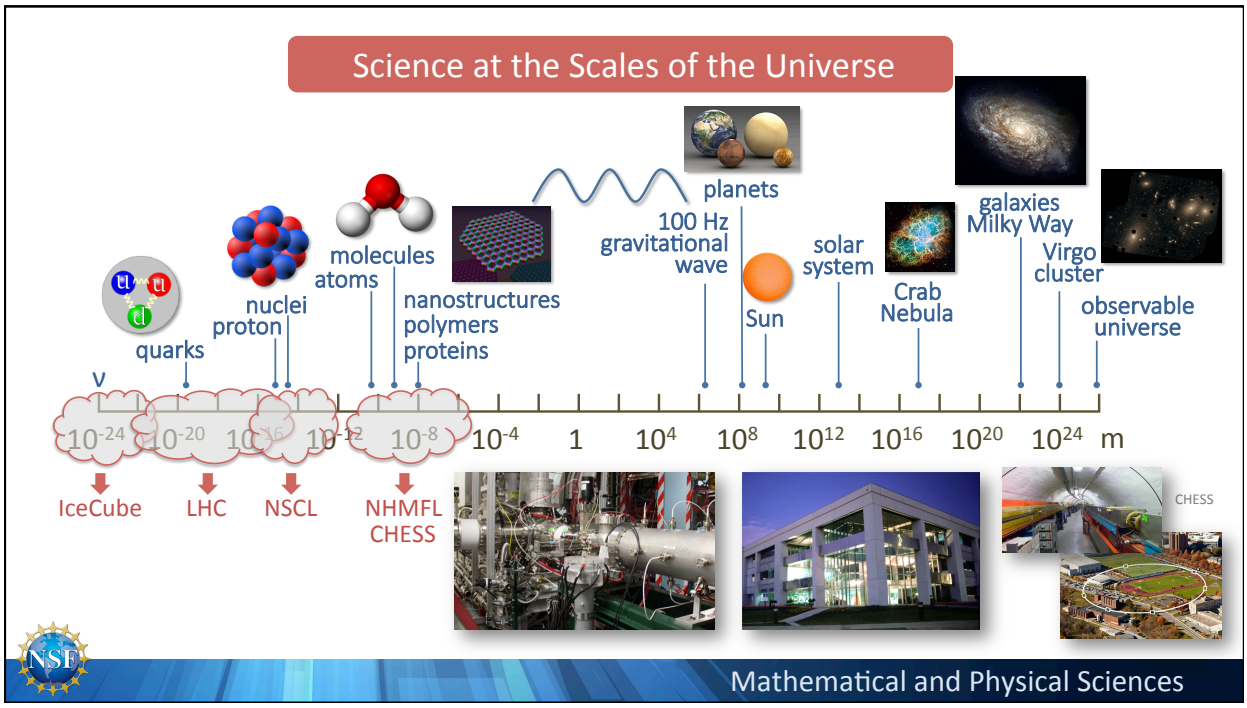
IceCube
LHC
ATLAS
CMS
Mathematical and Physical Sciences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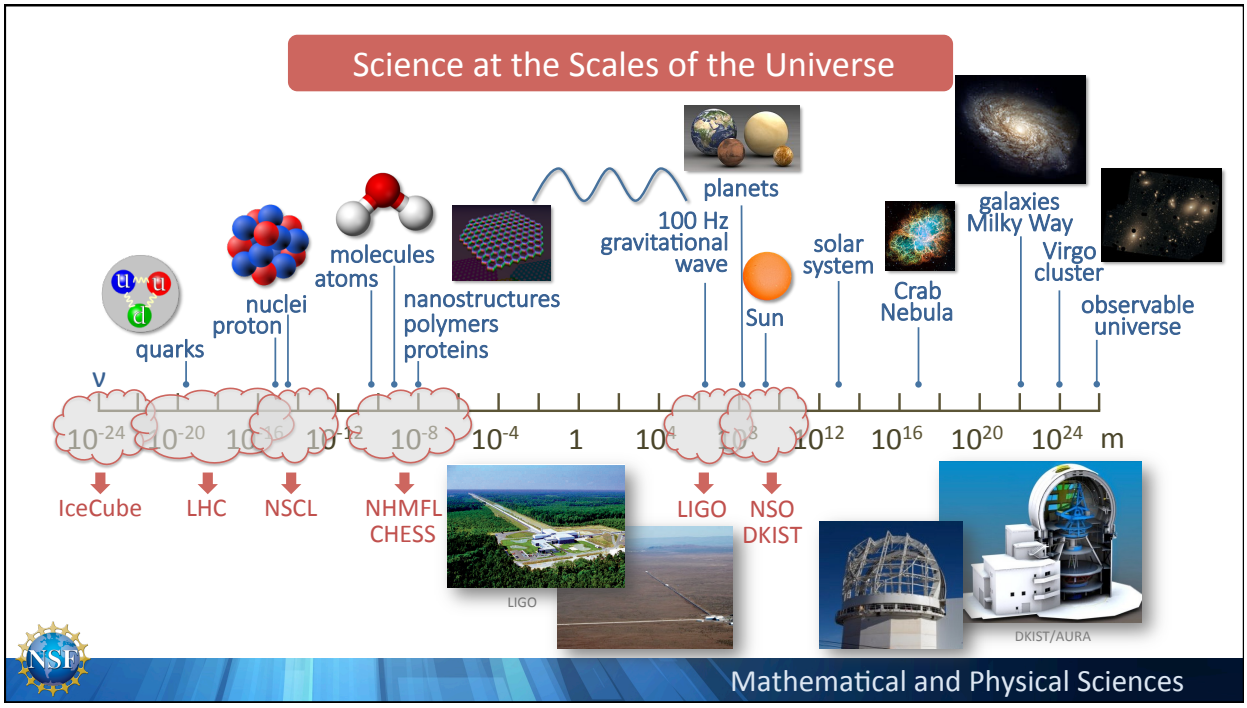
CHESS
CHESS
Mathematical and Physical Sciences


Science at the Scales of the Universe
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IceCube
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CHESS
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DKIST
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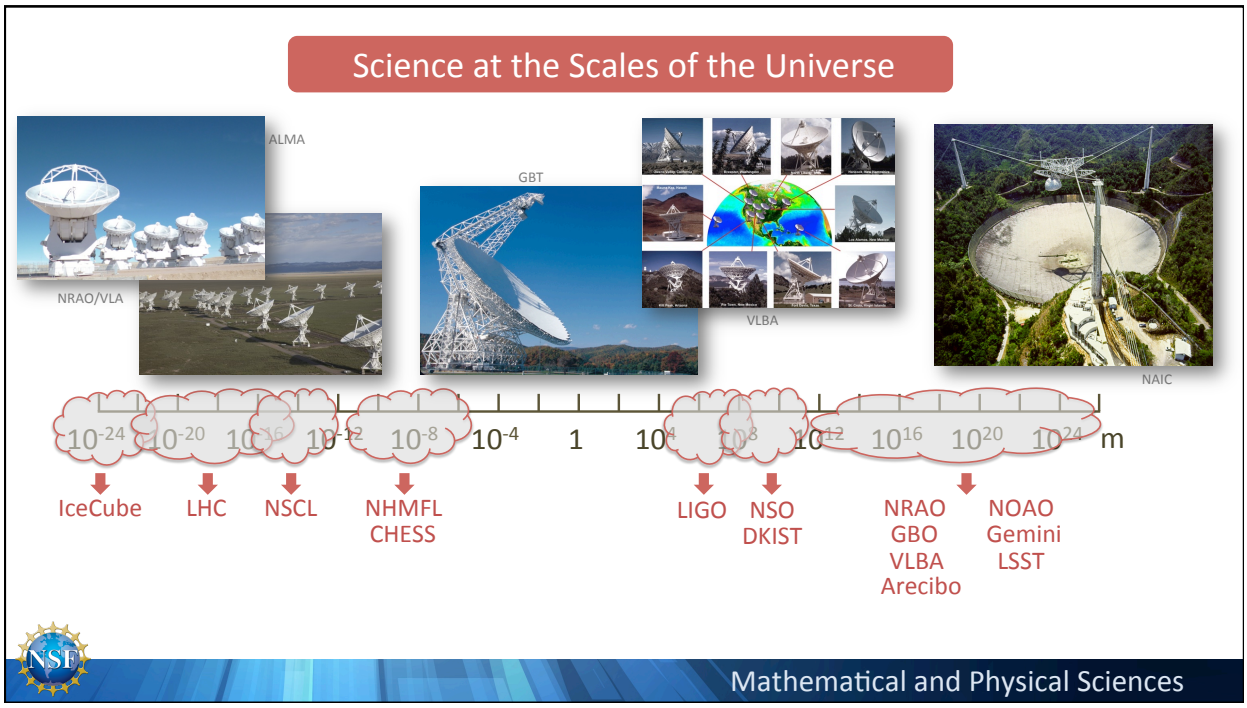
DKIST/AURA
Mathematical and Physical Sciences


Science at the Scales of the Universe
ALMA
NRAO/VLA
GBT
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IceCube
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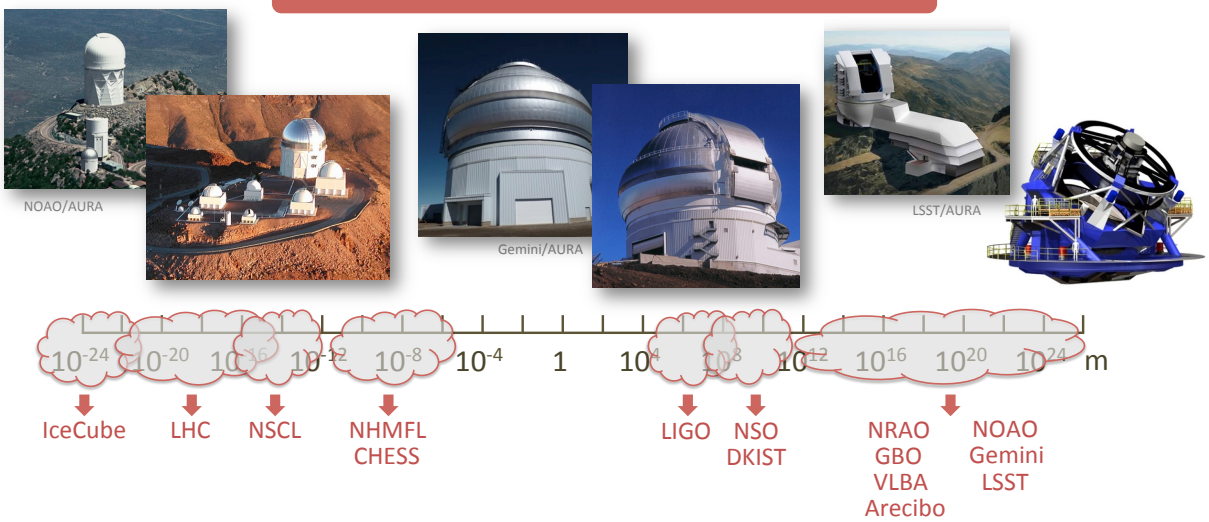
LSST
Mathematical and Physical Sciences

Science at the Scales of the Universe



Mathematical and Physical Sciences

Building the STEM Pipeline Through MPS-Funded Research

CAREER
Young Teacher-Scholars

	FY 2016 Estimate	FY 2017 Request
MPS	$ 67.5 M	$ 68.5 M
NSF	$ 227 M	$ 230 M

30% of CAREER funding from MPS

Research Experiences for Undergraduates (REU)
Undergraduate Research Programs

	FY 2016 Estimate	FY2017 Request
MPS	$ 20.1 M	$ 20.1 M
NSF	$ 75.4 M	$ 75.6 M

27% of REU funding from MPS

Mathematical and Physical Sciences


Supporting basic research
to create knowledge that
transforms our future
⬇
Drives the economy
Enhances our security
Sustains global leadership