Astrophysics Research Program

NASA Advisory Council
Astrophysics Subcommittee

20 July 2016

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Research and Analysis Opportunities

Solicited through ROSES-16:

- **Supporting Research & Technology**
  - Astrophysics Research & Analysis (APRA)
  - Strategic Astrophysics Technology (SAT)
  - Astrophysics Theory Program (ATP)
  - With Planetary Science Division: Exoplanet Research Program (XRP), Habitable Worlds
- **Data Analysis**
  - Astrophysics Data Analysis (ADAP)
  - Guest Observer and Guest Investigator programs for Fermi, K2, NuSTAR, Swift

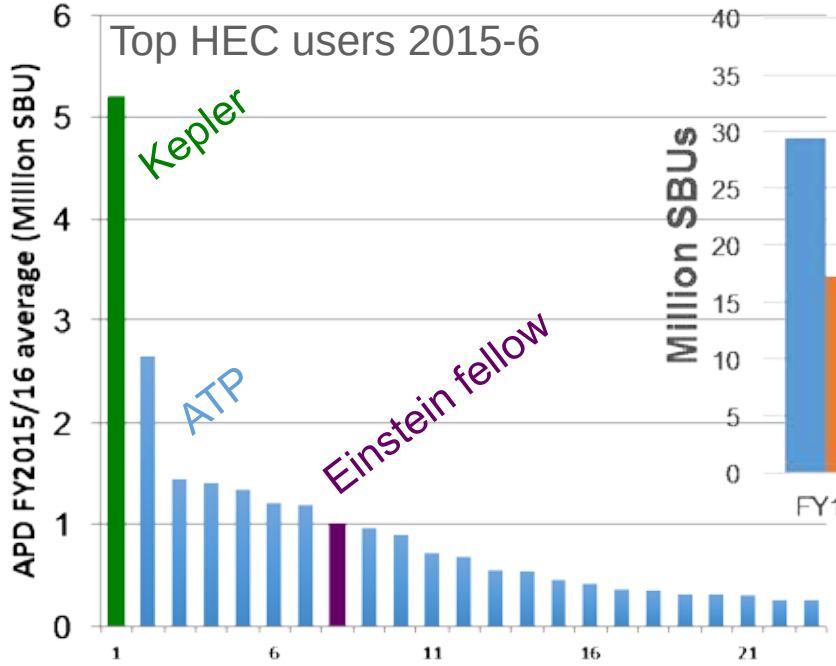
Separately solicited:

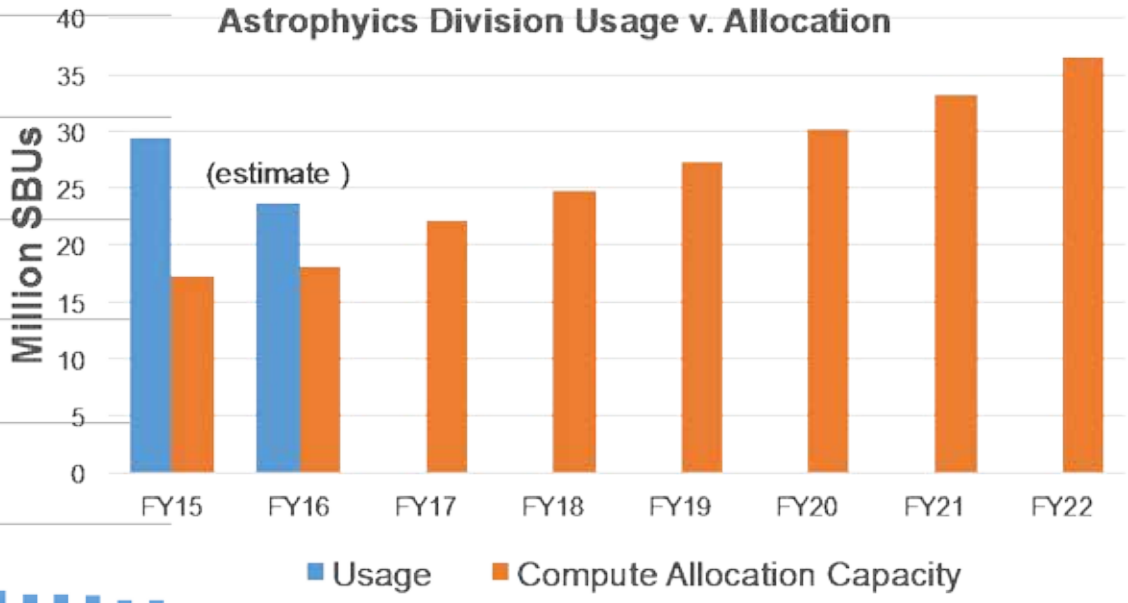
- Proposals for Hubble & Chandra observations and archival research, and for SOFIA and Spitzer observations; XMM (ESA)
- NASA Earth and Space Science Fellowships, for graduate students
- Einstein, Hubble and Sagan Postdoctoral Fellowships

ROSES: Data Management and Computing

New in 2015: ROSES proposals must include a plan for data management, or explain why no data will be generated. Data needed to reproduce figures, tables and other representations in publications must be made available at the time of publication. See http://science.nasa.gov/researchers/sara/faqs/dmp-faq-roses/

New for 2016: proposals needing high-performance computing (HEC) must now estimate and justify required resources. We will need similar data for other users – postdoc fellows, GO award recipients, missions – to estimate need: likely more than is available. Astrophysics was given extra resources in 2015-6 for Kepler mission processing.





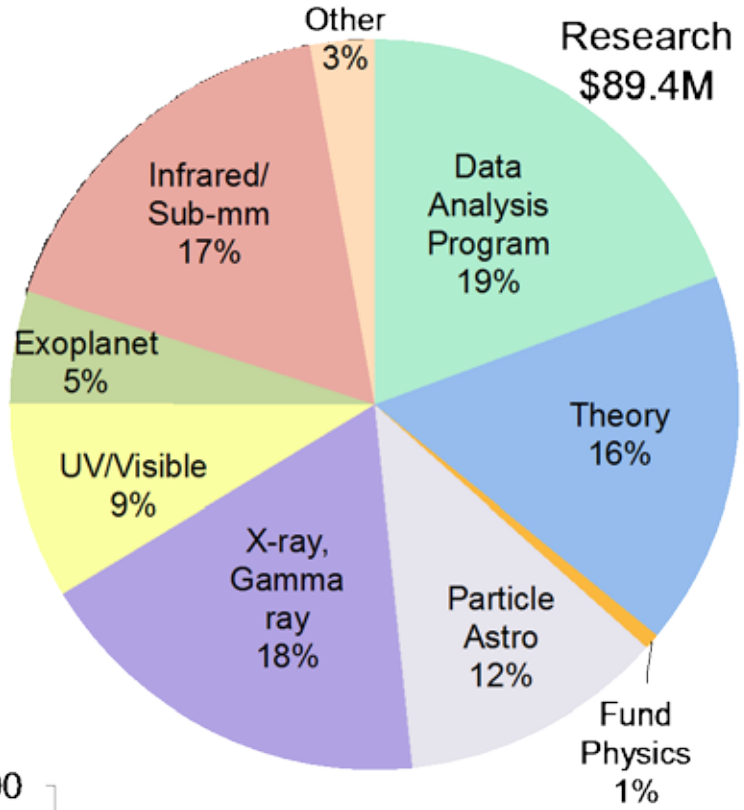
Astrophysics Proposal Competitions

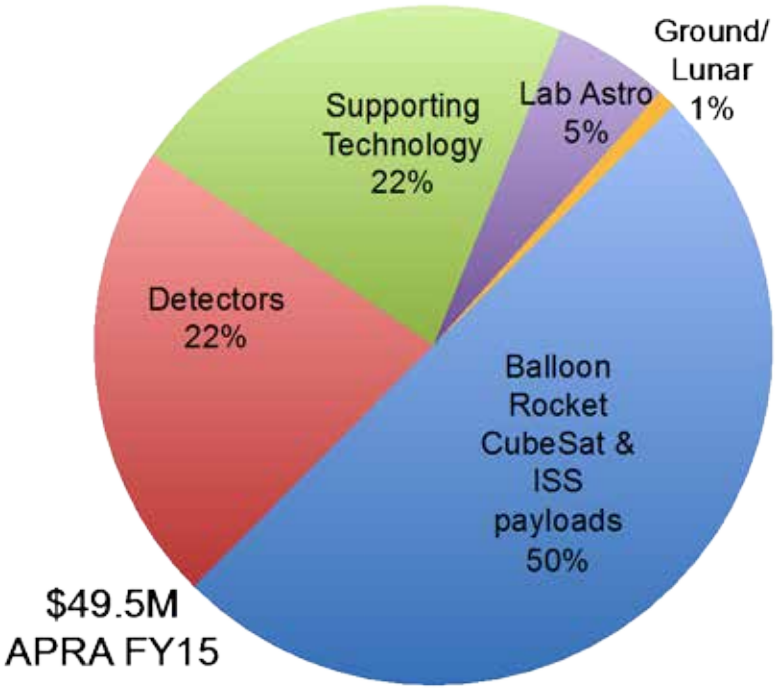
	Proposal Due Date	Notify Date	Days past received	Number received	Number selected	% selected
Hubble GO – Cycle 23	Apr 10, 2015	June 24, 2015	75	1114	261	23%
EPDS (Doppler Spectr)	Apr 24, 2015	July 2, 2015	69	6	2	33%
ADAP (Data Analysis)	May 15, 2015	Sep 29, 2015	137	250	51	20%
Exoplanet Research	May 22, 2015	Oct 15, 2015	146	43	7	16%
Kepler K2 GO – Cycle 3	Jul 1, 2015	Oct 14, 2015	105	72	32	44%
SOFIA GI – Cycle 4	Jul 10, 2015	Oct 22, 2015	104	155	82	53%
Spitzer GO – Cycle 12	Sep 11, 2015	Oct 26, 2015	45	104	31	30%
SOFIA 3rd Gen Instrument	Oct 7, 2015	Dec 10, 2015	64	3	2	67%
WFIRST Sci. Inv. Teams	Oct 15, 2015	Dec 18, 2015	64	38	12	32%
Swift GI – Cycle 12	Sep 25, 2015	Jan 19, 2016	116	185	43	23%
Roman Tech Fellows	Nov 6, 2015	Feb 5, 2016	91	5	3	60%
NuSTAR GO – Cycle 2	Dec 11, 2015	Feb 2, 2016	53	185	50	27%
Fermi GI – Cycle 9	Jan 22, 2016	May 5, 2016	104	184	36	20%
NESSF-16	Feb 8, 2016	June 1, 2016	114	136	9	7%
Kepler K2 GO – Cycle 4	Mar 4, 2016	July 11, 2016	118	109	36	33%
Chandra GO – Cycle 18	Mar 15, 2016	July 18, 2016	125	556	168	30%
APRA (Basic Research)	Mar 18, 2016		122	157		
SAT (Technology)	Mar 18, 2016		122	29		
Hubble GO – Cycle 24	Apr 8, 2016	June 24, 2016	77	1094	245	22%
ADAP (Data Analysis)	May 13, 2015		66	238		
Exoplanet Research	May 23, 2015		56	50		
Spitzer GO – Cycle 13	June 8, 2016		40	115		
SOFIA GI – Cycle 5	July 1, 2016		17	179		
ATP (Astrophysics Theory)	July 8, 2016		10	201		

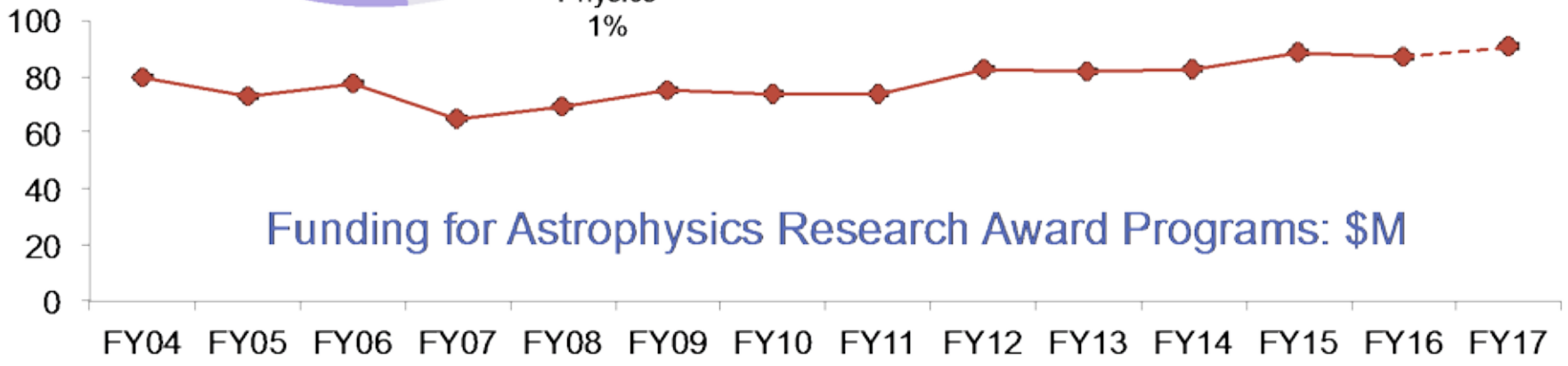
100% of recent selections announced within 150 days

R&A Selection Rate: 22%; GO Selection Rate: 28%

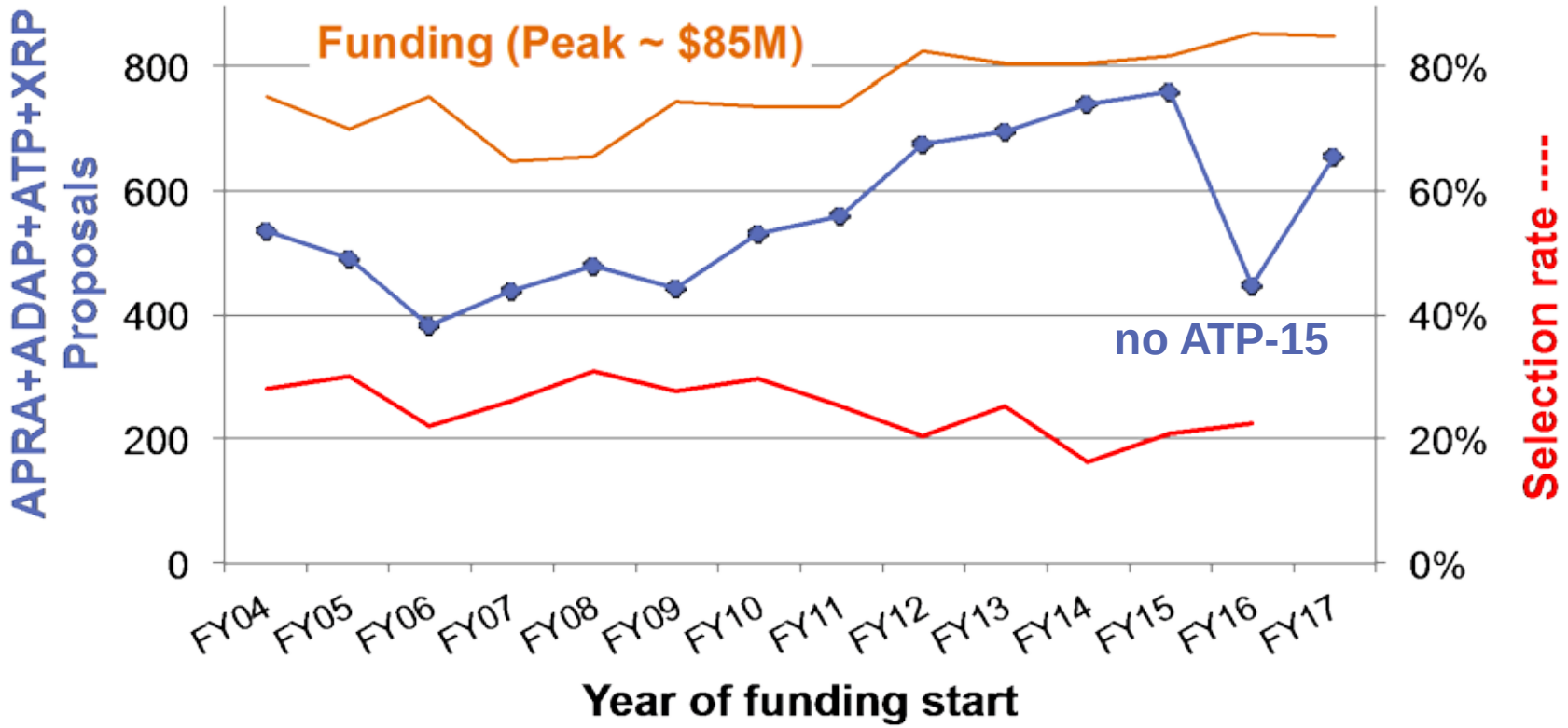
FY15 Research Program Budget and Spending







Proposal Numbers Grew Faster than $$



Since 2010, proposal numbers have grown faster than funding, so selection rates have fallen.

We received fewer proposals for 2016 funding because there was no ATP-15 competition.

Suborbital-Class Payloads

Wallops ArcSecond Pointer (WASP) is now regularly available. Initial cost to PI to use WASP on their flight is ~$650k. Support for subsequent flights would cost $100k-$240k, depending on location and duration.

COSI's 46-day SuperPressure balloon flight from New Zealand in May-July 2016 demonstrates a new balloon capability at mid-latitudes. COSI observed a bright gamma-ray burst, placing limits on polarization; it mapped the Galactic center in the 511keV positron annihilation line.

The Sounding Rocket program plans to offer launch opportunities from Australia in 2019-2020.

HALOSAT (PI Kaaret, U Iowa), a CubeSat measuring soft X-ray emission from highly ionized oxygen to map the Milky Way's hot gas halo, has passed early instrument reviews and expects to launch in 2018-19. This APRA selection was funded by the SMD CubeSat Implementation Project (SCIP).

Astrophysics Named Postdoctoral Fellowships

NASA Astrophysics offers three named postdoctoral fellowships, tenable at US institutions for 3 years. The 35 new fellows starting in 2016 receive a first-year stipend of $67,500, with benefits, and $16,000 for research expenses.

The Einstein, Hubble and Sagan Postdoctoral Fellowships support roughly 100 Fellows at any time. The Astrophysics Division budgeted ~$14M for these programs in FY2016. The FY2016 budget for Astrophysics core R&A programs was ~$87M, supporting ADAP, APRA, ATP, XRP, etc.

NASA plans to increase R&A funding, within the constraints of a flat overall astrophysics budget, by awarding fewer named postdoctoral fellowships and re-allocating the funds to grow the R&A budget.

The Astrophysics Subcommittee is tasked with considering these planned changes, and providing a response to the Director of Astrophysics at its October 2016 meeting.

Hubble, Einstein and Sagan Fellowships

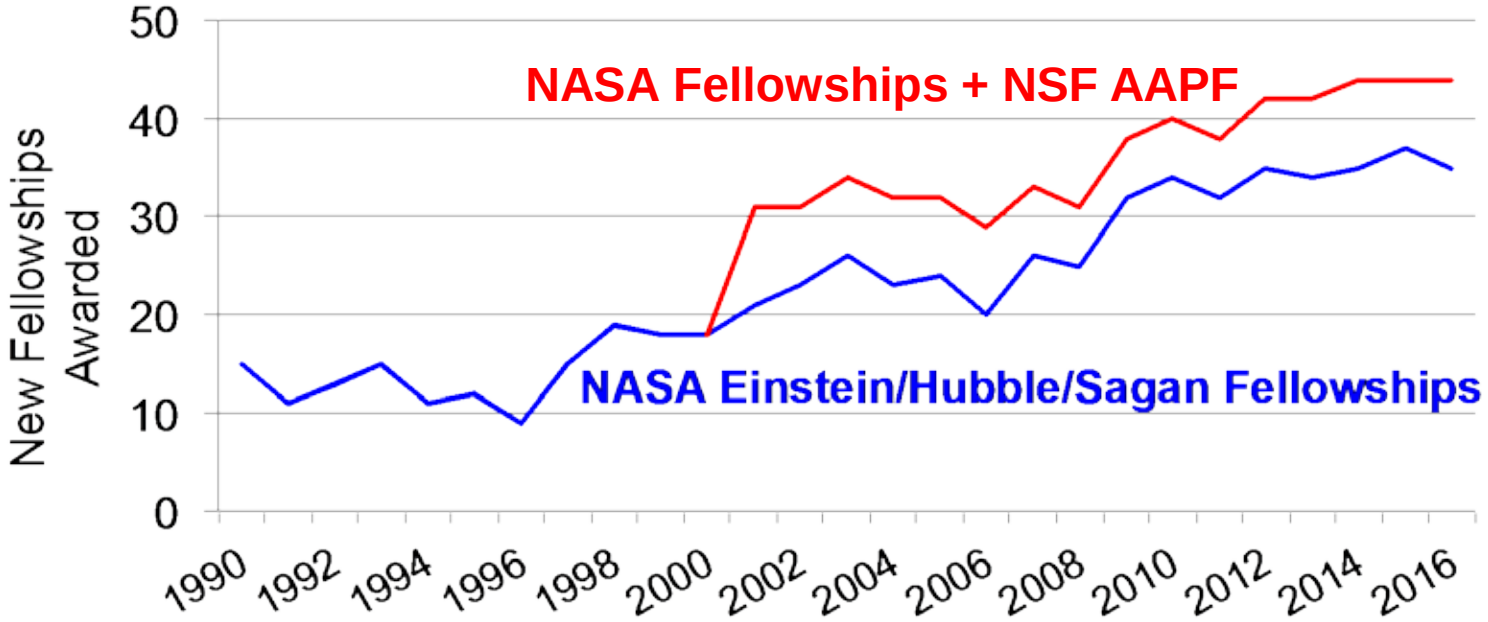
Hubble Fellowships: started in 1990, absorbed Spitzer Fellowships from 2009. 16-17 new awards each year, for a total of 43-44 fellows, through the Space Telescope Science Institute.
For research topics broadly related to the Cosmic Origins program.

Einstein Fellowships: combined Chandra (started 1998) and Fermi Fellowships, from 2009. 12-14 new awards each year, through the Chandra X-ray Center.
For research topics broadly related to the Physics of the Cosmos program.

Sagan Fellowships: started in 1999 as Michelson Fellowships, renamed in 2008. 5 or 6 new awards each year, through the NASA Exoplanet Science Institute.
For research topics broadly related to the Exoplanet Exploration program.

These are highly prestigious and very competitive. In 2015, the Hubble program received 272 applications, the Einstein program received 163 applications, and the Sagan program 89 applications. Even allowing for those who apply to more than one program, the success rate is below 10%.

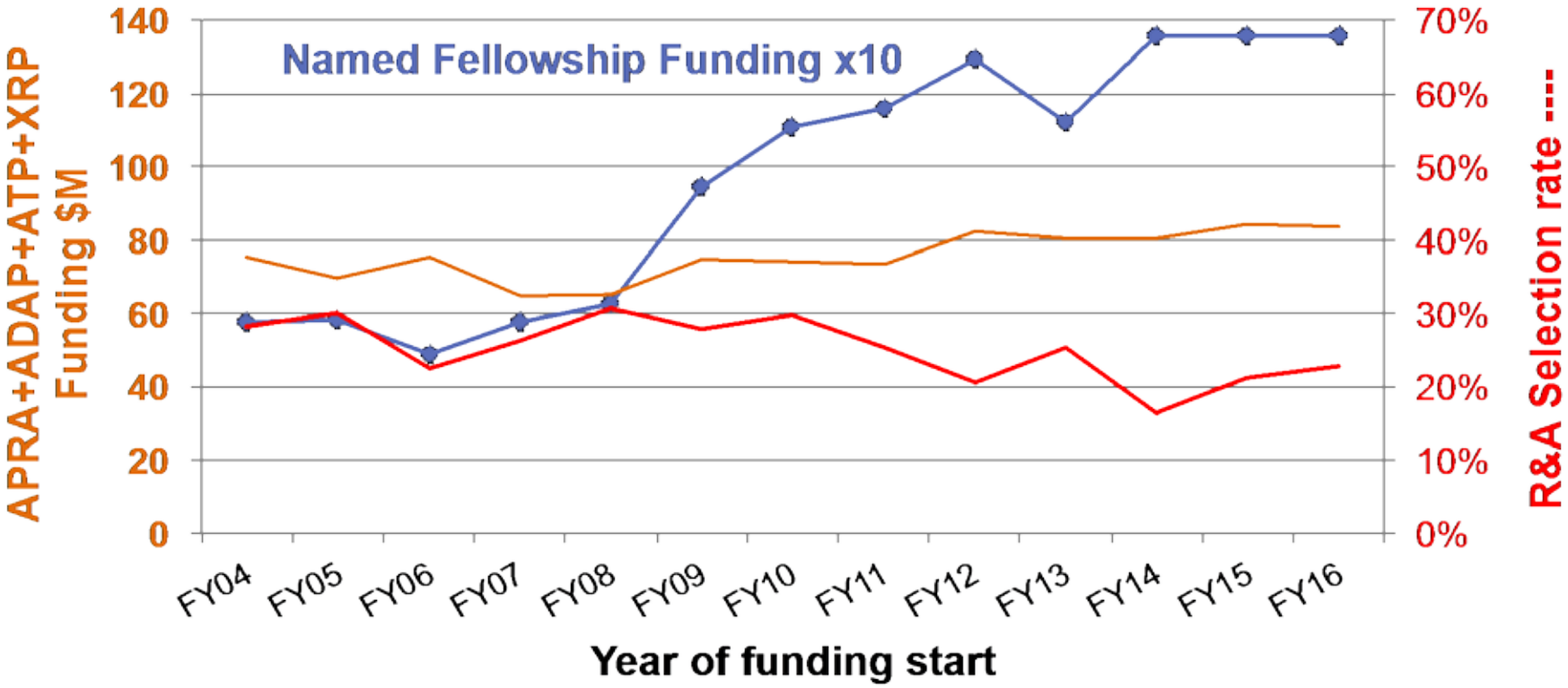
More Postdoctoral Fellowships Now Offered



The number of NASA and NSF Astrophysics postdocs has tripled since 1990; NSF Astronomy and Astrophysics Postdoctoral Fellowships were added in 2001. US universities awarded ~150 Astronomy PhDs yearly in the decade 2007-16 (AIP). The Astro2010 Decadal Survey estimated 200 PhDs/year in astrophysics fields.

Astro2010 Decadal Survey: "the number of postdoctoral positions advertised every year has doubled over the last decade, whereas the number of advertised tenure-track positions and long-term research or support positions has decreased slightly".

How Many Postdoc Fellowships is Right?



New NASA named postdoc fellowships were added as major missions launched, and fellowship spending has more than doubled over the past decade. Funding for Research and Analysis awards has grown far more slowly, and selection rates have fallen.

Fewer Fellowship Awards, Boost R&A Funding

Past recipients of the Einstein, Hubble and Sagan fellowships have gone on to highly successful careers: why is Astrophysics considering fewer awards?

We plan to re-balance support for postdocs to pursue independent research with that for the Research and Analysis Programs, including APRA which supports technology development, suborbital payloads and CubeSats.

PLAN: reduce the number of new fellowships awarded by roughly 30% starting in FY2017. All current fellows would continue their 3-year fellowships. Savings from the named fellowship program would augment the Research Program budget. These would reach 30% by FY2019.

The Astrophysics Subcommittee is asked to consider these planned changes, and provide a response to the Director of Astrophysics at its October 2016 meeting.

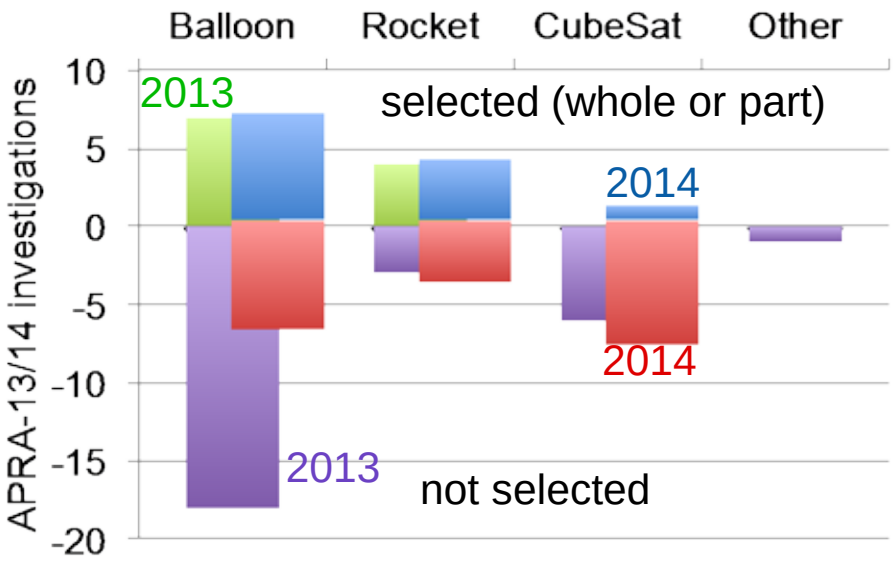
backups

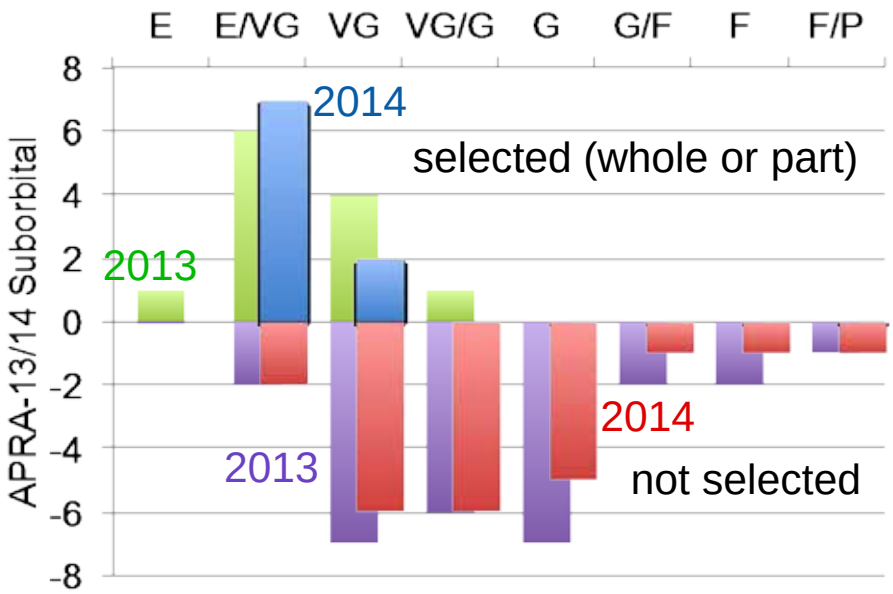
Astrophysics R&A Budget is up from FY14

Amounts in $k	FY09 Final	FY10 Final	FY11 Final	FY12 Final	FY13 Final	FY14 Final	FY15 Jul-16	FY16 Op Plan	FY17 request
Particle Astro	$ 8,201	$ 8,260	$ 8,305	$ 9,375	$10,545	$11,125	$ 9,806	$ 9,065	
High Energy	$13,878	$14,110	$13,846	$14,950	$14,270	$13,391	$14,935	$14,595	
UV/Opt/IR/ Sub-mm	$22,389	$21,537	$21,292	$23,385	$21,859	$21,379	$22,731	$25,023	
Fundamental Physics		$ 968	$ 588	$ 860	$ 741	$ 784	$ 618	$ 800	
APRA Total	$44,468	$44,875	$44,030	$48,570	$47,415	$46,680	$48,089	$49,483	
Exoplanet Research	$ 3,000	$ 2,807	$ 2,944	$ 3,244	$ 3,500	$ 3,701	$ 4,350	$ 4,230	
Astro Theory Program	$11,488	$12,262	$12,173	$11,811	$11,560	$12,009	$13,003	$10,373	
TCAN with NSF						$ 1,435	$ 1,563	$1,501	
Tech Fellows				$ 538	$ 975	$ 694	$ 1,555	$1,124	
Other	$ 1,045	$ 670	$ 647	$ 2,008	$ 1,588	$ 1,256	$ 2,512	$2,970	
R&A (399131)	$60,000	$59,646	$59,611	$66,172	$65,038	$63,275	$71,073	$69,681	$72,717
ADAP	$14,384	$13,258	$14,132	$16,365	$16,929	$17,008	$16,983	$17,550	$17,573
399131+ADAP	$74,384	$72,904	$73,743	$82,537	$81,967	$80,283	$88,056	$87,231	$90,290
Other funding					WFIRST support	$ 2,500	$ 522	$ 195	CREAM
					CubeSat (964105)	$ 863	$1,287	$1,180	
TOTAL ($M)	**$74.38**	**$73.87**	**$73.74**	**$82.54**	**$81.97**	**$82.78**	**$89.44**	**$88.71**	**$91.47**
	partial recovery	flat	flat	growth!			growth to cover CREAM costs	flat	some growth

Funding for R&A, including Astrophysics Data Analysis (ADAP) is up 25% since the Astro2010 Decadal Survey.

Suborbital-Class Payloads in APRA





In APRA-14 (most recent), 31 investigations were proposed for suborbital-class payloads; 17 were rated VG or better.

5/14 balloon investigations and 3/8 sounding rocket investigations were selected for full or part funding (36% success). One of the 9 CubeSat proposals was selected. Average award: rocket $2.5M; balloon and CubeSat ~$4M.

In APRA-13, 38 investigations were proposed for suborbital-class payloads; 20 were rated VG or better. 7/25 balloon investigations and 4/7 sounding rocket investigations were selected for full or part funding (~30% success). The highest ranked of the 6 CubeSat proposals rated VG.