

NSF AST Update to AAAC



Division of Astronomical Sciences

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February 22, 2011



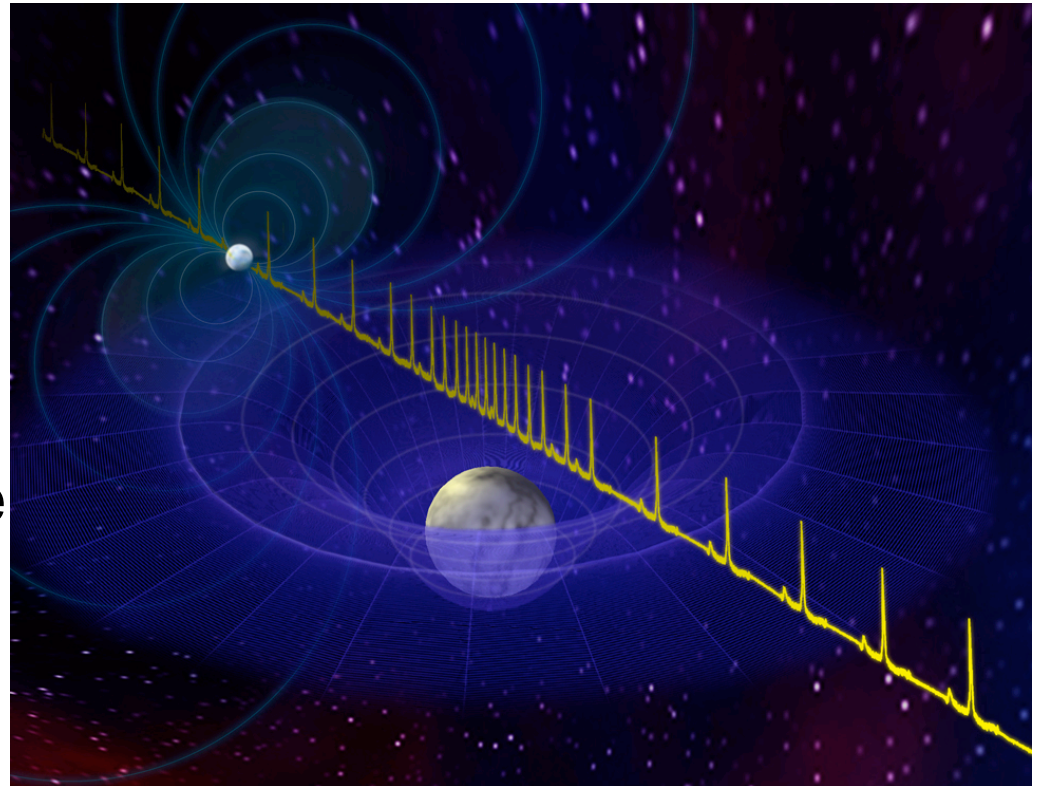
Outline

- Research and Facility Highlights
- Interagency Collaborations
- FY 2012 Budget Request
- Astro2010 Response and Budget Availability



Most Massive Neutron Star

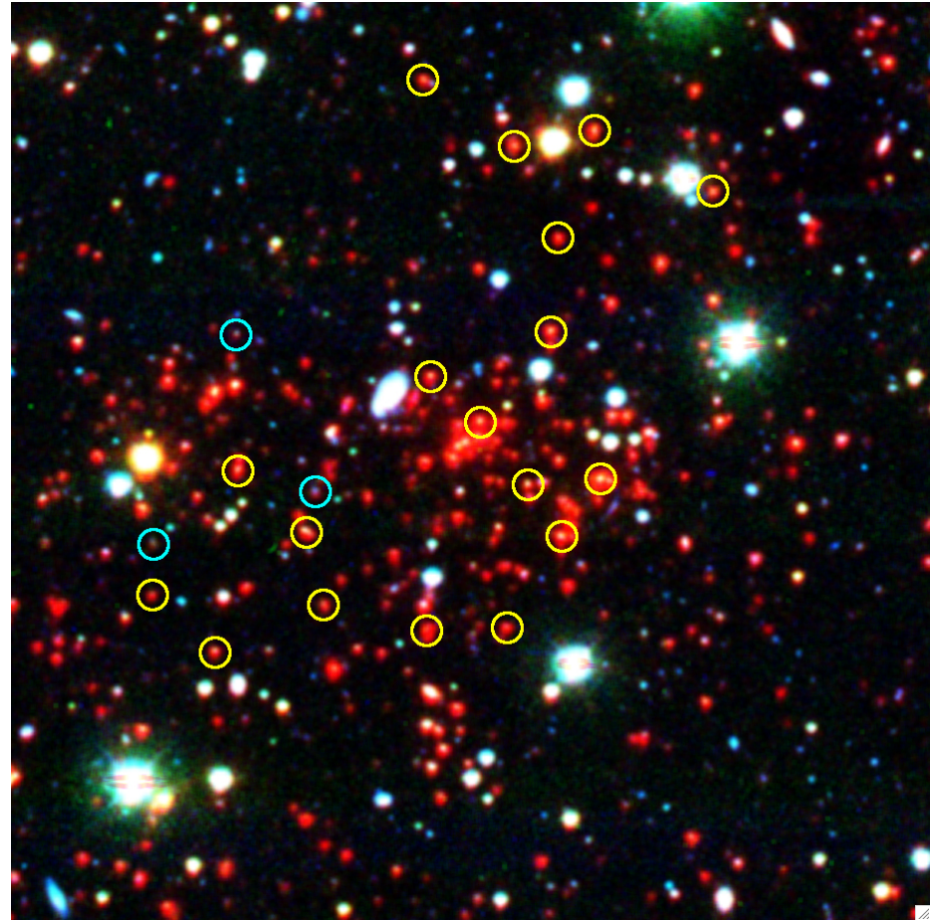
- GBT measured modification of pulse periods from pulsar in binary pair with white dwarf
 - “Shapiro” delay
- Modeling gives precise masses of system, with neutron star $M=1.97M_{\text{Sun}}$



Demorest et al. 2010, Nature, 467, 1081

Most Massive Galaxy Cluster

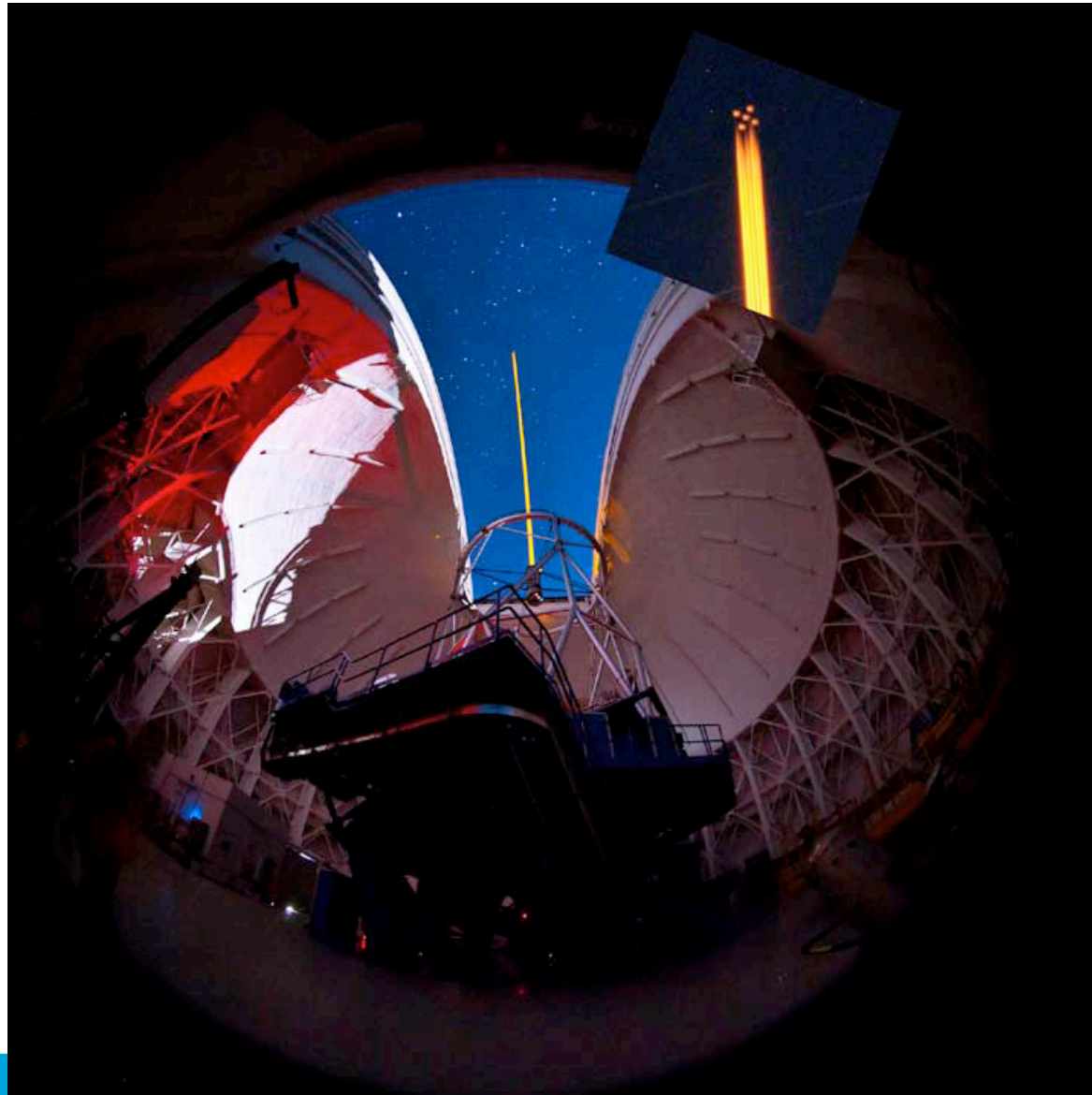
- South Pole Telescope detected $8 \times 10^{14} M_{\text{Sun}}$ galaxy cluster at $z=1.07$, using blind survey of Sunyaev-Zeldovich effect
- Multi-color images (CTIO 4m) reveal numerous “old” galaxies



Brodwin et al. 2010, ApJ, 721, 90



Gemini MCAO Constellation



50-watt laser (above) is projected as a 5-spot constellation covering 1 sq. arcmin by GeMS to illuminate the sodium layer ~90 km above Cerro Pachon, Jan. 22, 2011.



Antarctic Astronomy and Physics



- South Pole Telescope operations funded into 2012
- Various smaller-scale astronomy projects
- Operations of IceCube Neutrino Observatory

ALMA Status

- 33 antennas in Chile
- Early science call out; first observations late 2011



Expanded Very Large Array

- VLA upgraded through the Expanded Very Large Array (EVLA) project
 - \$94 M funded by NSF, Canada, and Mexico
 - NSF funding 2001 through 2011
 - Scheduled for completion in 2012, on time and on budget
 - Same number of antennas.
 - All-new telescope electronics.
 - Continuous frequency coverage from 1–50 GHz
 - Exceedingly capable correlator (from Canada)
 - Array data transmission via fiber optics.
- Shared-risk science now under way



ATST—Completion 2018

Improvements over current state of the art:

- Resolution – ~3X improvement
- Light grasp – ~8X improvement (solar physics is actually photon starved in some experiments)

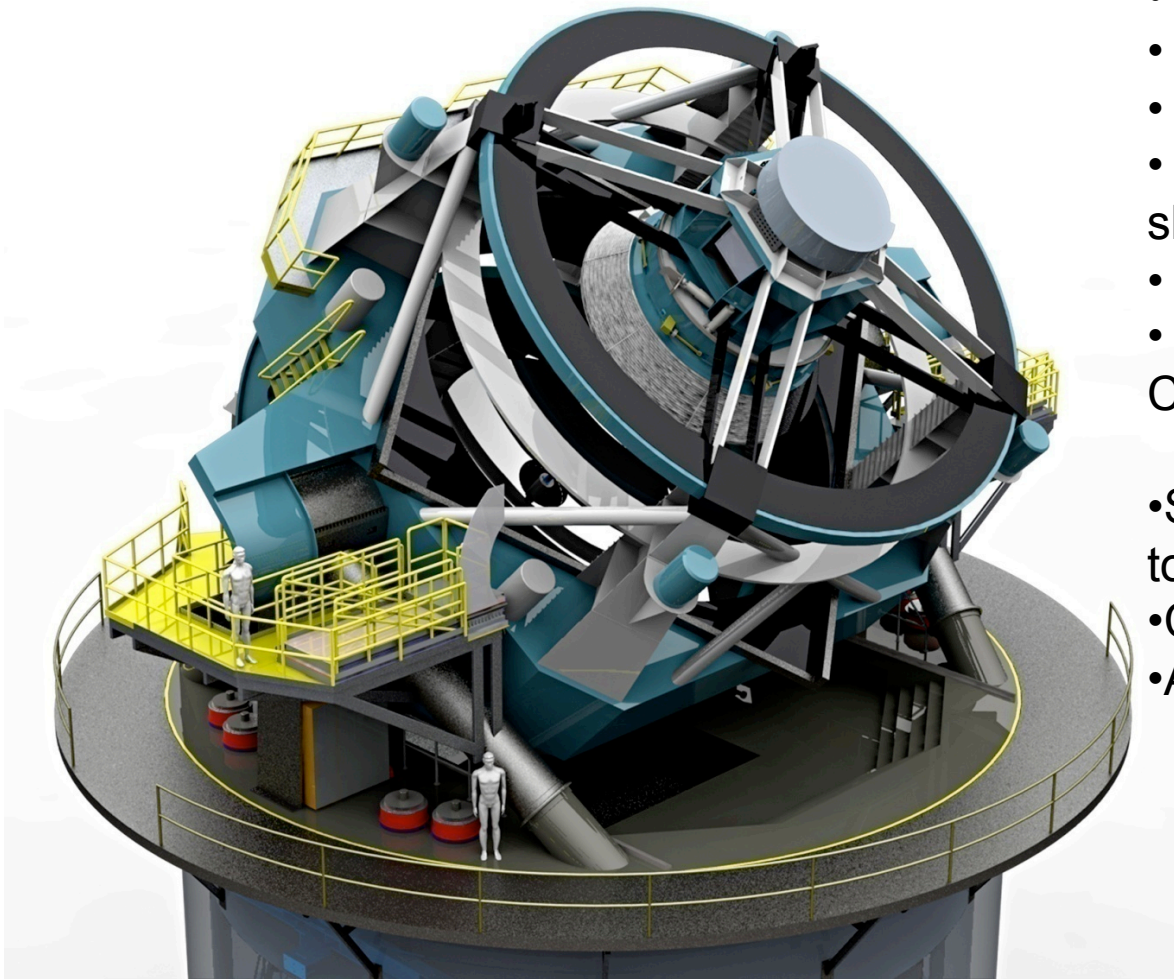
Technical Specifications:

- 4-m, off-axis Gregorian (all reflective), alt-az mount.
- Integrated adaptive optics.
- Hybrid enclosure with thermal control and dust mitigation.
- Wavelength sensitivity from 0.3-28 microns (near-UV through thermal infrared).
- Field of view: 3 arcminutes.
- Angular resolution < 0.03 arcsecond.
- Polarization accuracy < 0.01%.

ATST will be the world's flagship facility for ground-based solar physics observation and the first large US public-access solar telescope constructed in the past 30 years.



The Large Synoptic Survey Telescope - LSST



- 8.4 meter primary mirror
 - 3.3 gigapixel digital camera
 - 3.5 deg field of view
 - 30 terabytes of data nightly
 - Complete coverage of the visible sky twice per week
 - Nominal 10-yr lifetime
 - To be located on Cerro Pachon, Chile
-
- Site, telescope, and data handling to be funded by NSF
 - Camera funding by DOE (SLAC)
 - Aiming for FY14 MREFC start

LSST Update

- NSF process follows the *Large Facilities Manual* for MREFC projects
- Moving to Preliminary Design Review (PDR), which sets project scope and estimated cost; based on NSF proposal but covering entire project
- Current estimate \$563M in as spent, then year dollars, assuming a start in FY2014 (NSF \$392M, DOE \$132M, other \$39M)
- Interagency NSF-DOE Joint Oversight Group formed and meeting
- Directorate advisory committee (MPSAC) recommended LSST for PDR
- NSF MREFC panel endorsed LSST to go forward to PDR
- Placed within MPS and NSF facility plans; NSF share of operations tentatively identified; presented to the National Science Board and called 'solid'
- Waiting for NSF Director's approval to arrange PDR
- Working on a robust operations plan and cost



VAO Update

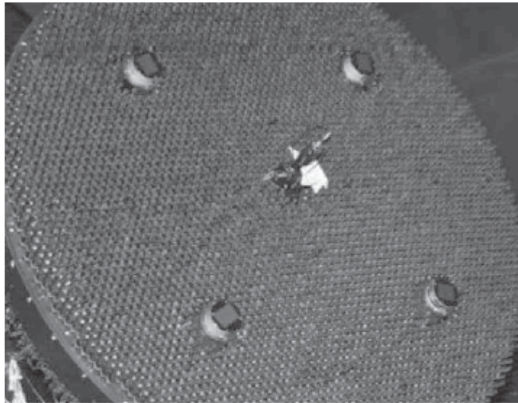
- VAO, LLC preliminary certification to receive federal funding agreed by NSF business office; NSF award made, May 2010
- NASA contribution funded through existing centers and thus unaffected by status of VAO, LLC
- New organization subject to review: NSF's Award Management and Business Assistance Program is holding a site visit in March
- NASA & NSF Program Managers attended VAO Board meeting last week
- Interagency Joint Oversight Group meets regularly and will soon start meeting with project management
- Strong link with Microsoft Research, World Wide Telescope product
- Development of the VAO as a facility; first VAO team meeting fall 2010
- Notable publications – <http://www.us-vo.org/pubs/notablepubs.cfm>



Other Interagency Collaborations

DECam –Dark Energy Camera

- 3 square degree fov; Camera built by DOE/FNAL, dedicated Blanco telescope time for Survey
- Delivery later this year, DES begins in '12



BigBOSS – Baryon Acoustic Oscillation

Proposal from LBL to NOAO for a 5,000 fiber spectrograph for Mayall for DE science
Five year survey beginning late in decade?
No commitment from NSF or DOE

Theory and Computation Networks

Astro2010 recommendation, to be discussed among agencies

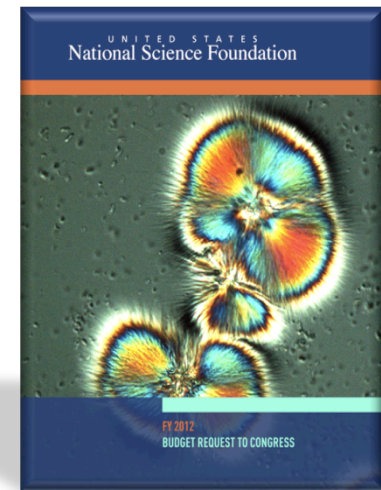
Atmospheric Cerenkov Telescope Array (#4 Large Project in Astro2010)

No near-term funding source



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

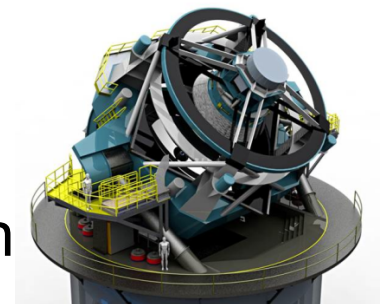
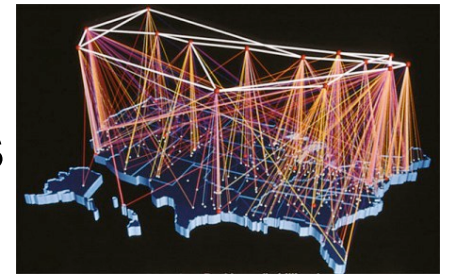


MPS FY 2012 Budget Request Highlights

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 Major Investments for FY 2012

- Compare Changes to Total MPS Increase of \$80M

MPS Major Investments

(Dollars in Millions)

Area of Investment	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
NNI	\$199.11	-	\$190.59	\$182.36	-\$8.23	-4.3%
SEES Portfolio	151.15	-	87.00	160.00	73.00	83.9%
CAREER	62.81	0.11	47.92	53.78	5.86	12.2%
SEBML	59.12	-	18.68	42.18	23.50	125.8%
BioMaPS	-	-	-	25.57	25.57	N/A
CIF21	-	-	-	20.00	20.00	N/A
Advanced Manufacturing	-	-	-	20.00	20.00	N/A
EARS	-	-	-	3.00	3.00	N/A

Major investments may have funding overlap and thus should not be summed.

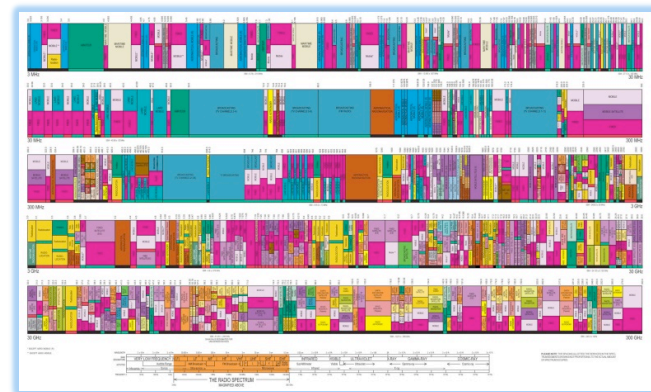


Enhancing Access to the Radio Spectrum (EARS)

MPS partnership with ENG, CISE, and SBE

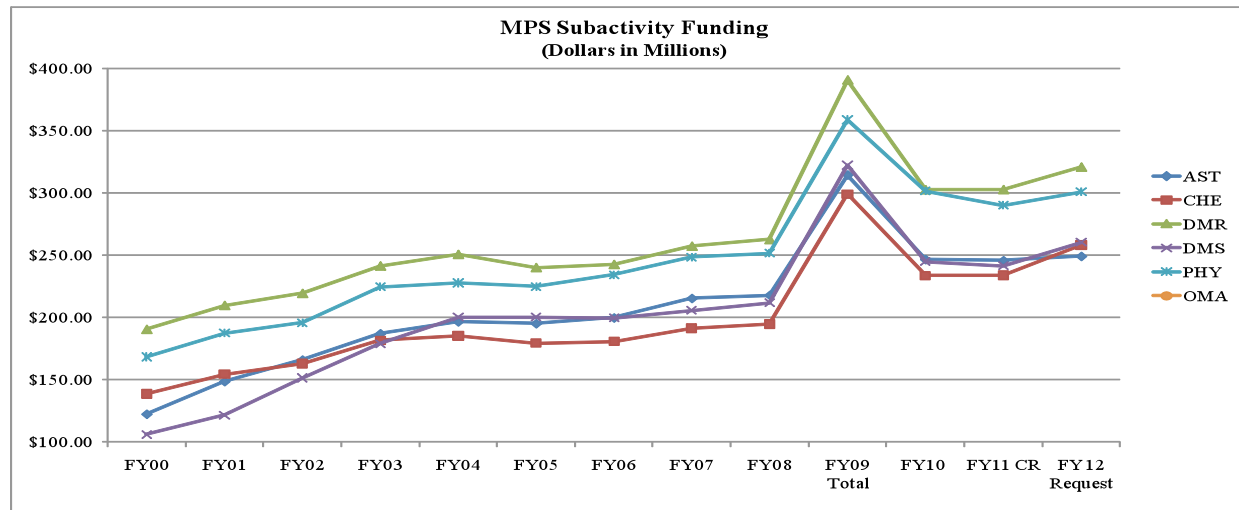
NSF: \$15M;
MPS EARS
Request: \$3M

- Cross-cutting research on efficient use of the radio spectrum
 - Developed with input from many communities, including radio astronomy
- Interdisciplinary themes: technology, economics, social science, and public policy
 - \$15M appropriated request (\$3M MPS, \$4M ENG, \$7M CISE, \$1M SBE)
 - Complementary Small Business Technology Transfer (STTR) EARS solicitation to be issued in Spring 2011 (additional \$12M)
- 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 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%
Total, MPS	\$1,367.95	\$15.70	\$1,351.84	\$1,432.73	\$80.89	6.0%



AST Spending (FY12 req – FY10 spend)

ADDITIONS

TOTAL	+\$30.6M
ALMA Ops	+12.7M
NOAO Base	+1.7M
Gemini	+1.0M
LSST	+1.0M
NSO	+0.7M
ATST	+2.0M
CIF21	+4.0M
EARS	+3.0M
SEES	+2.0M
Existing mid-size	+2.0M
CAREER	+0.5M

SUBTRACTIONS

TOTAL	-\$26.2M
NRAO Base ^{1,2}	-6.7M
ReSTAR ³	-3.9M
TSIP ²	-4.0M
NAIC ^{1,2}	-2.9M
SKA TDP ^{1,2}	-3.0M
IGERT, GRF ²	-2.0M
PAARE ²	-1.0M
Concluding mid-size ¹	-2.7M

1. Planned decrease
2. Program cut
3. One-time in 2010



Estimated AST Spending “Commitments”

Year	FY12	FY13	FY14	FY15	FY16
Facilities	140.1	145.5	156.3	164.4	164.4
Mid-scale	23.0	21.5	17.4	13.0	13.0
Grants	81.4	82.6	84.7	85.9	88.0
Mgmt	4.6	4.7	4.8	4.9	4.9
TOTAL	249.1	254.3	263.2	268.2	270.3

- Remember, these commitments include NO Astro2010 recommendations, and no new mid-scale starts; assumes ongoing NSF-wide initiatives at FY12 levels.
- Mid-scale includes “mid-scale”, URO, VAO, and LSST D&D. TSIP (after FY11), ReSTAR, and GSMT are assumed zero for this exercise.
- Facilities runouts from FY 2012 budget request; assumed flat after C.A.s expire.
- Grants costs assume inflation-level increases in individual programs.

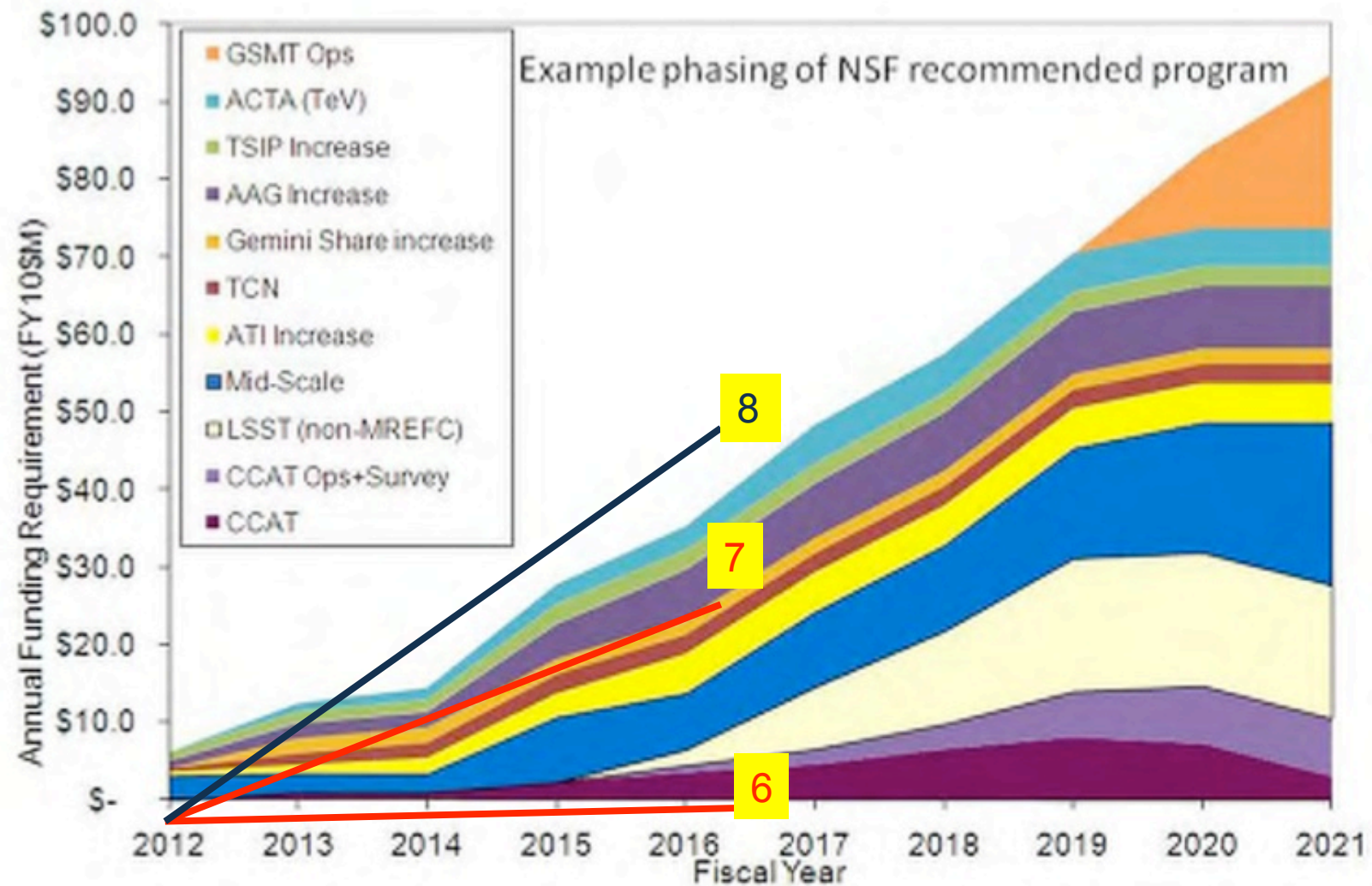


Budget Scenarios Assessed for Astro2010

- **1: $FY12=0.95*FY11$, $FY11=0.95*FY10$, then 2.5%/yr**
- **2: $FY11=0.95*FY10$, then flat**
- **3: $FY11=0.95*FY10$, then 2.5%/yr**
- **4: Flat at FY10 levels**
- **5: $FY11\&12=\text{request}$, then flat**
- **6: $FY11\&12=\text{request}$, then 2.5%/yr**
- **7: $FY11\&12=\text{request}$, then 4.5%/yr**
- **8: $FY11\&12=\text{request}$, then 6.5%/yr**



Astro2010 Ramp + Budget Scenarios



Current Astro2010 Plans

- Continuing LSST D&D funding, moving toward PDR and MREFC start (FY14?)
- No funding wedge available for mid-scale
 - Awaiting NSB/NSF response to America Competes Act
 - Seeking ways to create budget space
- No GSMT commitment in FY12 request
 - May go ahead with solicitation for selection of candidate for federal investment
- No current budget envelope for initiating the recommended “small” increases, but protecting AAG & ATI near current levels
- Pursuing Gemini governance & OIR-system issues
- Aiming for strategic portfolio review in next year



Strategic Review Plan

- Not just a facility review
- Aimed at an assessment of the proper strategic balance within the division in 2015, 2020, and 2025, with all parts of the program included
 - Specific realizable budget scenarios to be addressed
 - Evolution of program also must be realizable
 - Any facility decommissioning may require application of significant funding before savings can be achieved
- AST working group is currently assessing exact charge and mechanism for strategic review
 - Present initial plan to MPS Advisory Committee in April
 - Completion in first half of 2012



Thank You



MPS Large Facilities in 2012

ALMA

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



LIGO

- Latest, highest-sensitivity run ended Oct 2010
- Facility handed over to Advanced LIGO project

	FY 2012 Request (M\$)
<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

\$140.07M of total is AST