

National Aeronautics and
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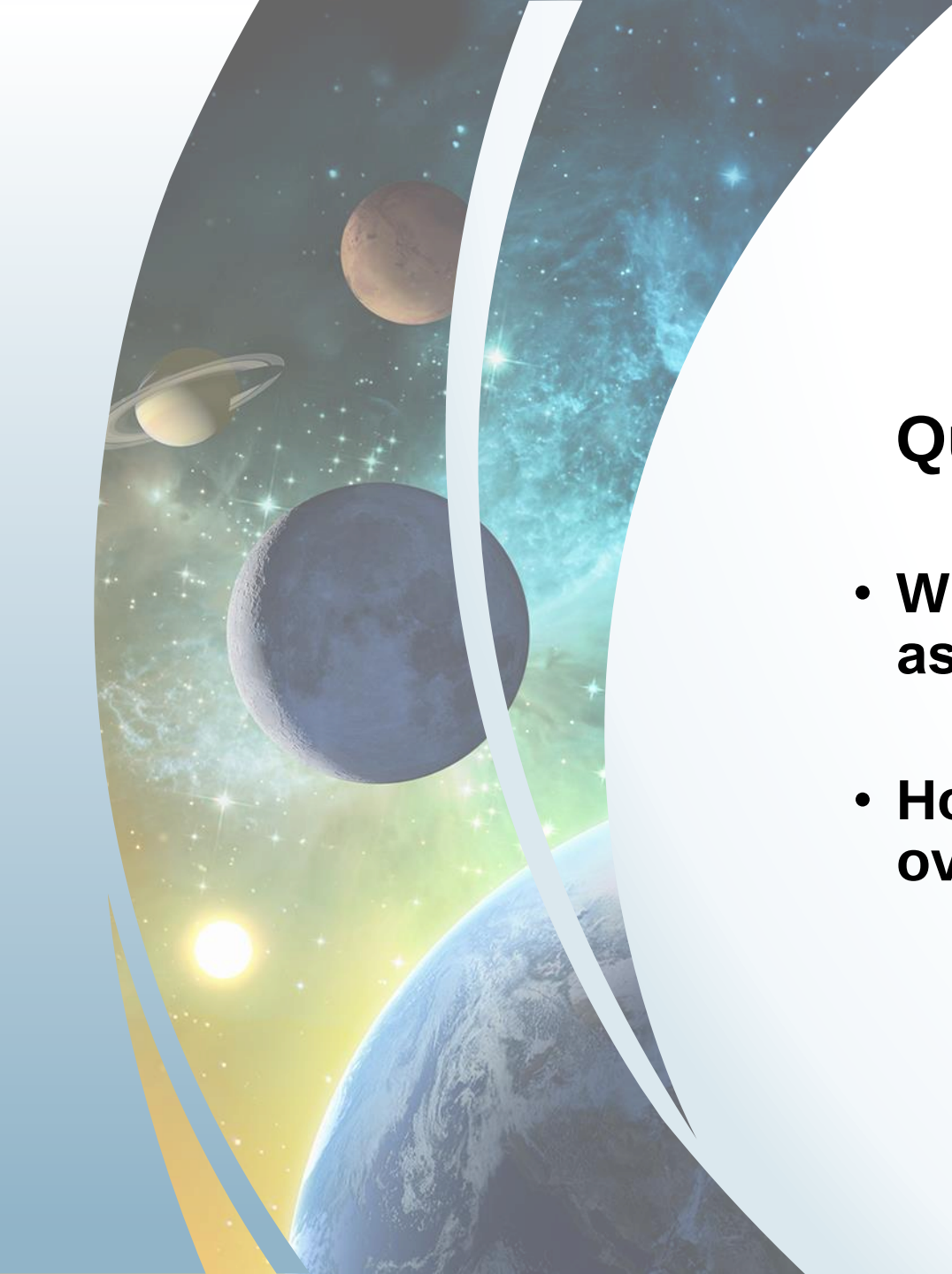
Laboratory Astrophysics in the NASA Astrophysics Division

2020 Decadal Panel on An Enabling Foundation for Research
Washington DC

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Questions from the panel:

- **What do you see as the role of laboratory astrophysics in your agency's portfolio?**
- **How has support of lab astro work changed over the past decade?**

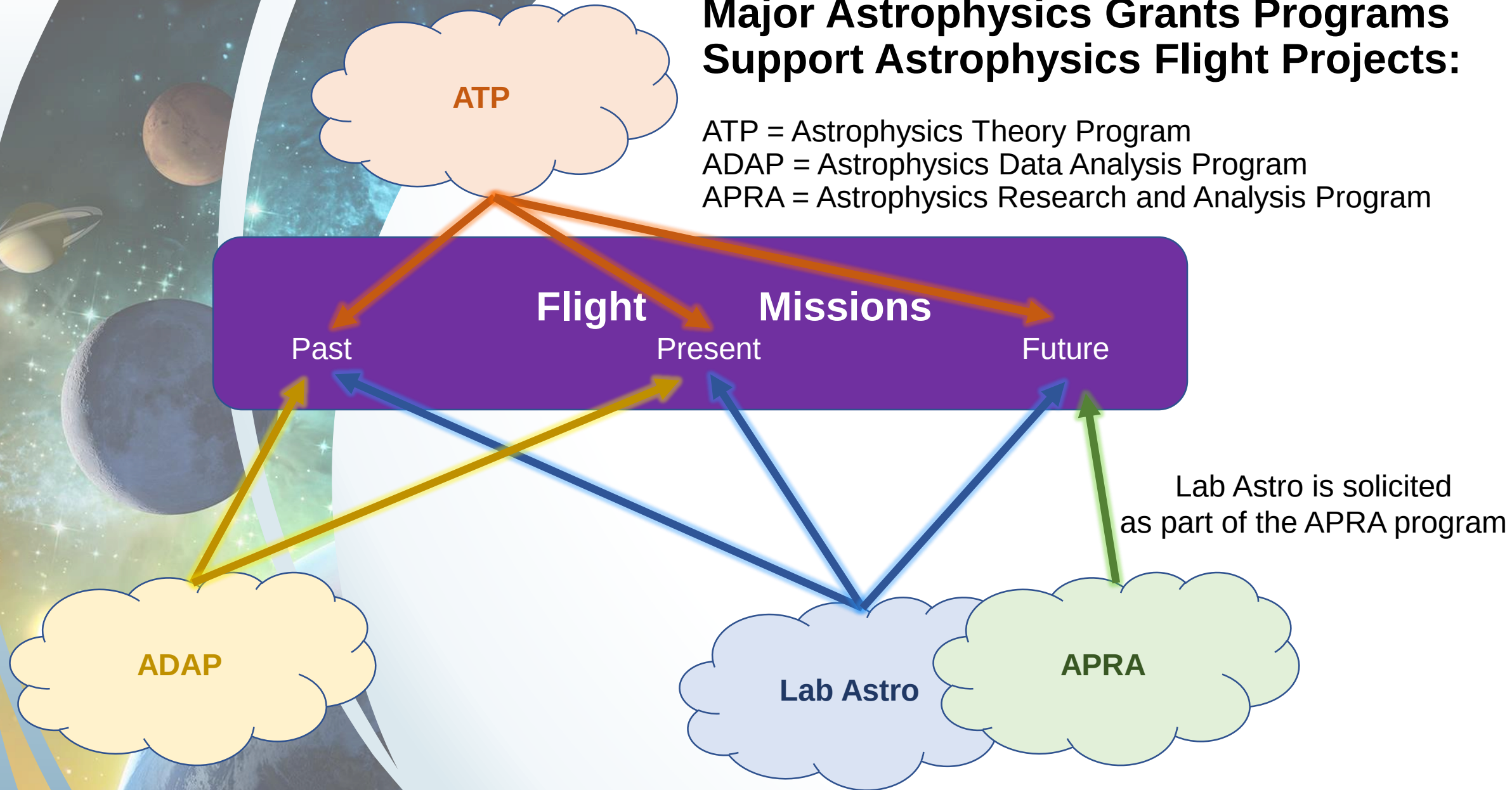
**“SIRTF” was rated by
the “Bahcall
Committee” Decadal
Survey as the
astrophysics highest
priority major new
initiative – The Decadal
Surveys have a real
impact.**

A Brief Tribute



Major Astrophysics Grants Programs Support Astrophysics Flight Projects:

ATP = Astrophysics Theory Program
ADAP = Astrophysics Data Analysis Program
APRA = Astrophysics Research and Analysis Program





Brief Summary of ROSES-20 APRA Lab Astro Solicitation

1.2.4 *Laboratory Astrophysics*

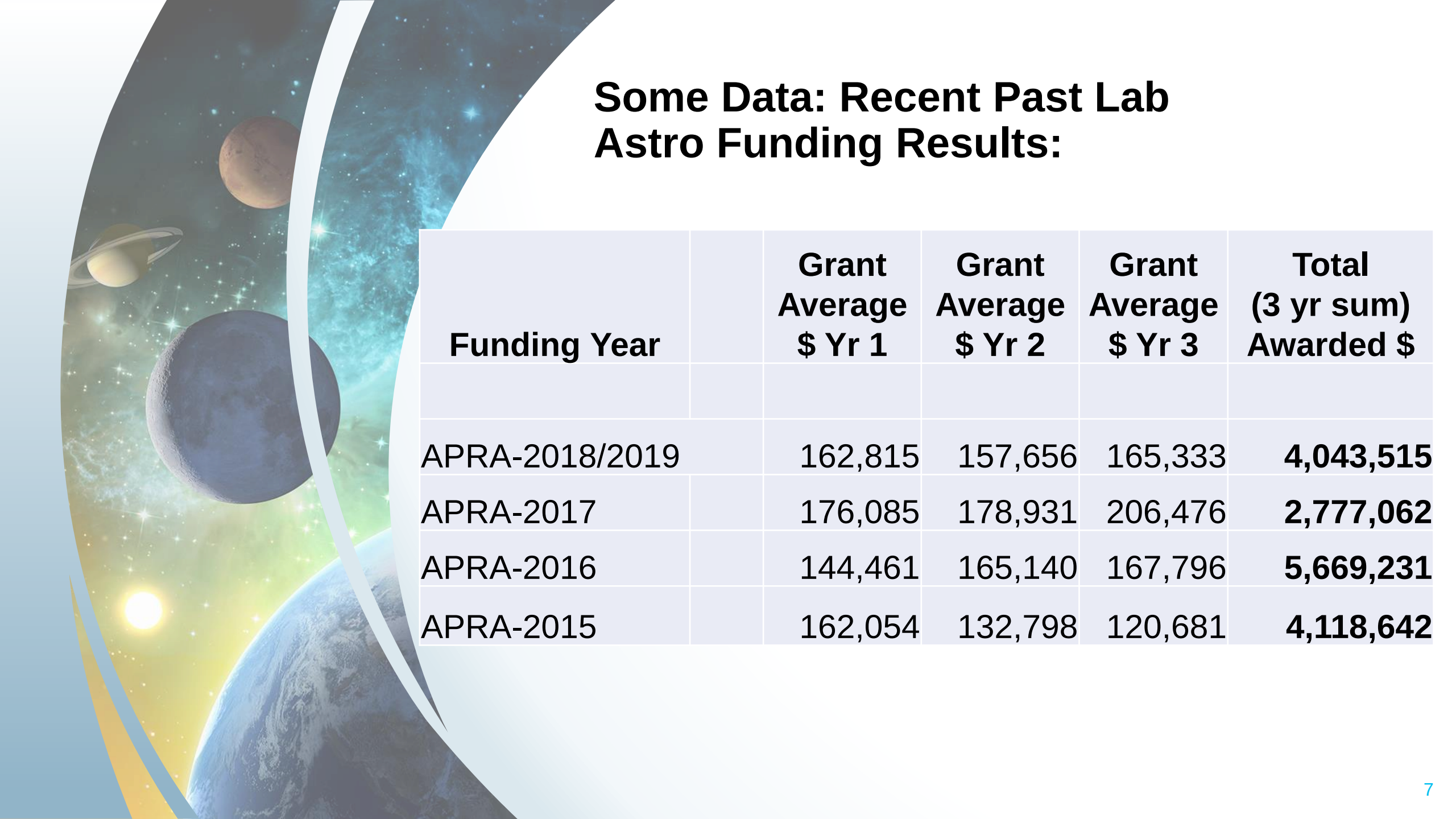
The Laboratory Astrophysics category of the APRA program element supports the **determination of fundamental atomic, molecular, nuclear, and solid-state parameters that are essential for analyzing and interpreting the data from NASA Astrophysics missions.** The category supports **both laboratory (experimental) and computational efforts** to explore the spectroscopic properties of atoms and molecules and particulate matter, as well as their chemical, physical, and dynamical properties under astrophysical conditions. **The resulting data products directly impact our understanding of a wide range of astrophysical phenomena spanning the electromagnetic spectrum and ranging from the epoch of reionization and the evolution of cosmic structure to the formation and evolution of galaxies, stars, and exoplanetary systems in the current epoch.**



Some Perspective: Lab Astro Community Responds and Supports Astrophysics Objectives.

- The Lab Astro community has been organizing. Several communities have come together, and the AAS Lab Astro Division is now well established.
- Lab Astro is essential to understanding data from many past, present, and future Astrophysics missions, including all four large mission concept studies, Herschel, Spitzer, Webb, GUSTO, SPHEREx, XRISM, multi-messenger, and many more.
- NASA Astrophysics sponsors regular Lab Astro “Workshops” that provide detailed reports to NASA.
- The most recent NASA Lab Astro Workshop emphasized that the community is changing and greying. It is (at least partly) up to us (NASA) to make sure a younger and more diverse generation is engaged and interested.
- The community is flexible and adapts to NASA’s priorities.
- NASA Astrophysics needs to properly emphasize the importance of Lab Astro to former, ongoing, and future missions. We need the Lab Astro community to not lose interest and transition away from Lab Astro of value to NASA. They are generally not astrophysicists – chemists, biochemists, physical chemists, materials scientists, etc.

**Image from Southeast Lab Astro
Community Workshop 2019 –
*Laboratory Astrophysics in the
Era of Multi-Messenger
Astrophysics.***



Some Data: Recent Past Lab Astro Funding Results:

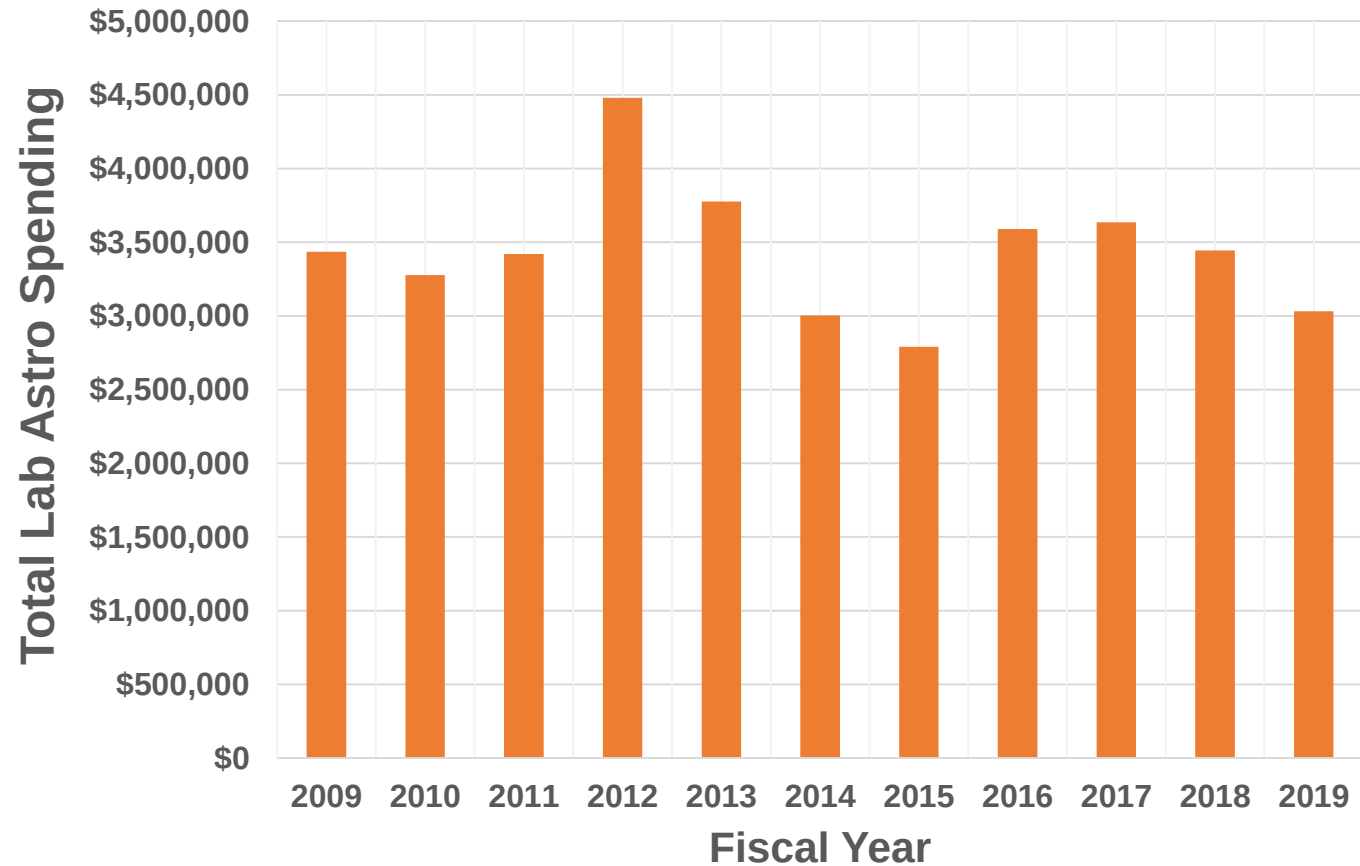
Funding Year		Grant Average \$ Yr 1	Grant Average \$ Yr 2	Grant Average \$ Yr 3	Total (3 yr sum) Awarded \$
APRA-2018/2019		162,815	157,656	165,333	4,043,515
APRA-2017		176,085	178,931	206,476	2,777,062
APRA-2016		144,461	165,140	167,796	5,669,231
APRA-2015		162,054	132,798	120,681	4,118,642



Some Example Lab Astro Projects: APRA-2018 Selection Titles

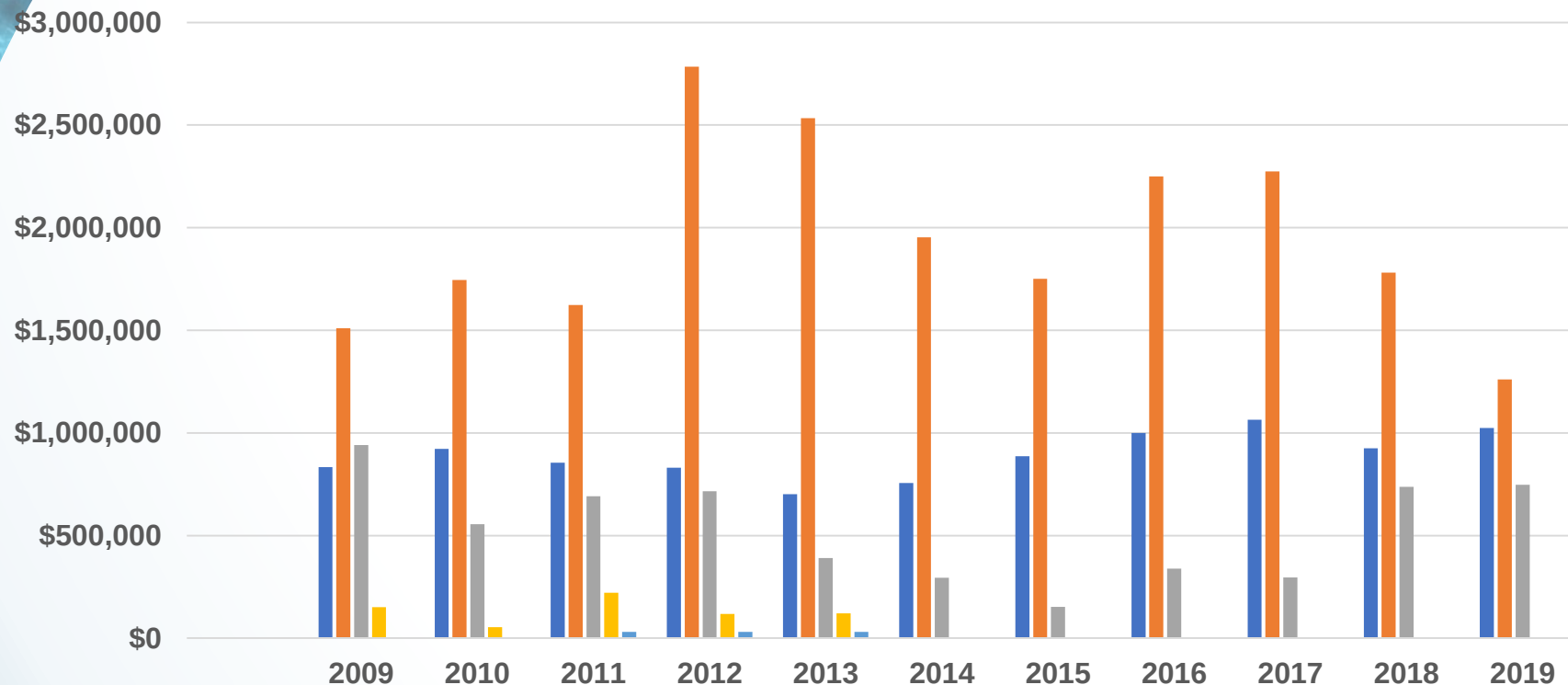
- Towards Accurate Rovibrational Line List for Use in Modeling and Interpreting Observations of ISM and (Exo)Planet Atmospheres: N_2O
- Spectroscopy and Physical Properties of Ices in Cold Astrophysical Environments
- Building Biomaterials in Space: Organic Acids and Amides in Prebiotic Interstellar Chemistry
- Rovibrational Collision Rates for Infrared Modeling of Triatomics in Warm Interstellar Gas from Full-dimensional Quantum Calculations
- Contributions of X-ray emission lines from open L-shell Fe ions to the long-wavelength segment of the Fe XVII L-shell X-ray spectrum
- Theoretical Atomic Data of K-shell Transitions With Spectroscopic Accuracy
- High Resolution X-ray Measurements Following Charge Exchange with Atomic H: Data for a New Observational Window on Diffuse Astrophysical Sources
- Laboratory studies of X-ray emission of highly-charged ions in non-equilibrium collisional plasmas

Additional Data: Total Spending in Lab Astro Program over the Past Decade



Yet More Data

Astrophysics Lab Astro Spending by Discipline



The “bumps and wiggles” in Lab Astro spending on the previous slide are almost entirely due to IR Sub-mm Lab Astro spending differences.

- APRA High Energy Astrophysics
- APRA IR Sub-mm Astrophysics
- APRA UV Opt Astrophysics
- Astrophysics Theory
- Origins of Solar System (SSO) Astrophysics



Plans to improve the NASA Astrophysics Lab Astro Program:

In ROSES-20 APRA, the Astrophysics Lab Astro Program (LAP) will establish:

- Separate portfolio for tracking, insight, management.
- Inclusive policy to engage discipline scientists in Lab Astro selections.
 - Gives Lab Astro a more stable budget and a program that is determined by LAP needs/priorities, not overall APRA priorities, which might differ.

Near Future:

- Decide how to determine what the right-sized Astrophysics LAP budget should be (via internal data, community input, annual budget allocation process, Decadal Survey, etc.).
- Develop metrics for evaluating success of LAP.
- Plan for LAP 'infrastructure years' to fill this missing need.

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