

# **Astrophysics Research Program**

## **NASA Advisory Council Astrophysics Subcommittee**

3 October 2016

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# Research and Analysis Opportunities

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## Solicited through ROSES:

- **Supporting Research & Technology**

- Astrophysics Research & Analysis (APRA)
- Strategic Astrophysics Technology (SAT)
- **Astrophysics Theory Program (ATP)**
- **Theory and Computational Astrophysics Networks (TCAN)**
- Exoplanet Research Program (XRP) & Habitable Worlds (with Planetary Science Division)
- **Nancy Grace Roman Technology Fellowship (Early Career)**

- **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



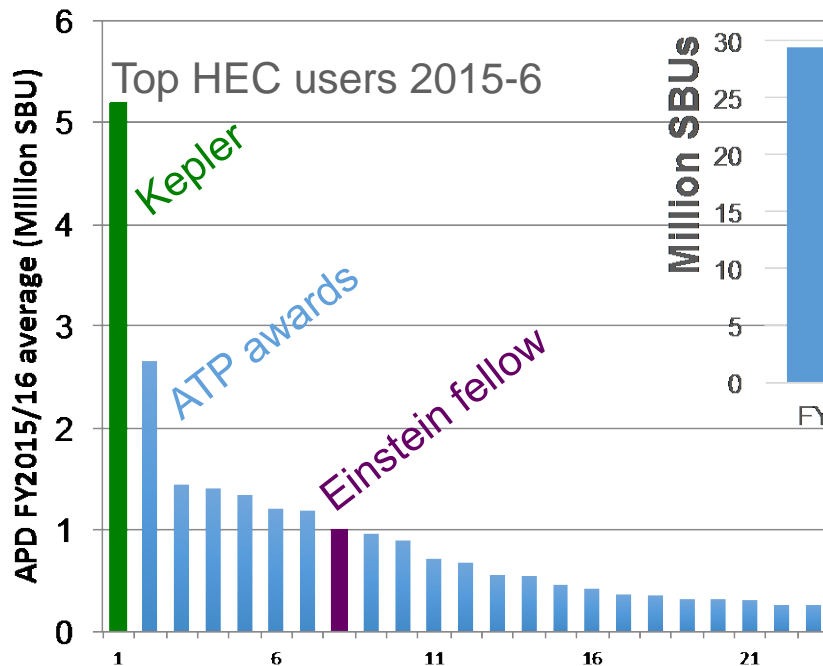
# ROSES: High End Computing

New for 2016: ROSES proposals needing high-end computing (HEC) must now estimate and justify required resources. Other users – postdoc fellows, Guest Observer award recipients, missions – will be asked for similar data.

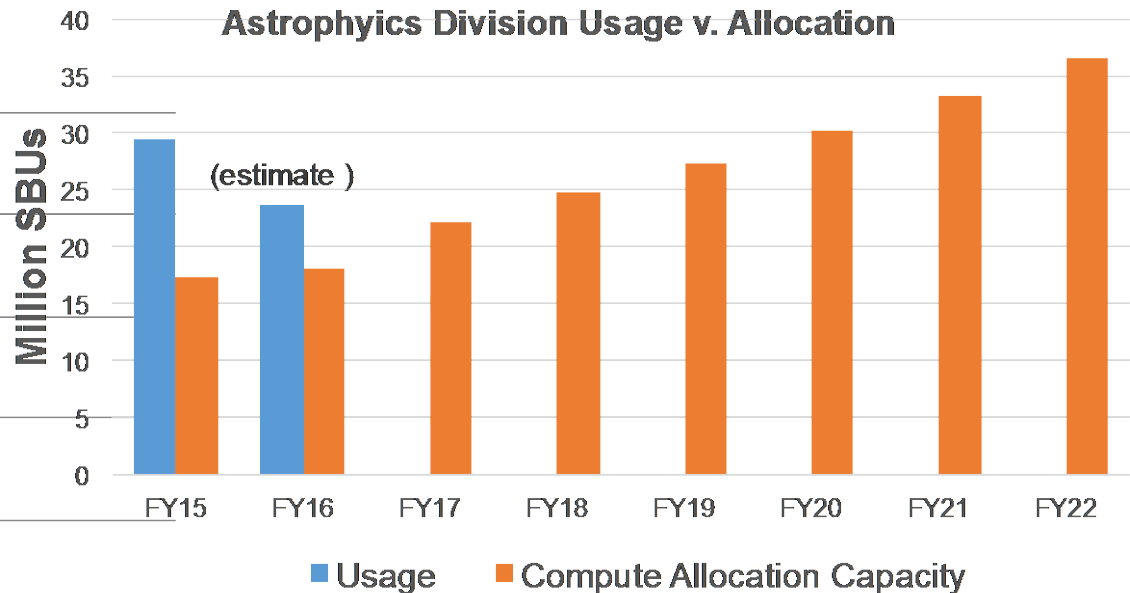
**Proposers request far more HEC cycles than are available; we must plan for the future.**

Astrophysics received extra resources in 2015-6 for Kepler mission processing.

June 2016 estimates of usage  
in FY15 and FY16



Astrophysics Division Usage v. Allocation





# High End Computing: Astrophysics Needs

Total Astrophysics Request	81.9M Standard Billing Units
From Current APD Awardees	55.7M SBU
Expected Allocation	~23M SBU

For FY 2017, the Astrophysics request is roughly 3.5 times the allocation. Removing those where funding awards are in 2nd extension or beyond, or from sources other than Astrophysics, yields ~2.5x oversubscription.

	Request	Proposals	% of available
Kepler/TESS	6.6M SBU		29%
WFIRST Science Teams	1.6M	6	7%
TCAN Networks	8.8M	5	38%
Astro Theory Program	19.3M	32	84%
ADAP/APRA/XRP	5.0M	8	24%
Guest Observers	9.1M	10	39%
Named Fellows/NPP	4.9M	11	21%
Other	0.1M	1	0.3%



# TCAN: Theoretical & Computational Networks

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In FY 2013, NSF's Division of Astronomical Sciences (AST) and NASA's Astrophysics Division jointly solicited proposals for Theoretical and Computational Astrophysics Networks. Each of six networks was funded at \$1.5M for a 3-year period (\$0.5M/year).

In 2015, NSF AST and NASA Astrophysics jointly convened an external panel to review progress reports from the six networks and assess TCAN. The panel found that "TCAN as a program marks an important step..." in the direction set by the Decadal Survey, and "...by providing 'enabling' funds on the condition that the funded networks demonstrate collaborative success, TCAN ...managed to drive highly collaborative networks" yielding "results that would not have come about" otherwise. The panel felt that TCAN should continue.

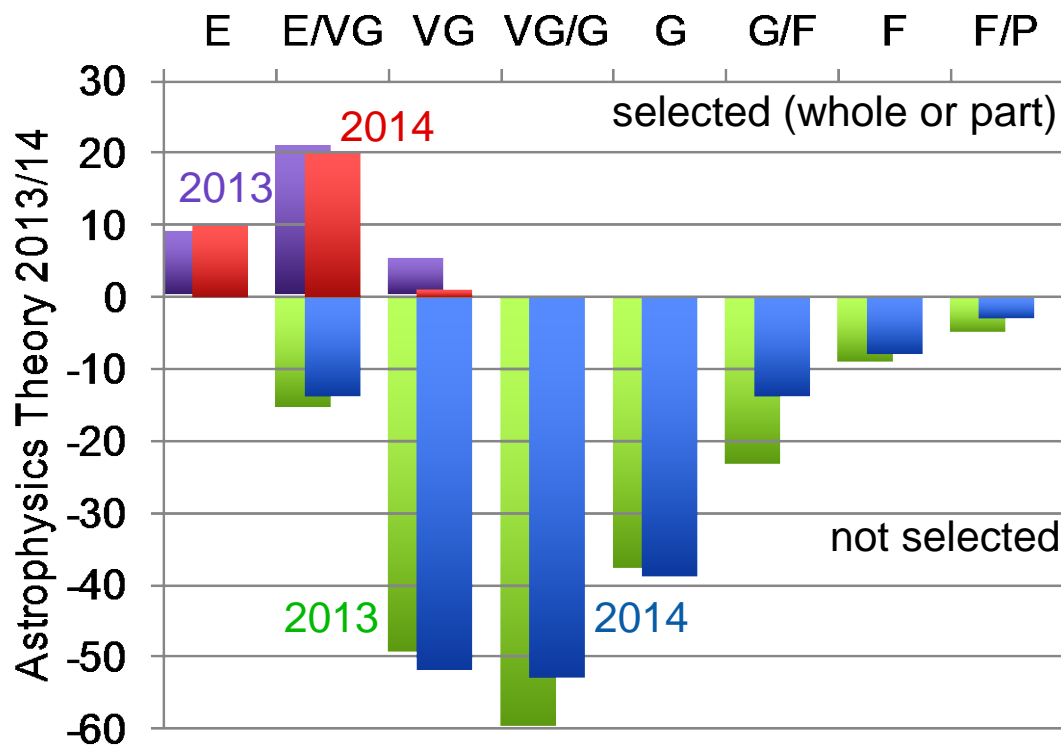
On 16 September 2016 NSF AST announced that NSF will not issue a second solicitation for TCAN since this would require a reduction in funding for the core Astronomy & Astrophysics Research Grants (AAG) program, contrary to recommendations of the 2010 Decadal Survey.

**NASA's Astrophysics Division plans a TCAN solicitation in 2017** to award roughly \$1.5M/year under similar guidelines as in 2013, soliciting 3-year proposals to fund 2-3 research networks, each with 3 or more nodes at distinct institutions.



# ATP: Astrophysics Theory Program 1

In November 2014 APD advised the Astrophysics Subcommittee that it would not solicit new ATP investigations in 2015, to allow funding to start closer to the proposal due date. For ATP-16 we received 197 proposals requesting \$30M in year-1 funding and \$91M in total – similar to the 214 proposals received for ATP-14. Selected proposers should receive funds early in calendar 2017.



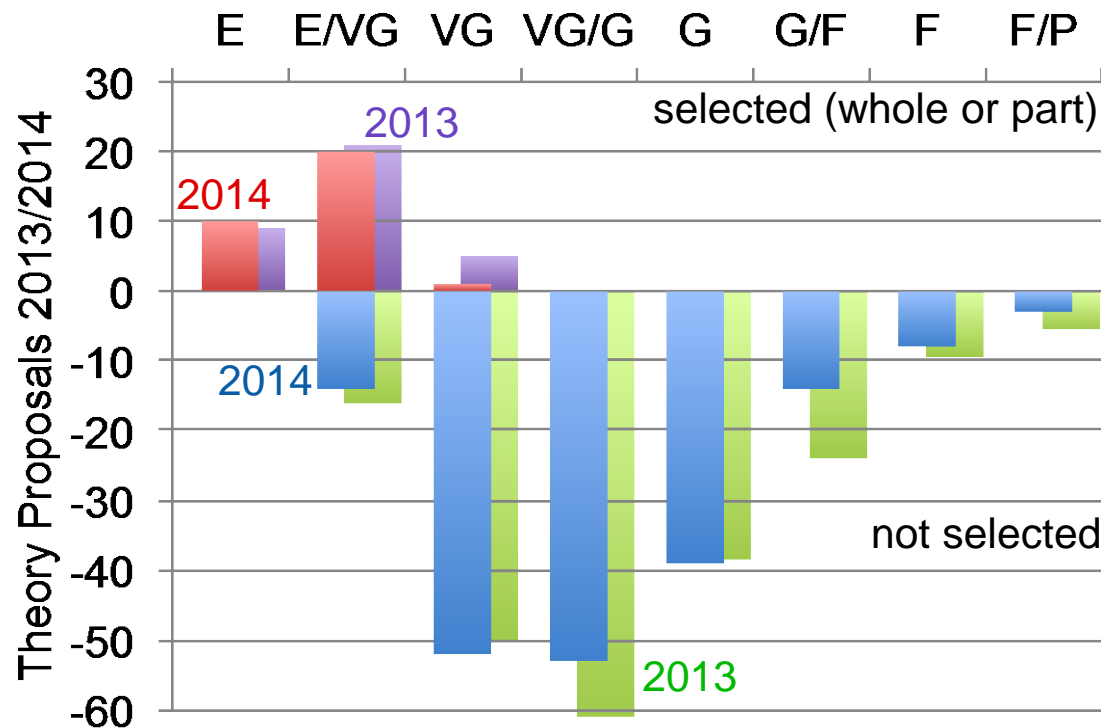
In ATP-13 and ATP-14 all E-rated proposals were funded, and ~60% of those rated E/VG; almost no VG proposals were selected.

With selection rates below 20%, highly meritorious proposals must be declined. Review panels are reluctant to “take a chance” on riskier proposals or new investigators.



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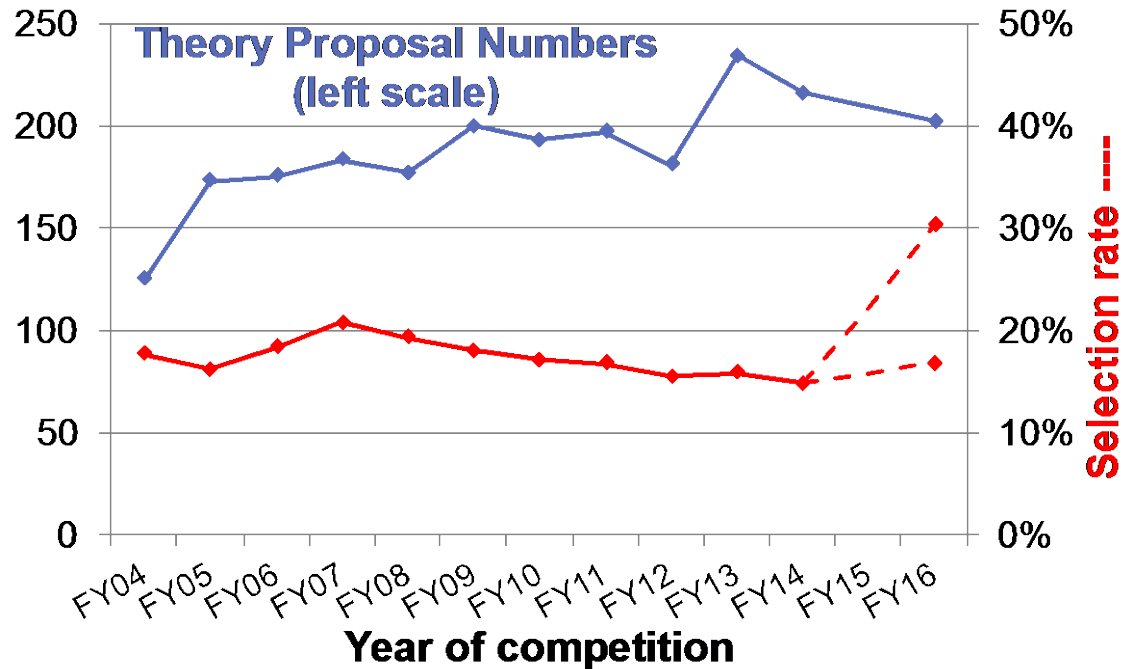
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# ATP: Astrophysics Theory Program 2

To address the problem of low selection rates, the Astrophysics Division plans to compete ATP in alternate years, without reducing the program budget. This change will increase the selection rate close to that recommended in the 2015-6 report of the Astronomy and Astrophysics Advisory Committee.



Continuing with an annual ATP competition: roughly \$5M or 17% of the requested year-1 funding could be awarded for ATP-16. If grades are as in past years, we would have to decline almost half of the E/VG proposals.

Competing the ATP program only in even years: roughly \$9M in year-1 funding could be awarded for ATP-16, about 30% of the request. We could likely fund all the E and E/VG proposals, and some VG proposals.

This change will reduce the burden on reviewers and proposers alike.





# RTF: Roman Technology Fellowship 1

The Nancy Grace Roman Technology Fellowship (RTF) program aims to give early career researchers the opportunity to develop the skills necessary to lead astrophysics flight instruments/projects and become principal investigators of future astrophysics missions; to develop innovative technologies with the potential to enable major scientific breakthroughs; and to foster new talent by putting early-career instrument builders on a trajectory towards long-term positions.

The Astrophysics Subcommittee recommended this program in 2010, recognizing that “very few recent PhDs will be capable of submitting a viable proposal or carrying out an independent program”. Indeed, application numbers have declined over the 4 cycles.

	Proposals	Phase 1 selected	Phase 2 selected	\$ awarded
RTF-11	19	3	McEntaffer, McElwain	\$2.7M
RTF-12	12	2	Blake	\$1.4M
RTF-14	8	3	Conklin, Fleming	\$2.1M
RTF-15	5	3	in 2017	incomplete



# RTF: Roman Technology Fellowship 2

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**'Non-tenured' early career researchers now propose to RTF in two phases:** those selected for a one-year concept study (Phase 1) may propose to continue into a 4-year development (Phase 2). Phase 2 proposals must include an institutional commitment for required lab space and other needed resources.

**Planned change:** allow scientists proposing technology projects or suborbital payloads to other Astrophysics ROSES elements (now, APRA and SAT) to indicate their status as an early-career scientist. Roman Fellows will be selected from eligible awardees in APRA and SAT. Roman Fellows who hold, or subsequently win, a permanent-track position within a time limit (e.g. 10 years from PhD) may then propose for further funding to develop a lab or research group, or to continue their APRA/SAT project.

**The planned change mirrors the Early Career Fellowship offered by the Planetary Science Division**, which has been successful in moving researchers into permanent-track positions.

At their July 2016 meeting, the Astrophysics Subcommittee was asked to consider this change, and to provide a response to the Astrophysics Director at this meeting.

**backups**



# Recent Proposal Selections

Status: October 3, 2016

	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 3 <sup>rd</sup> 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	August 13, 2016	148	157	TBD	TBD
SAT (Technology)	Mar 18, 2016	August 15, 2016	150	29	TBD	TBD
Hubble GO – Cycle 24	Apr 8, 2016	June 24, 2016	77	1094	245	22%
ADAP (Data Analysis)	May 13, 2015	Sep 22, 2016	132	238	45	19%
Exoplanet Research	May 23, 2015		130	50		
Spitzer GO – Cycle 13	June 8, 2016	Aug 5, 2016	58	115	49	43%
SOFIA GI – Cycle 5	July 1, 2016		94	179		
ATP (Astrophysics Theory)	July 8, 2016		87	201		

100% of recent announcements within 150 days

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



# 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	
<b>APRA Total</b>	<b>\$44,468</b>	<b>\$44,875</b>	<b>\$44,030</b>	<b>\$48,570</b>	<b>\$47,415</b>	<b>\$46,680</b>	<b>\$48,089</b>	<b>\$49,483</b>	
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	
<b>R&amp;A (399131)</b>	<b>\$60,000</b>	<b>\$59,646</b>	<b>\$59,611</b>	<b>\$66,172</b>	<b>\$65,038</b>	<b>\$63,275</b>	<b>\$71,073</b>	<b>\$69,681</b>	<b>\$72,717</b>
ADAP	\$14,384	\$13,258	\$14,132	\$16,365	\$16,929	\$17,008	\$16,983	\$17,550	\$17,573
<b>399131+ADAP</b>	<b>\$74,384</b>	<b>\$72,904</b>	<b>\$73,743</b>	<b>\$82,537</b>	<b>\$81,967</b>	<b>\$80,283</b>	<b>\$88,056</b>	<b>\$87,231</b>	<b>\$90,290</b>
Other funding				WFIRST support		\$ 2,500	\$ 522	\$ 195	CREAM
				CubeSat	(964105)	\$ 863	\$ 1,287	\$ 1,180	
<b>TOTAL (\$M)</b>	<b>\$74.38</b>	<b>\$73.87</b>	<b>\$73.74</b>	<b>\$82.54</b>	<b>\$81.97</b>	<b>\$82.78</b>	<b>\$89.44</b>	<b>\$88.71</b>	<b>\$91.47</b>
	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.



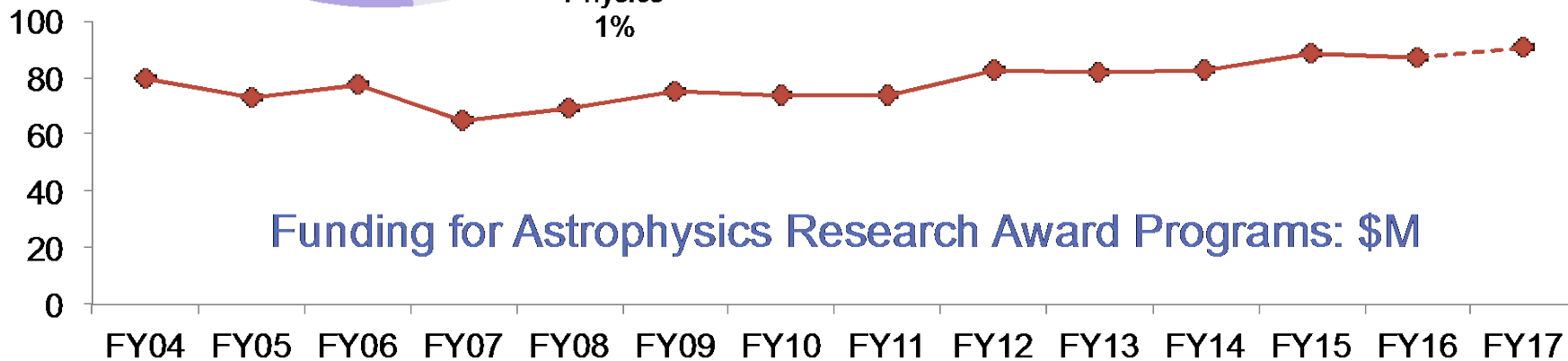
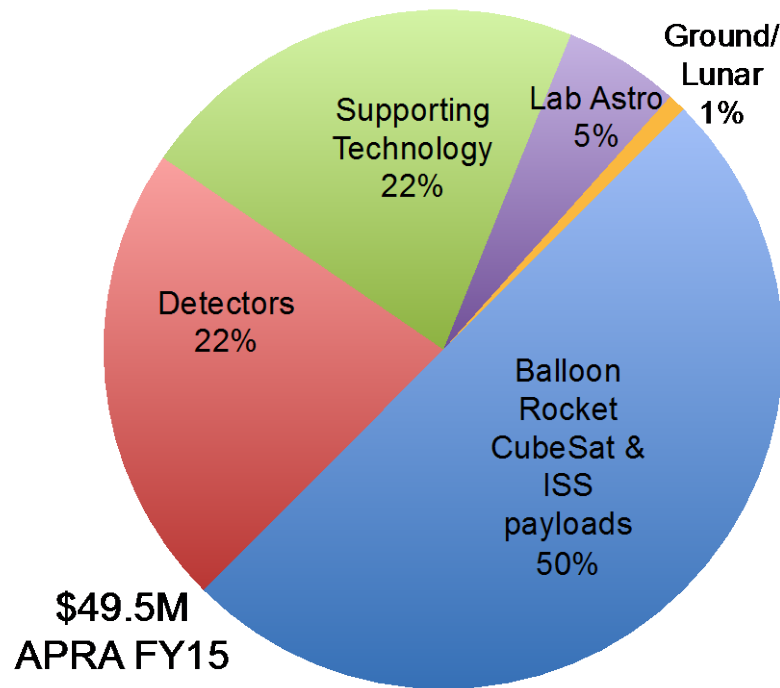
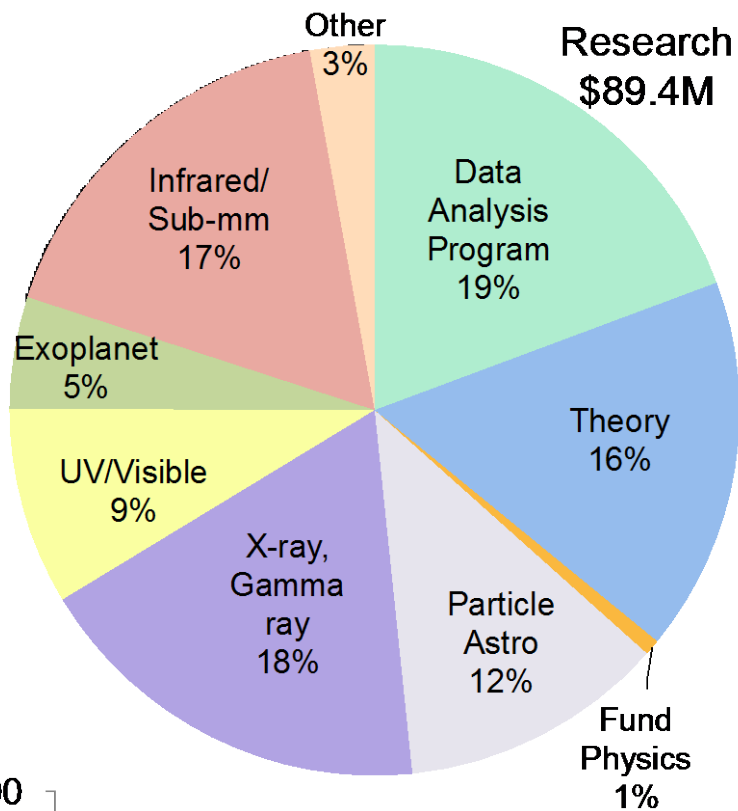
# R&A Theory Program (from 14 Nov 2014)

- The Astrophysics Division will not solicit proposals for new Astrophysics Theory Program (ATP) investigations in ROSES-2015. The next proposal opportunity will be offered in ROSES-2016.
- Although there is a break in proposal opportunities, there is no break in funding opportunities and the level of ATP funding is not affected.

	Proposal Due Date	Selections Announced	Funding Initiated	Delay in Funding after Submission of Proposal
ROSES-2013	July 12, 2013	January 17, 2014	October 1, 2014 - July 1, 2015	15-25 months
ROSES-2014	July 11, 2014	NLT 180 days after proposal receipt (NLT January 7, 2015)	October 1, 2015 - July 1, 2016	15-24 months
ROSES-2015	Not solicited			
ROSES-2016	July 2016	NLT 180 days after proposal receipt (Early January 2017)	January - July 2017	6-12 months

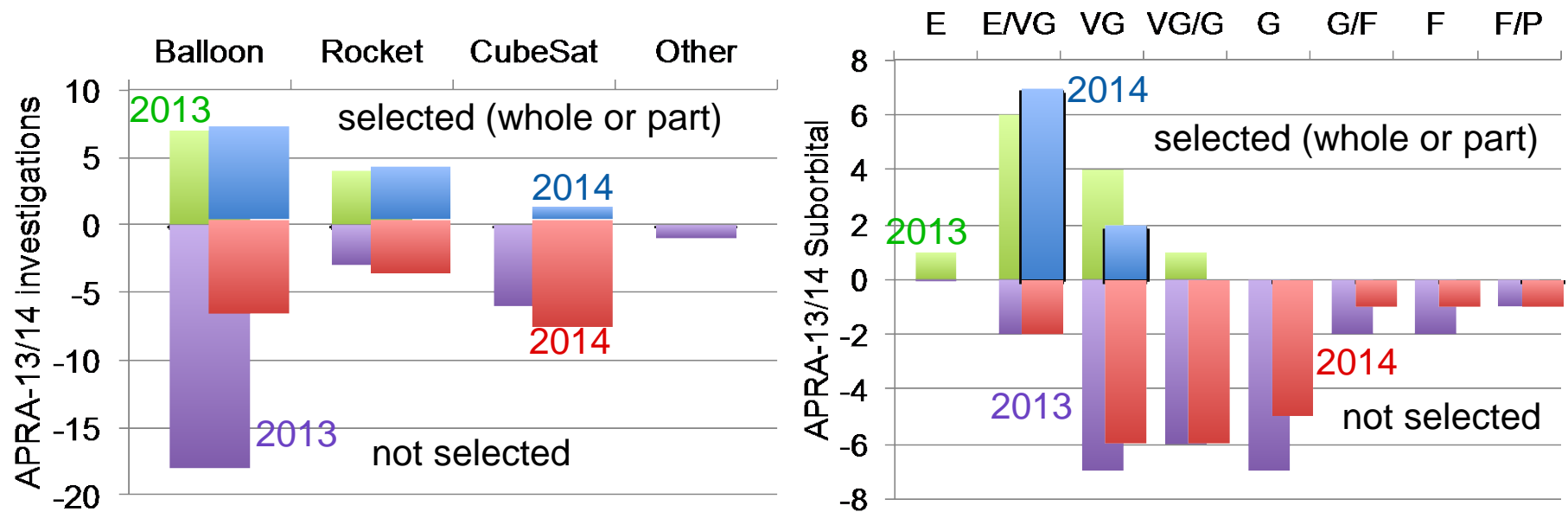


# FY15 Research Program Budget and Spending





# Suborbital-Class Payloads in APRA



In APRA-14 (reviewed in 2015), 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.