



# NSF FY 2012 Budget Request

Mathematical and Physical Sciences

Edward Seidel

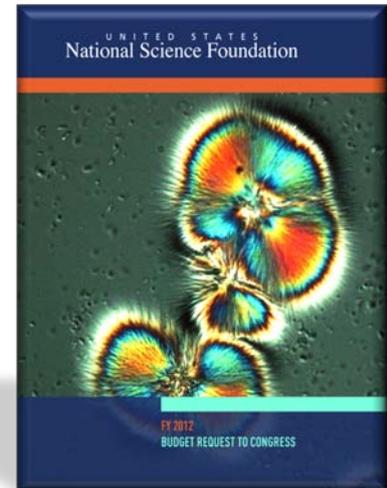
Assistant Director, MPS

March 2, 2011



# NSF in the Broader Context

- Strong Role in President's Strategy for U.S. Innovation
  - *Building blocks of innovation; catalyzing breakthroughs; promoting competitive markets*
- Total NSF request: \$7.767 billion
- OneNSF Concept
  - *Support* fundamental research in all disciplines
  - *Address* multidisciplinary challenges of national/global significance
  - *Spark* greater innovation and opportunity for scientific discoveries
  - *Create* networks and infrastructure for the nation
  - *Improve* organizational efficiency
  - *Catalyze* human capital development

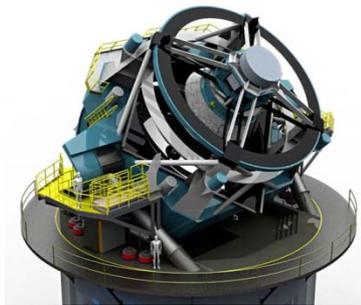
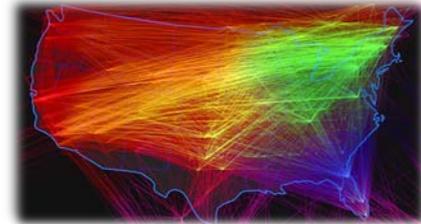


# MPS FY 2012 Budget Request Highlights

MPS Request: \$1.43B  
+\$80.89M (+ 6.0%)

## MPS Budget Request Reflects NSF Priorities

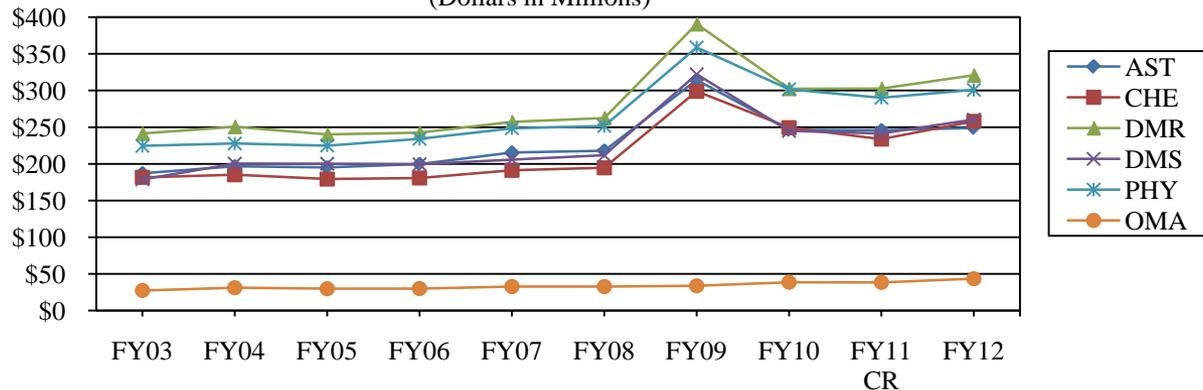
- Support innovation in healthy core programs
- Invest in research addressing national priorities
  - *OneNSF Activities: SEES, CIF21*
- Advance a strong scientific and technical workforce
  - *CAREER, postdocs, GRF, REU*
- Support multidisciplinary research
  - *Centers, institutes, and networks*
- Invest in facilities critical for fundamental research
  - *New Era of Observation; ties into CIF21*



# MPS FY 2012 Budget Request

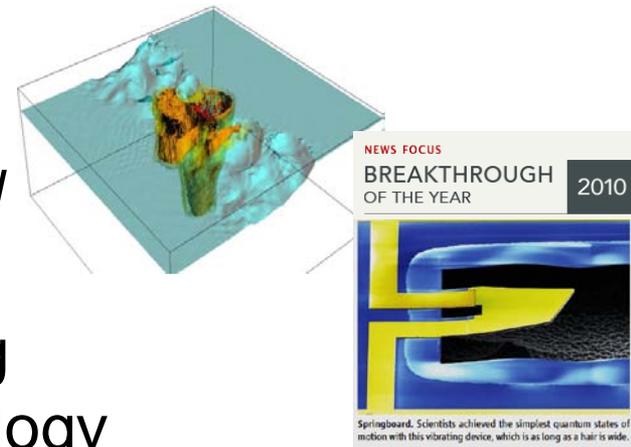
	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request	Change Over FY 2010 Enacted	
					Amount	Percent
Division of Astronomical Sciences (AST)	\$246.53	-	\$245.69	\$249.12	\$3.43	1.4%
Division of Chemistry (CHE)	233.68	15.70	233.73	258.07	24.34	10.4%
Division of Materials Research (DMR)	302.57	-	302.67	320.79	18.12	6.0%
Division of Mathematical Sciences (DMS)	244.92	-	241.38	260.43	19.05	7.9%
Division of Physics (PHY)	301.66	-	290.04	300.91	10.87	3.7%
Office of Multidisciplinary Activities (OMA)	38.58	-	38.33	43.41	5.08	13.3%
<b>Total, MPS</b>	<b>\$1,367.95</b>	<b>\$15.70</b>	<b>\$1,351.84</b>	<b>\$1,432.73</b>	<b>\$80.89</b>	<b>6.0%</b>

**MPS Subactivity Funding**  
(Dollars in Millions)



# MPS Core Programs: Building Blocks of Innovation

- Support researchers to investigate
  - *Structure/evolution of the universe*
  - *Behavior/control of molecules at nanoscale*
  - *New mathematical/statistical theories, connections to computation, experiment, and massive data*
- Catalyze advances in science impacting innovation in medicine, industry, technology
- 2010 Chemistry Nobel Prize
  - *Richard F. Heck and Ei-ichi Negishi*
  - *Discovery of fundamental chemical reactions which allow the construction of new bonds*



Richard  
F. Heck

Ei-ichi  
Negishi



# Science, Engineering, and Education for Sustainability (SEES)

NSF: \$998M;  
MPS Request:  
\$160M (+84%)

MPS is partnering in an NSF-wide effort to achieve an environmentally and economically sustainable future

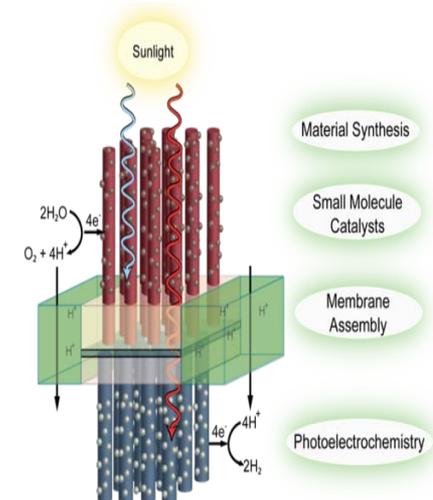
## ➤ Sustainable Energy Pathways

- *Novel earth-abundant materials for creating efficient solar cells*
- *Efficient materials for converting photons into hydrogen via water electrolysis*

## ➤ Sustainable Materials and Chemistry

- *Replacing rare, expensive and toxic chemicals with abundant, inexpensive, and environmentally benign alternatives*

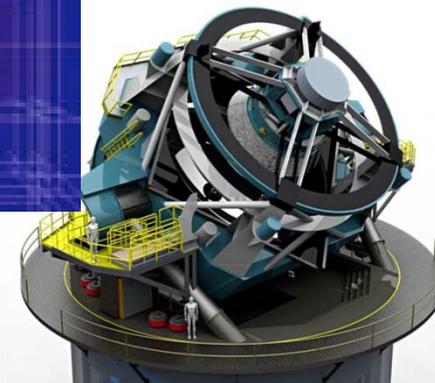
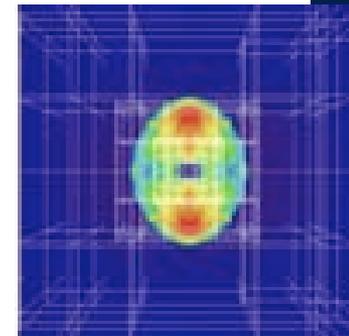
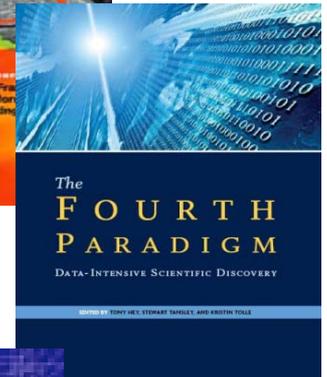
## ➤ Sustainability Research Networks



# Cyberinfrastructure Framework for 21<sup>st</sup> Century Science and Engineering (CIF21)

- Cyberinfrastructure to transform research, innovation and education
- Coherent program building on other CI investments across NSF
  - *eXtreme Digital (XD), Software Infrastructure for Sustained Innovation(SI2)*
- Four major components
  - *Data-enabled science*
  - *New computational infrastructure, including “matter-by-design”*
  - *Community research networks*
  - *Access and connections to cyberinfrastructure facilities*

NSF: \$117M;  
MPS CIF 21  
Request: \$20M

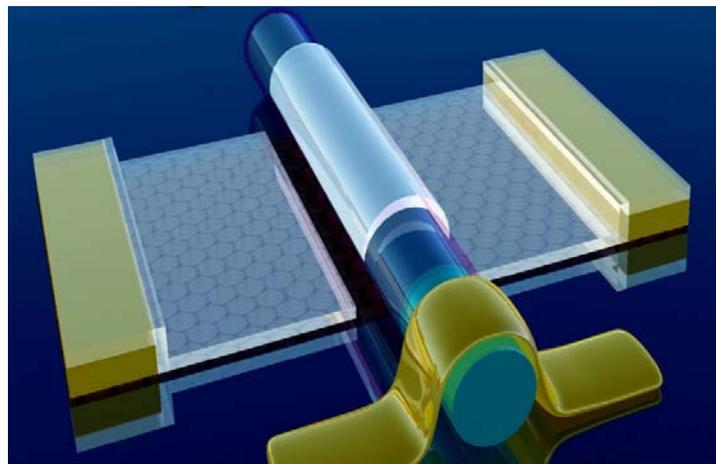


# Science and Engineering Beyond Moore's Law (SEBML)

NSF: \$96.18M;  
MPS Request:  
\$42.18M (+125%)

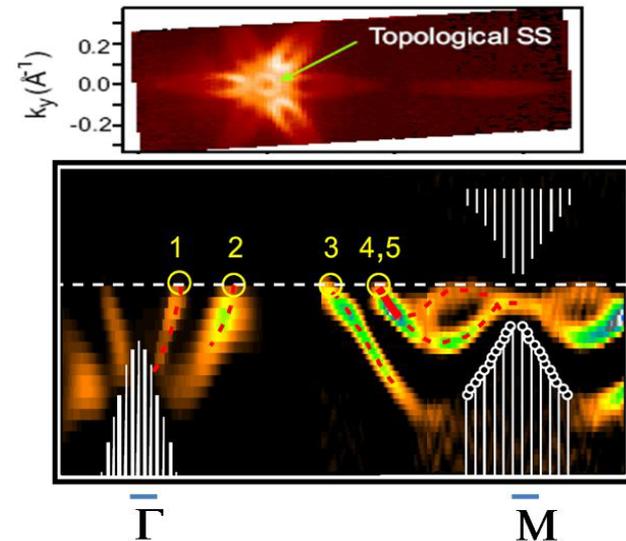
- Partnering with CISE, ENG on fundamental research for economic competitiveness
- Component of NSF's National Nanotechnology Initiative

*Materials for ultrafast computing*



**Graphene Nanostructures for High Performance Electronics**

*Quantum Information Science*



**Materials for Spintronics**

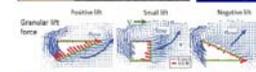
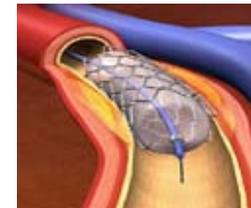
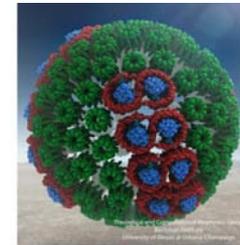


# BioMaPS: Biological, Mathematical, Physical Sciences and Beyond

NSF: \$76M;  
MPS BioMaPS  
Request: \$25.57M

## Research at the interface between BIO, MPS, and ENG

- Renewable fuels; bio-based materials; bio-imaging; supports SEES and Advanced Manufacturing activities
- Computational modeling for visualizing the geometrical structure of photosynthetic vesicles
- Improved mathematical models for blood vessel stents lead to a better stent with less chance of buckling
- Sandfish swimming in sand inform studies of motion in granular media



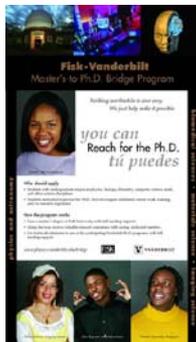
# CAREER

MPS Request:  
\$53.78M  
(+12.2%)

## Investing in the next generation S&T Workforce

- MPS accounts for 25% of all CAREER awards
- Important science: optical studies of quantum dots, materials for next generation electronic devices, gamma-ray bursts
- Impact in outreach and education: innovative university curricula, outreach efforts to schools and MSIs

### Keivan Stassun: Physics and Astronomy, Vanderbilt



- The Bridge program: 43 students; 38 minorities; 55% female; retention rate 93%
- Fisk awards the most MA degrees in physics to African American U.S. citizens

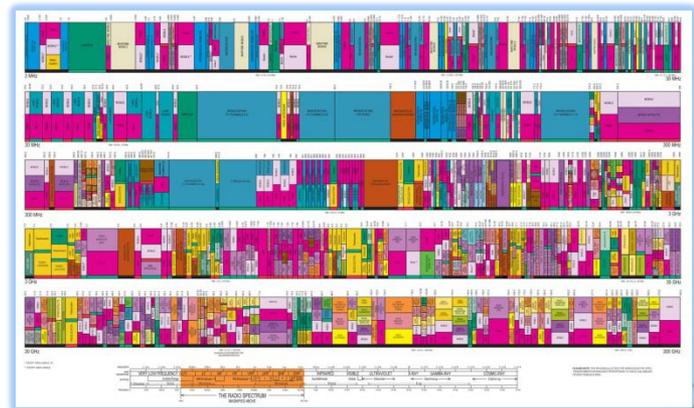


# Enhancing Access to the Radio Spectrum (EARS)

NSF: \$15M;  
MPS EARS  
Request: \$3M

## MPS partnership with ENG, CISE, and SBE

- Cross-cutting research on efficient use of the radio spectrum
- Interdisciplinary themes: technology, economics, social science, and public policy
- Responsive to national broadband priorities established by the White House and Congress
- Wireless Innovation Fund to support spectrum-related R&D
  - \$1B over 5 years into NSF programs
  - EARS, Cyber-Physical Systems, Wireless Testbeds



# MPS Support for Multidisciplinary Research: Institutes, Centers, and Networks



- Office of Multidisciplinary Activities (+\$5M)

- Institutes and Centers

- *Physics Frontier Centers*

- Joint Institute for Nuclear Astrophysics (JINA)

- *Materials Research Centers and Teams (MRCT)*

- The Centers of Excellence for Materials Research and Innovation (CEMRI)

- Materials Interdisciplinary Research Teams (MIRT)

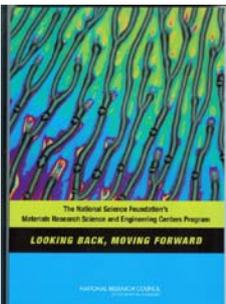
- *Mathematics Institutes Programs*

- Institute for Computational and Experimental Mathematics (ICERM)

- Networks

- *Sustainability Research Networks*

- *Research Networks in the Mathematical Sciences*



# MPS Large Facilities in 2012

	FY 2012 Request
<i>Adv. Tech. Solar Telescope (ATST)</i>	2.00
<i>Atacama Large Millimeter Array (ALMA)</i>	30.65
<i>Cornell High Energy Synchr. Source (CHESS)/ Cornell Electron Storage Ring (CESR)</i>	15.47
<i>GEMINI Observatory</i>	20.07
<i>IceCube Neutrino Observatory</i>	3.45
<i>Large Hadron Collider (LHC)</i>	18.00
<i>Laser Interfer. Grav. Wave Observatory (LIGO)</i>	30.40
<i>Nat'l Astronomy and Ionosphere Ctr. (NAIC)</i>	5.50
<i>Nat'l High Magnetic Field Laboratory (NHMFL)</i>	33.30
<i>Nat'l Nanotechnology Infra. Network (NNIN)</i>	2.68
<i>Nat'l Optical Astronomy Observatory (NOAO)</i>	29.17
<i>Nat'l Radio Astronomy Observatory (NRAO)</i>	42.89
<i>National Solar Observatory (NSO)</i>	9.79
<i>Nat'l Superconducting Cyclotron Lab (NSCL)</i>	21.50
<i>Other MPS Facilities</i>	3.90
	\$268.77

*Dollars in millions*

## ALMA

- 33 (of 66) antennas now in Chile
- Early Science with 16 antennas begins in 2011



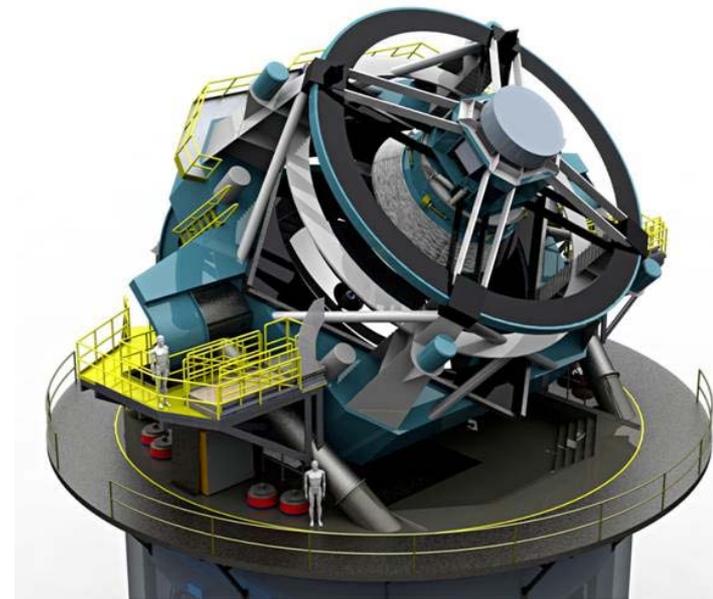
## NSCL

- Anticipate 5-year renewal for world-class research program
- NSF-DOE Joint Oversight Group handles transition to FRIB



# Summary

- \$1.43B budget requested for FY 2012 for MPS
- Sustaining basic research in fundamental science
  - *AST, CHE, DMR, DMS, PHY*
- Investing in national priorities
  - *OneNSF programs: SEES, CIF 21*
  - *BioMaPS, SEBML, EARS*
  - *Supporting young researchers: REU to CAREER*
- Continued investments in developing and operating facilities critical for fundamental research



LSST



Thank You

