National Aeronautics and Space Administration

Astrophysics

Exoplanet Research Program




Astrophysics Subcommittee

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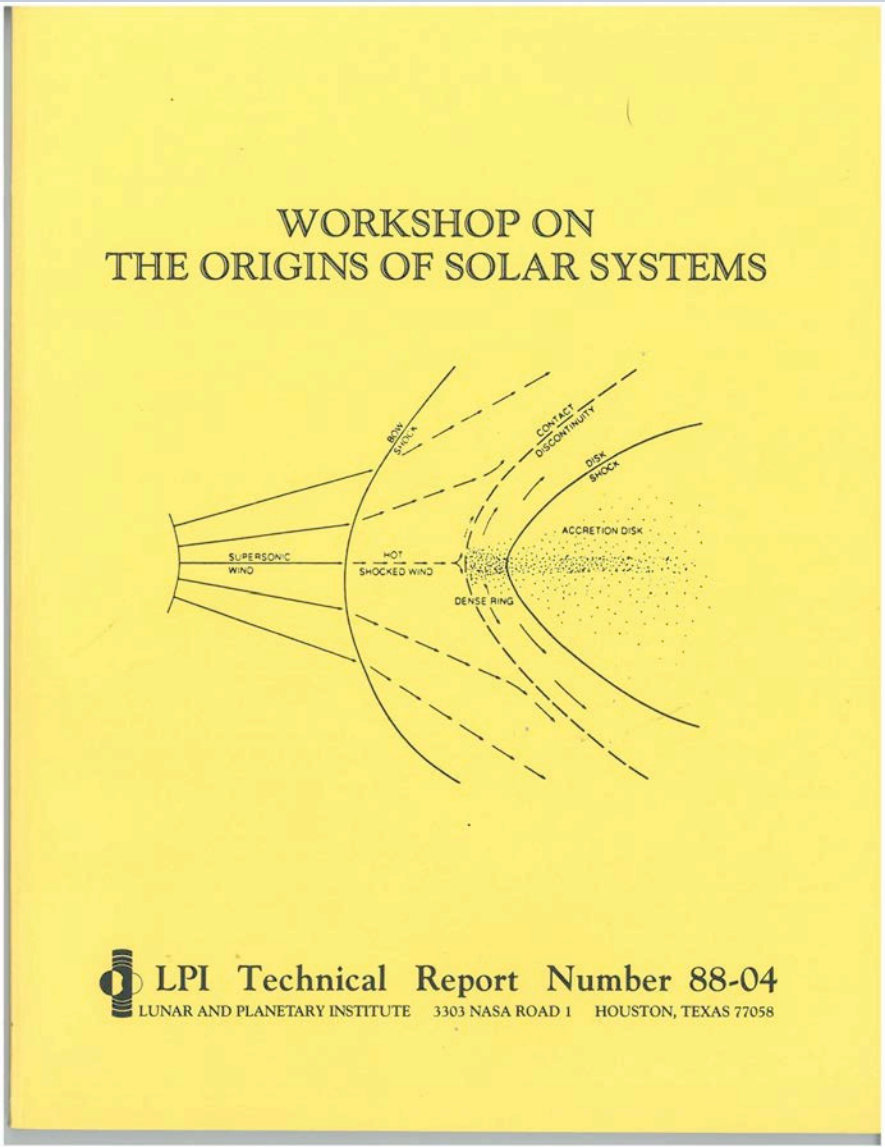
What is the Exoplanet Research Program (XRP)?

From ROSES-16 Element E.2

- The XRP element solicits basic research proposals to conduct scientific investigations related to the research and analysis of extrasolar planets
- Its broad objectives include the determination of compositions, dynamics, energetics, chemical behaviors of exoplanets, and the detection and characterization of other planetary systems
- The XRP program element is shared between the Planetary Science and Astrophysics Divisions
- The XRP fosters cross-divisional, multi-discipline science

Origins of Solar Systems (OSS) initiative started in 1986

http://ntrs.nasa.gov/search.jsp?R=19880021152



Started as an inter-disciplinary program for solar and space sciences; several years before the first exoplanet around solar-type stars were discovered

- Grain agglomeration
- Giant planet formation
- Terrestrial planet accumulation
- Gas-dust/planet-disk interactions
- Initial chemical and physical states
- Planetary atmospheres

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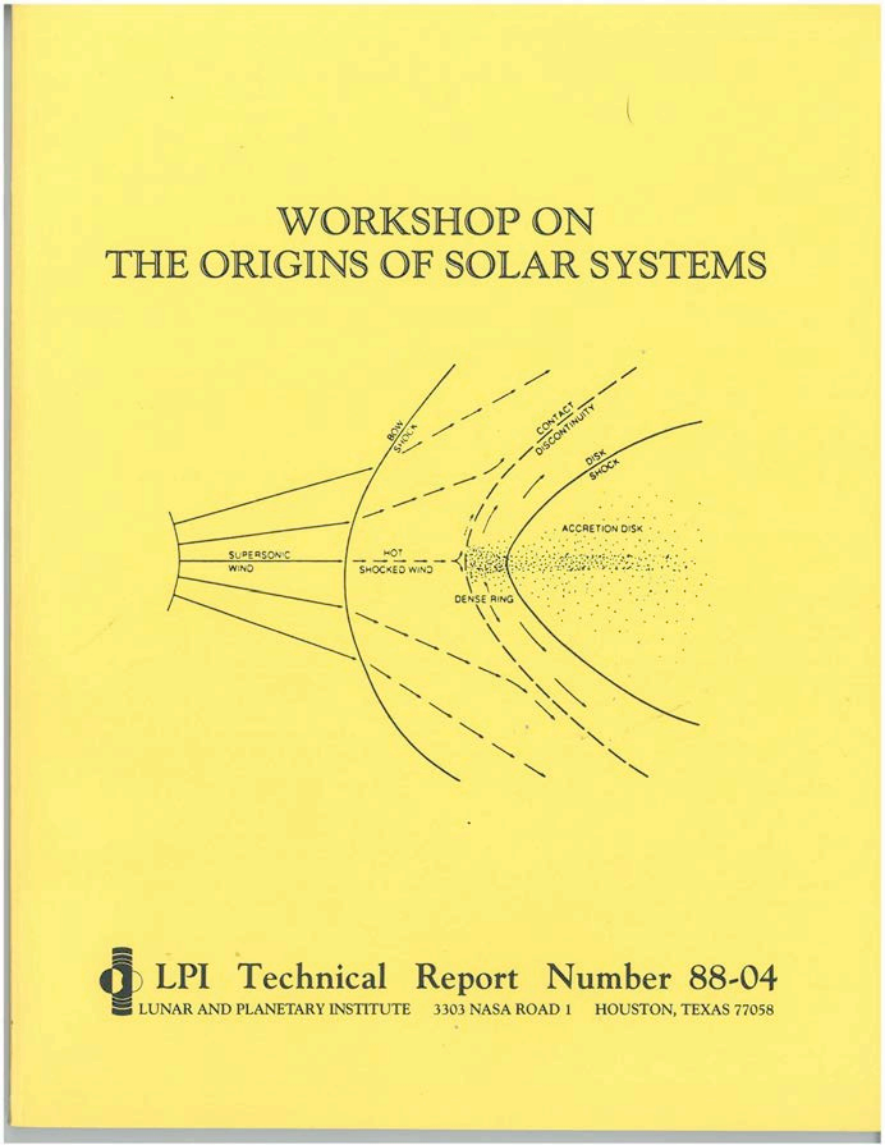

After its inception, OSS continued to be an interdisciplinary solicitation jointly managed by the Planetary Science and Astrophysics Divisions, until ending as a program after ROSES-2013

1. Why was the Origins of Solar Systems (OSS) ROSES element rebranded as the Exoplanet Research Program (XRP)?

Planetary Science Division Reorganization for ROSES 2014

Adapted from PSD document: http://www.lpi.usra.edu/PSD-RandA/PSD-RA-Mapping-Charge-v2.pdf

- Encourage interdisciplinary research
- Enable PSD strategic decision making
- Be more flexible in responding to changing research priorities
- Reduce overlaps between program elements
- Make the structure of the R&A program explainable to those outside of NASA
- Make it easier for those outside of NASA to compute the amount of money spent on grants

Planetary Science Division Reorganization for ROSES 2014

Adapted from PSD document: http://www.lpi.usra.edu/PSD-RandA/PSD-RA-Mapping-Charge-v2.pdf

ROSES-13

- Origins of Solar Systems
- Cosmochemistry
- Planetary Geology and Geophysics
- Planetary Atmospheres
- Lunar Adv. Sci. and Exp. Research
- Outer Planets Research
- Mars Fundamental Research
- Exobiology and Evolutionary Biology
- Planetary Observations
- Near-Earth Objects

ROSES-14

- Exoplanet Research Program
- Emerging Worlds
- Solar System Workings
- Habitable Worlds
- Exobiology
- Solar System Observations

Planetary Science Division Reorganization for ROSES 2014

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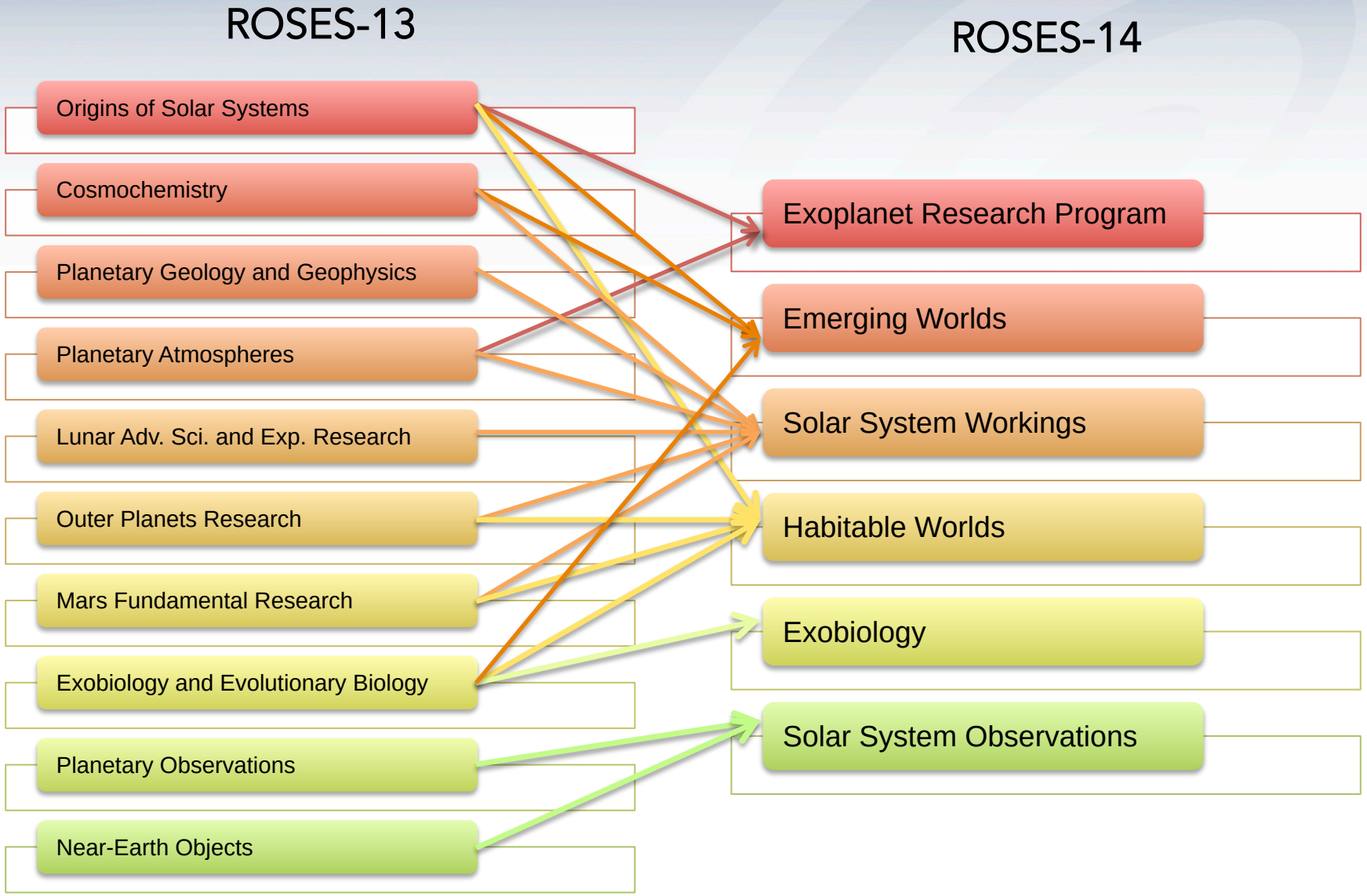

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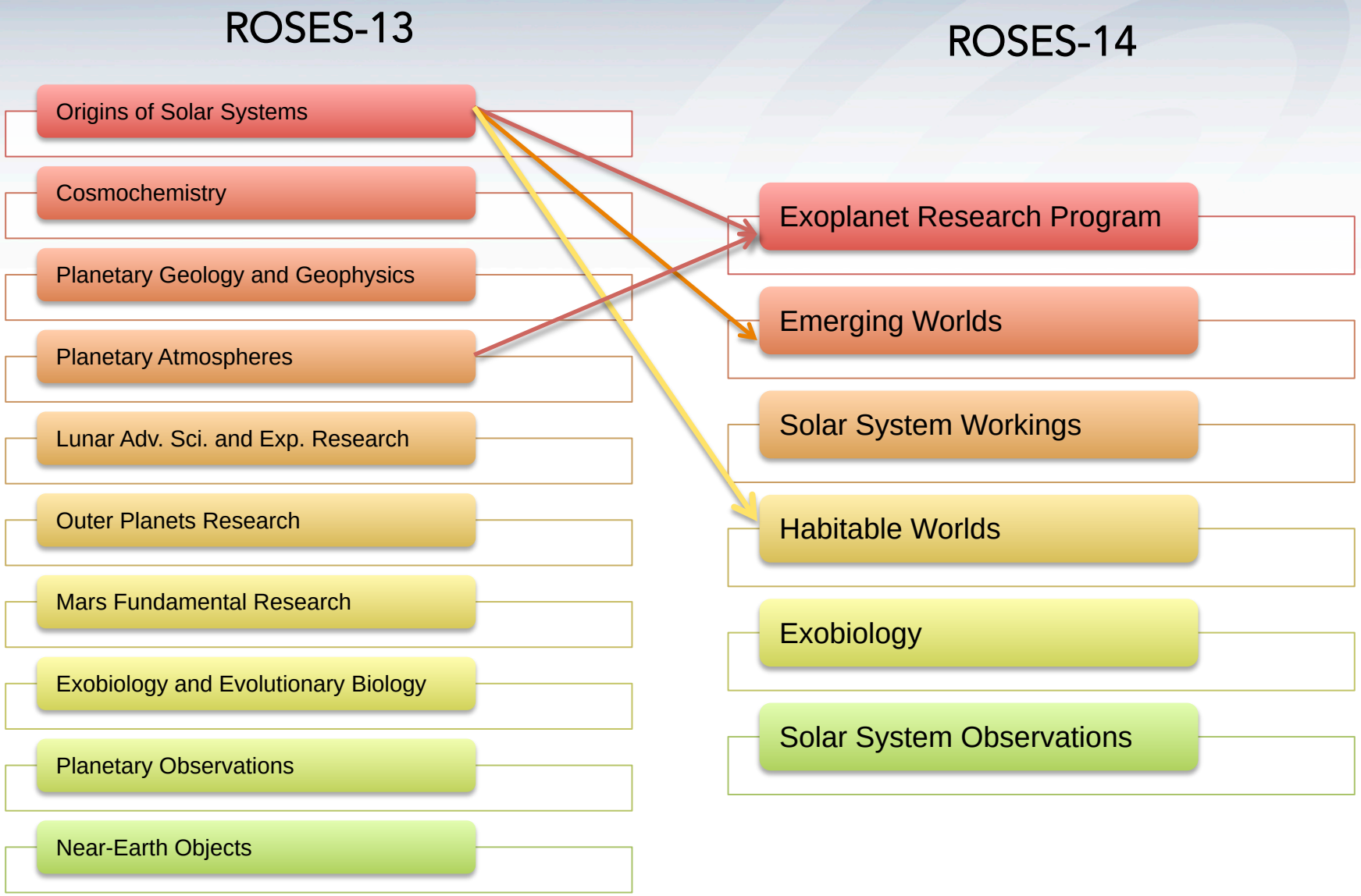

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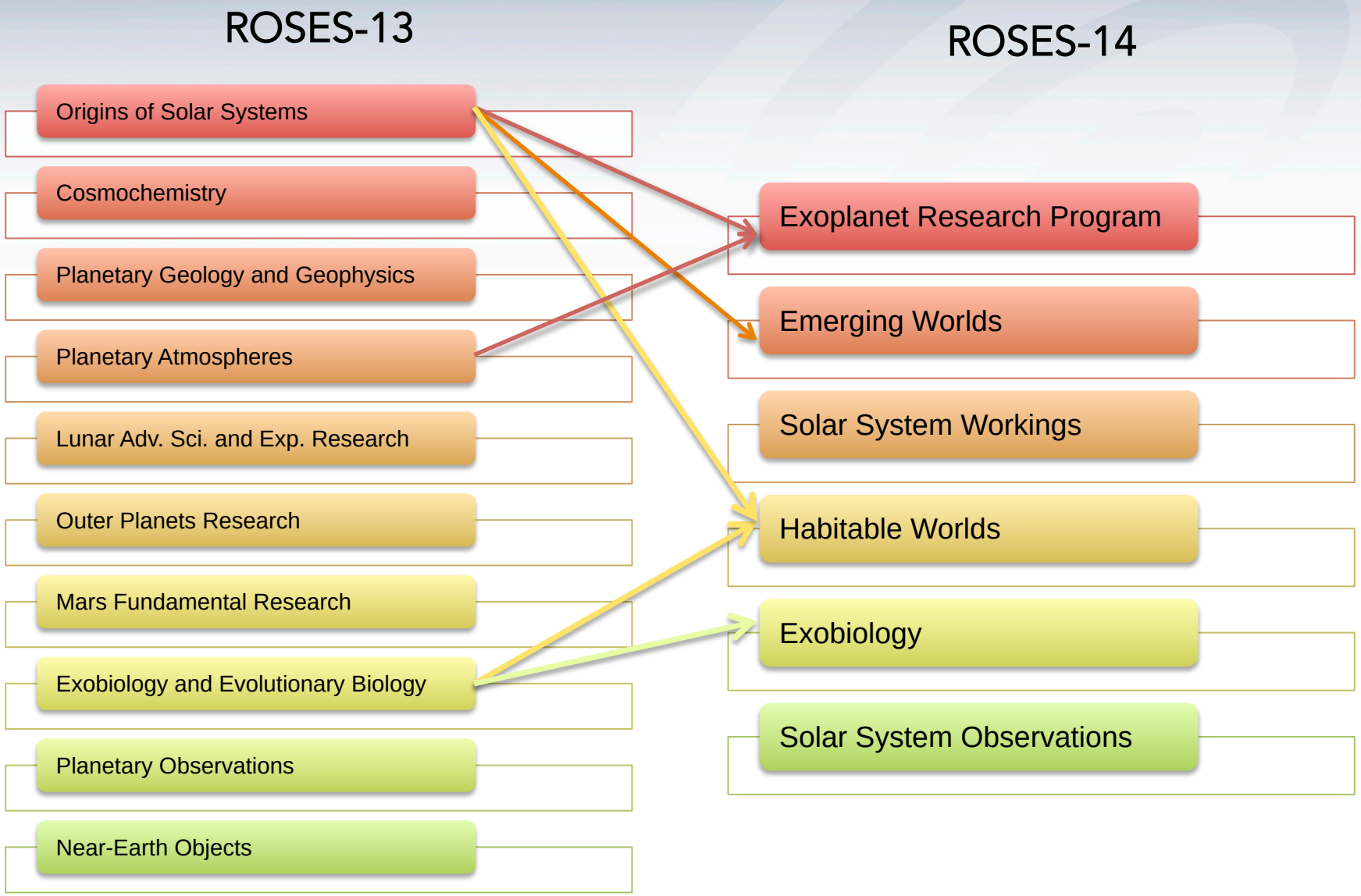
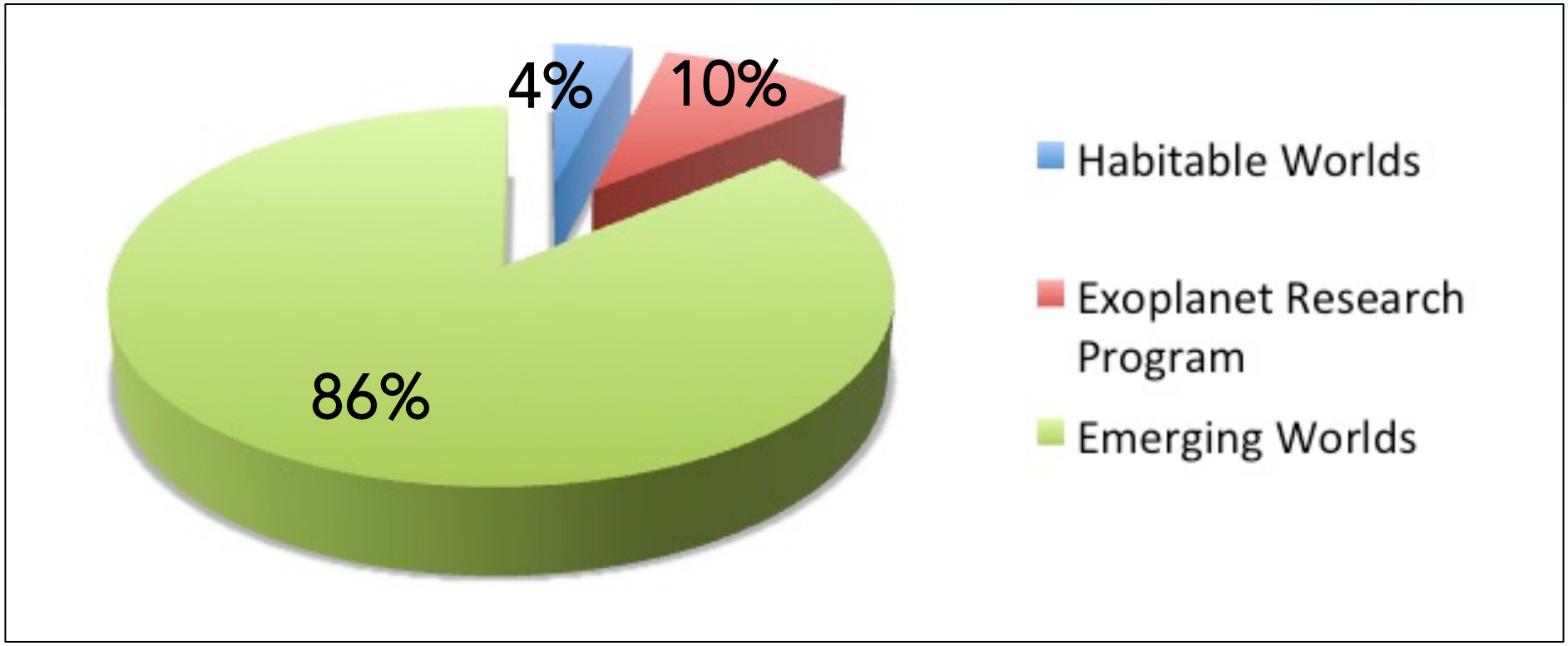


What did the Planetary Science Division OSS Proposals Become?

Adapted from PSD document: http://www.lpi.usra.edu/PSD-RandA/PSD-RA-Mapping-Charge-v2.pdf



Where did the Planetary Science Division XRP Proposals Come From?

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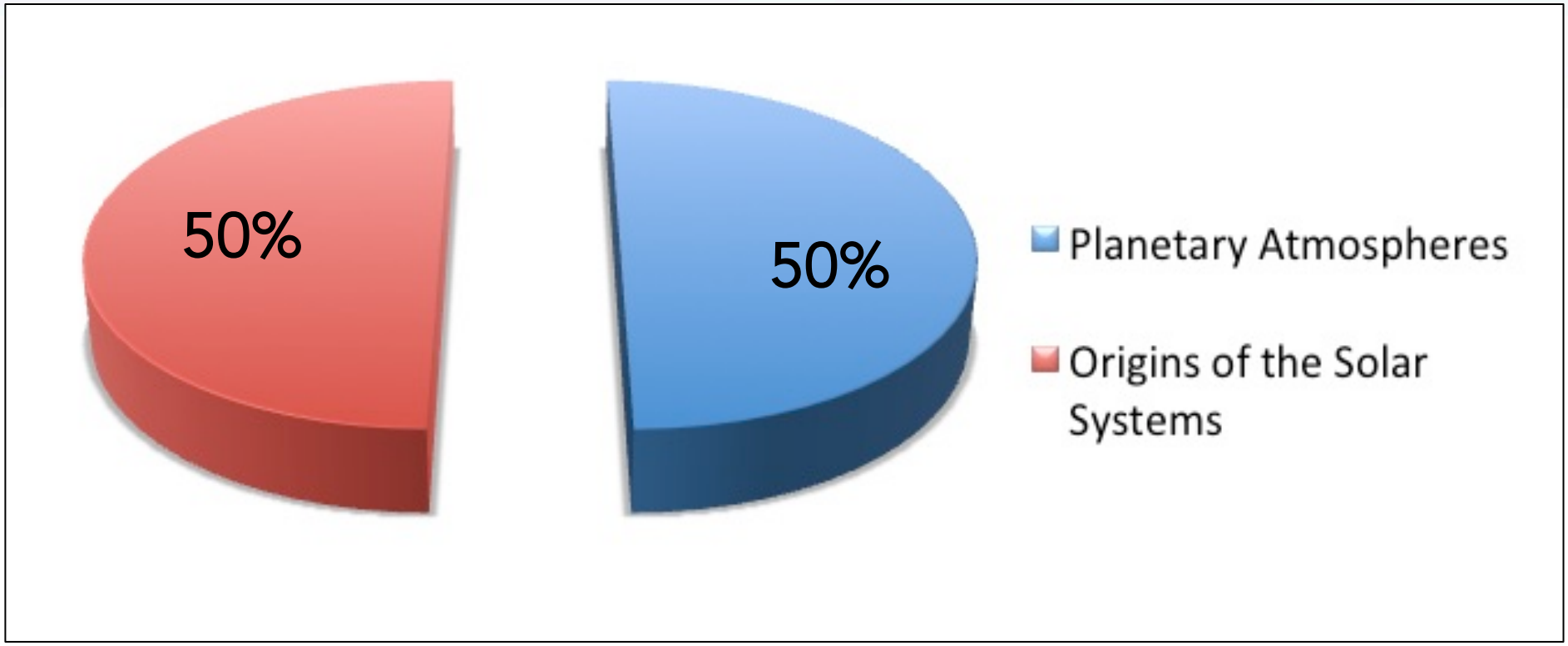
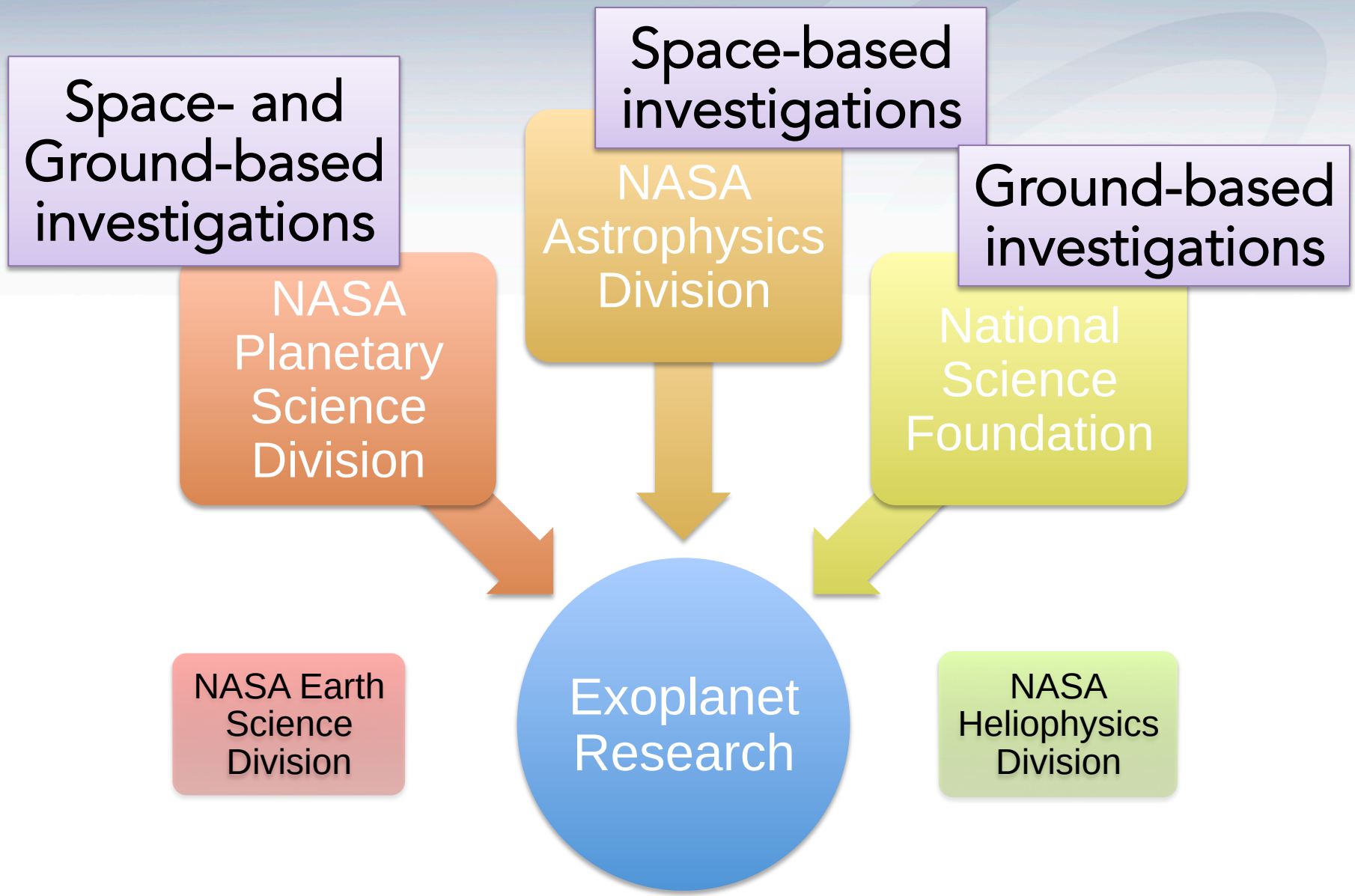


2. How is the XRP responding to evolving needs in Exoplanet research?

Who Funds Exoplanet Research?



In ROSES-16 the Astrophysics XRP does not fund…

- Archive data analysis
  - Go to ADAP
- Theoretical investigations or calculations
  - Go to ATP
- Lab Astro experiments
  - Go to APRA
- Technology development
  - Go to APRA
- Guest Observations
  - Go to the mission's GO programs
- Simulations of space data
  - Go to the missions

In ROSES-16 the Astrophysics XRP does fund…

- Everything else (= Ground-based support of NASA's Astrophysics Space Program)

What Investigations Do The Astrophysics Division Encourage Through The XRP?

- Follow-up observations of space-based planet detections
  - e.g. validation of Kepler, K2 and TESS planet candidates
- Ground-based observations that specifically increase the value of NASA space data
  - e.g. property characterization of new NASA planet detections
- Ground based observations that specifically increase the effectiveness or efficiency of future space observations
  - e.g. detection and/or characterization of future JWST targets
- Ground observations that inform operations of future space missions
  - e.g. collecting data that defines WFIRST visits to planetary systems

XRP and the Habitable Worlds Program

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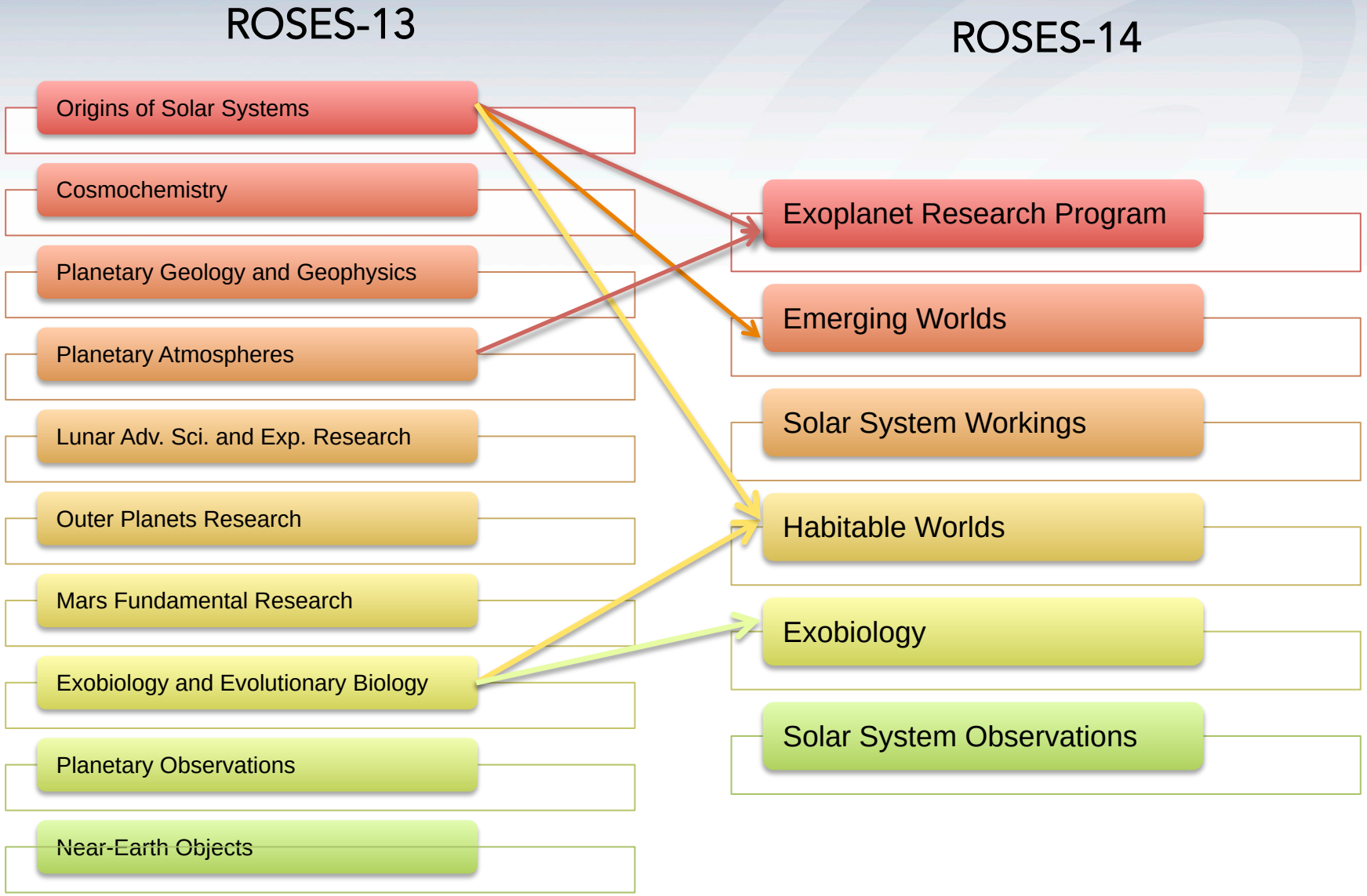
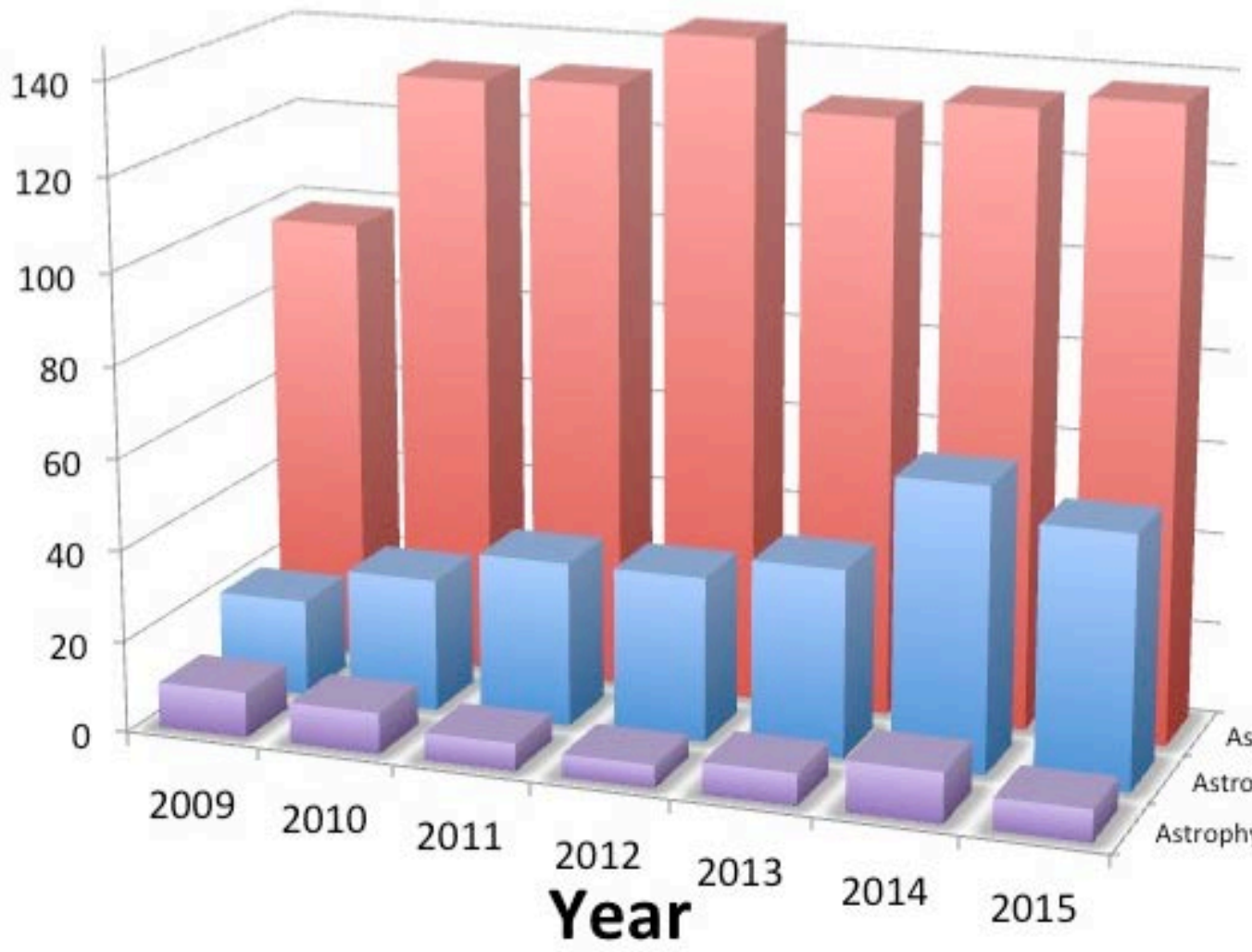


XRP and the Habitable Worlds Program

- Habitability has been an area of investigation for Kepler and K2 (+TESS)
- Biomarker science will become increasingly relevant to the Astrophysics Division as we progress from HST to JWST to WFIRST, and beyond
- Astrophysics R&A programs will need to support these activities in future years
- However, Habitable Worlds science is precluded from the XRP program in order to keep the Planetary Science Division R&A structure orderly
- The Planetary Division ROSES-15 Habitable Worlds element has become a cross-divisional element between Planetary and Astrophysics in ROSES-16
- New money is not available, but the Astrophysics Division will select suitably-strategic programs from Habitable Worlds for funding using XRP resources

3. Has there been a shift (and if so, by how much) in grants for exoplanet work compared to pre-exoplanet work (e.g. star formation, debris disk chemistry, etc)?

OSS/XRP Astrophysics Proposal Statistics



Year	APD Budget
2009	$3.0M
2010	$2.8M
2011	$3.0M
2012	$3.2M
2013	$3.5M
2014	$3.7M
2015	$3.9M

OSS/XRP Astrophysics + Planetary New Programs

	2008	2009	2010	2011	2012	2013	2014	2015
Detection	9%	38%	30%	21%	36%	14%	13%	5%
Validation							4%	
Bulk Properties	9%	6%	5%	11%		10%	21%	5%
Atmospheres	9%	6%		16%	12%	10%	25%	38%
Formation & Disks	73%	50%	50%	47%	32%	57%	33%	52%
Evolution			15%	5%	20%	9%	4%	
Total	11	32	20	19	25	21	24	21

There is no long-term trend in the number or ratio of star and planetary-system formation programs in the OSS/XRP element

Conclusions

1. Why was the Origins of Solar Systems (OSS) ROSES element rebranded as the Exoplanet Research Program (XRP)?

   - In response to a ROSES program shuffle by the Planetary Sciences Division

2. How is the XRP responding to evolving needs in Exoplanet research?

   - Requiring XRP programs to support NASA Astrophysics missions strategically to advance exoplanet science
   - Habitable Worlds programs can be supported through the XRP

3. Has there been a shift (and if so, by how much) in grants for exoplanet work compared to pre-exoplanet work (star formation, debris disk chemistry, etc)?

   - None within the OSS/XRP program