

Astronomy and Astrophysics in the FY 2014 Budget

*Joel R. Parriott and Kevin B. Marvel
American Astronomical Society*

HIGHLIGHTS

- The Administration has requested \$1.2 billion, almost \$0.3 billion below the FY 2012 level, for NASA's Planetary Science Division for the second year in a row.
- The National Science Foundation (NSF) and Department of Energy (DOE) have coordinated to request a new construction and fabrication start for the Large Synoptic Survey Telescope project in the FY 2014 Budget.
- Ongoing facility/mission operations, research and data analysis grants, and smaller-sized competitive facility/mission development programs continue to see downward budget pressures.

INTRODUCTION

Astronomy is the most ancient of the sciences, beginning when people first looked up at the sky and debated its mysteries. Now the universe is viewed with telescopes operating at every wavelength in the electromagnetic spectrum. A universe more fantastic than anything we might have imagined has been revealed.

Astronomers have managed to trace the history of the universe back to its very first moments when all matter and light were compressed into a dense energetic state that rapidly expanded in a so-called Big Bang forming our universe. Just in the past decade, astronomers have discovered that the universe is expanding faster and faster in a kind of "runaway" situation, while also finding that roughly 96 percent of the matter and energy content of the universe is completely unknown to us. Astronomers have

observationally confirmed the existence of black holes. These bizarre objects are now found to be not only ubiquitous, but also to play a major role in the formation of galaxies. Astronomers have also confirmed the existence of nearly 900 planets around other stars and have discovered a number of Earth-like planets in the “habitable zone.”

Table 1. Astronomy in the Federal R&D Budget
(budget authority in millions of dollars)

	FY 2012	FY 2013*	FY 2014	Change FY 12-14*	
	Actual	Estimate	Budget	Amount	Percent
Nat'l Aero and Space Admin	17,785	16,379	17,715	-69.6	-0.4%
<i>Science</i>	5,074	4,795	5,018	-55.9	-1.1%
<i>Heliophysics</i>	645	603	654	8.7	1.3%
<i>Planetary Science</i>	1,501	1,319	1,218	-283.9	-18.9%
<i>Astrophysics</i>	648	624	642	-6.1	-0.9%
<i>James Webb ST</i>	519	585	658	139.6	26.9%
National Science Foundation	7,105	6,884	7,626	520.4	7.3%
<i>Math & Physical Sciences</i>	1,309	1,256	1,386	77.0	5.9%
<i>Astronomical Sciences</i>	235	--	244	9.0	3.8%
<i>Major Res. Equip & Faci</i>	198	183	210	12.0	6.1%
<i>Astronomy projects</i>	13	--	70	57.0	456.0%
Department of Energy	26,320	--	28,416	2095.6	8.0%
<i>Office of Science</i>	4,953	4,632	5,153	199.8	4.4%
<i>High Energy Physics</i>	771	752	755	-15.5	0.0%
<i>Cosmic Frontiers</i>	72	--	99	27.1	37.7%

Source: Agency budget justifications and, for FY 2013, AAAS estimates.
Figures rounded to the nearest million.

Each new discovery raises more questions and creates new technological needs, thus spawning creativity and innovation. Astronomy is truly an exciting, vibrant science that adds meaning to our human existence, captures the public’s imagination, and inspires young people to pursue careers in science and technology. It also spurs economic growth through the development of new technologies and innovations, which find their way into a multitude of commercial and societal applications.

All three major areas of the astronomical sciences have now released their National Research Council decadal surveys: *New Worlds, New Horizons in Astronomy and Astrophysics*, *Visions & Voyages in Planetary Sciences*, and *Solar and Space Physics: A Science for a Technological Society*. These decadal surveys represent the consensus of scientific communities’ review

of the current state of understanding of the science and present a prioritized list of projects, programs and missions important in the next decade. The funding agencies look to these reports for guidance on scientific priorities.

NASA, NSF, and DOE provide the most federal funding for astronomical research, with NASA contributing over 80 percent of the federal share of support for these disciplines. Thus, the budget for the Science Mission Directorate at NASA affects many U.S. astronomers and the aerospace industry that builds the spacecraft to make research missions possible.

NSF funds the construction and operation of the U.S. ground-based national observatories in optical astronomy, radio astronomy, and solar physics. These observatories play a critical role for researchers from smaller institutions for which large observing facilities are too expensive to construct and operate. They also provide access for American astronomers to the Southern Hemisphere sky, where many important astronomical objects are located and cannot be observed from Northern Hemisphere locations (e.g. the Magellanic Clouds, our nearest galactic neighbors, and the center of our own galaxy, the Milky Way).

DOE has undertaken new astronomical research projects and has begun collaborations with both NSF and NASA on mission-relevant astrophysics projects, such as the Fermi Gamma-ray Space Telescope and construction of the camera on the Large Synoptic Survey Telescope (LSST) for studies of dark energy. The Congressionally-chartered Astronomy and Astrophysics Advisory Committee (AAAC) meets regularly to discuss the best and most efficient ways for DOE, NSF, and NASA to collaborate on astronomy research.

ASTRONOMY IN THE NASA BUDGET

The President has requested \$17.7 billion for NASA in FY 2014, level with his request for FY 2013, and a decrease of \$70 million from the FY 2012 level. The Science Mission Directorate (SMD) — which houses the James Webb Space Telescope project and the Earth Science, Astrophysics, Planetary Science, and Heliophysics Divisions — requests funding of \$5.0 billion in FY 2014, a decrease of \$56 million, or 1.1 percent, compared to FY 2012. The FY 2014 request for SMD is \$110 million above the FY 2013 request.

For the second year in a row, the budget request for Planetary Science is approximately \$1.2 billion, a decrease of \$280 million below the FY 2012 level. Congress rejected this proposal in FY 2013 and appropriated \$1.4 billion for the division, though the sequester cut and an across-the-board rescission result in a final FY 2013 AAAS estimate of \$1.3 billion. While the FY 2014 request is \$25 million higher than the FY 2013 request, this budget includes new activities for radioisotope production infrastructure (+\$50 million) and near earth object survey and characterization work in support of the Administration's proposed Asteroid Retrieval Mission (+\$20 million). As announced in December 2012, the budget does include funding for a Mars 2020 rover mission based on the successful Curiosity architecture.

Production of plutonium-238 is of critical importance to the development of planetary science missions since there is no viable alternative to power deep space missions. The FY 2014 request for Planetary Science includes \$16 million (an increase of \$6 million) for plutonium-238 production, and for the first time \$50 million to cover the full cost of the laboratory infrastructure for radioisotope power system development at the Department of Energy.

Funding for the Astrophysics Division is proposed to decrease by \$6 million below FY 2012, to \$640 million in FY 2014. The Astrophysics Explorer competitive mission line would increase by \$17 million, or 20 percent, compared to the FY 2012 level, but this FY 2014 level is \$33 million below its projected level in the FY 2013 request. As a result, the frequency of future Explorer missions will actually be reduced despite the increase compared to FY 2012. Funding for currently operating missions, research, and data analysis continues to face downward pressure in this request.

The budget request includes \$660 million, \$140 million above FY 2012, for the James Webb Space Telescope (JWST) to keep this top NASA priority on schedule to launch in 2018. FY 2014 is expected to be the peak funding year for the JWST project.

The Heliophysics budget would increase by \$9 million to \$660 million in the President's FY 2014 request. The request would provide \$105 million (double the level in FY 2012) to continue development of Solar Probe Plus, the solar physics decadal survey's top large mission. The request

also includes a \$31 million increase to continue development of the Solar Orbiter Collaboration with the European Space Agency.

As a component of the Administration's larger proposal to consolidate science and math education programs across the government, the NASA request would eliminate almost \$50 million in education and public outreach programs within the Science Mission Directorate.

ASTRONOMY IN THE NSF BUDGET

The budget request includes \$7.6 billion for NSF in FY 2014, a proposed increase of \$520 million, or 7.3 percent, over FY 2012. The Division of Astronomical Sciences (AST) is located within the Mathematics and Physical Sciences (MPS) Directorate in NSF's Research & Related Activities (R&RA) account. The budget includes \$1.4 billion for MPS, an increase of \$77 million, or 5.9 percent, above FY 2012.

AST is proposed to increase \$8.9 million, or 3.8 percent, from \$234 million in FY 2012 to \$244 million in FY 2014. Within this topline increase compared to FY 2012, research funding for the Enhancing Access to the Radio Spectrum (EARS) program would increase by \$9.0 million, operations funding for the Atacama Large Millimeter/sub-millimeter Array would increase by \$7.8 million, and a new competitive Mid-Scale Innovations Program starts at \$7.0 million. To offset most of these increases, education activities would be cut by \$0.8 million, national observatory funding would be cut by \$7.1 million, and several smaller instrumentation and university-scale telescope programs would be reduced or eliminated.

Astronomy continues to benefit from telescope construction funding through the NSF Major Research Equipment and Facilities Construction (MREFC) account, which is proposed to increase by \$12 million to \$210 million. There are two astronomy projects proposed for funding within the MREFC account in FY 2014: a new construction start for Large Synoptic Survey Telescope (LSST; \$28 million) and a requested increase for the ongoing construction of the Advanced Technology Solar Telescope (ATST; +\$32 million for a total of \$42 million). LSST was the top large ground-based priority in the most recent astronomy and astrophysics decadal survey. ATST is undergoing a cost and schedule re-baseline review due to the 30-month delay in gaining site access.

MPS chartered an ad hoc advisory panel to carry out a review of the entire AST portfolio given that roughly 60 percent of the AST budget is already devoted to facility operations, with new high-priority facilities (ATST and LSST) under or starting construction.¹ The review panel, which finished its work in August 2012, recommended that NSF divest itself of a number of currently operating telescopes (located primarily in Arizona and West Virginia) in order to achieve a more balanced portfolio within a constrained budget environment. The FY 2014 request for AST does not provide any details on how NSF plans to implement the panel's divestment recommendations, but the request does propose to cut the budgets for the national observatories below their FY 2012 levels.

ASTRONOMY IN THE DOE BUDGET

The Cosmic Frontier Experimental Physics program within the DOE Office of Science's High Energy Physics (HEP) division funds activities designed to advance our understanding of fundamental laws of physics and to answer mysteries of how the universe works, such as dark matter, dark energy, and gamma-ray astrophysics. The budget includes \$99 million for the Cosmic Frontier program, an increase of \$27 million, or 38 percent, above FY 2012.

HEP is collaborating with NSF on the LSST project for studies of dark energy. HEP would supply the primary camera for the telescope at an estimated cost of \$160 million. Just as the NSF request includes a new construction start for LSST in FY 2014, the DOE request includes \$22 million to start a new equipment fabrication project for the camera. This new start is the primary reason that the Cosmic Frontier budget would increase so dramatically in FY 2014. HEP also funds other dark energy projects, including the Dark Energy Survey, will enter operations phase in FY 2014, and development funding for the proposed Mid-scale Dark Energy Spectroscopic Instrument.

¹ http://www.nsf.gov/mps/ast/ast_portfolio_review.jsp