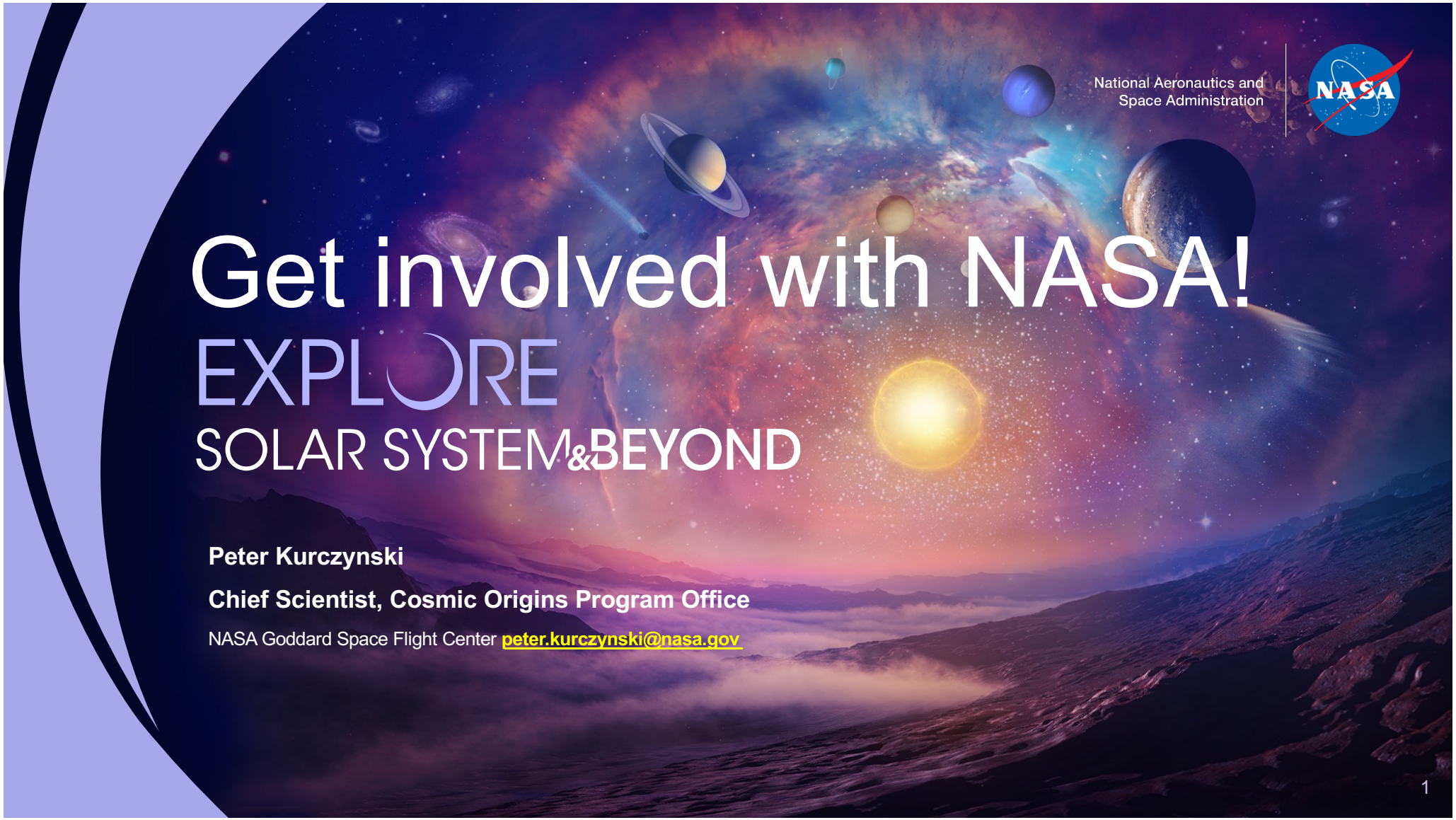
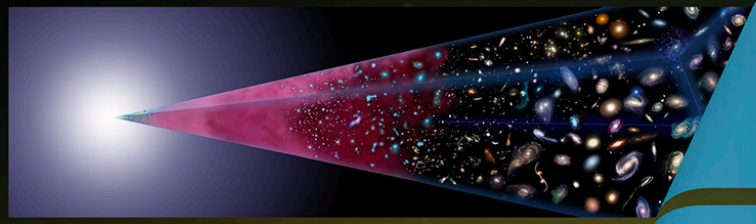

National Aeronautics and
Space Administration
NASA
Get involved with NASA!
EXPLORE
SOLAR SYSTEM&BEYOND
Peter Kurczynski
Chief Scientist, Cosmic Origins Program Office
NASA Goddard Space Flight Center peter.kurczynski@nasa.gov
1

Why Astrophysics?



How did our universe begin and evolve?

How did galaxies, stars, and planets come to be?

Are we alone?

Enduring National Strategic Drivers

Astrophysics is humankind's scientific endeavor to understand the universe and our place in it.

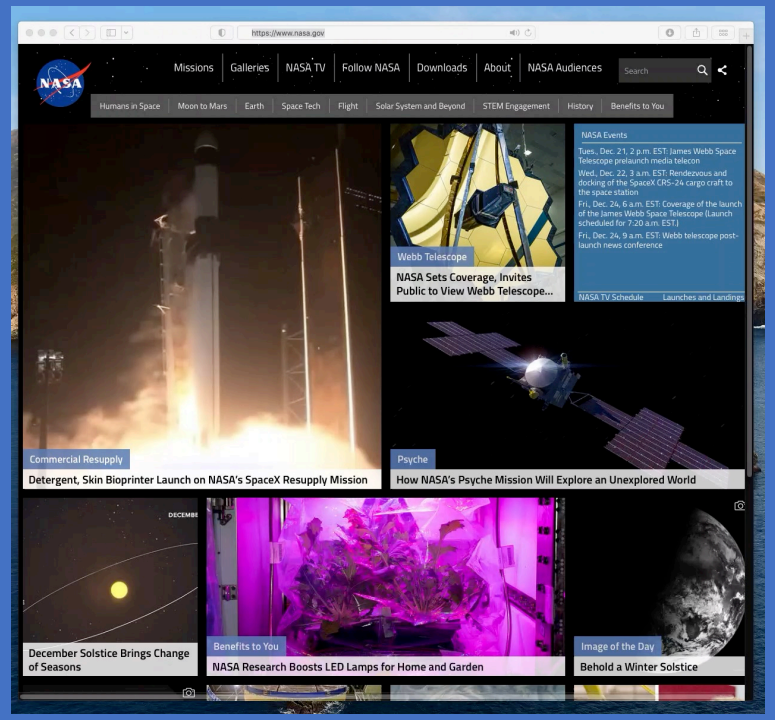
Cosmic Origins

https://cor.gsfc.nasa.gov

From the rise of the first stars to the role played by elusive dark matter, discover how we arrived at the complex universe of today.

Get involved!

Join a Science / Technology Interest Group



Events this month

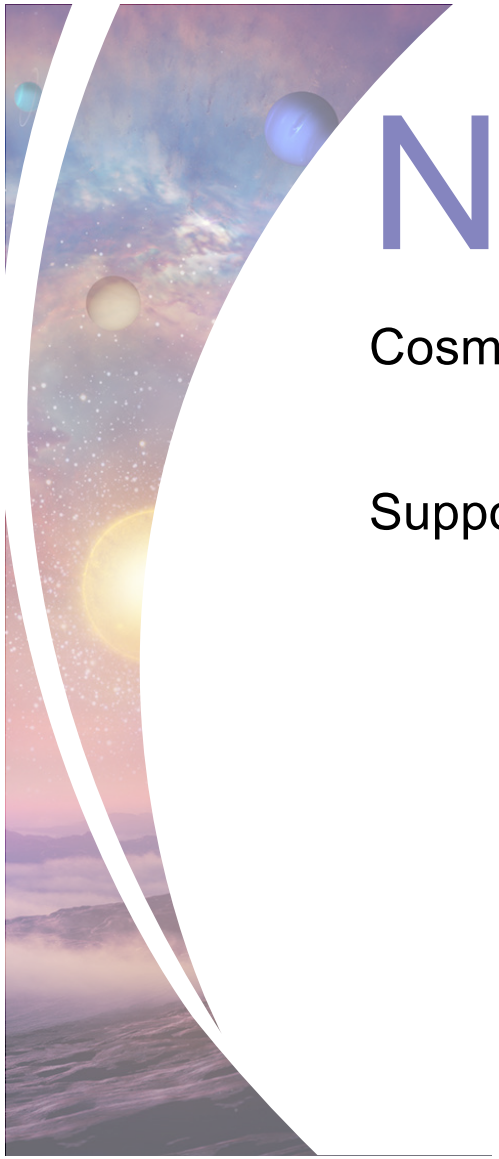
Cosmic Origins Program Analysis Group (COPAG)

https://cor.gsfc.nasa.gov/copag/AAS_Jan2022/AAS2022-agenda.php

Day/Time	Event
Yesterday	IR Science/Technology Interest Group
Happening Now	**Stars Science Interest Group**
Tomorrow! Thurs 6 Jan 1:00 pm ET	Galaxies Science Interest Group
Tues 11 Jan 12:00 pm ET	UV Science/Technology Interest Group
Tues 11 Jan 2:45 pm ET	NASA Astrophysics Town Hall (with Paul Hertz)
Wed 12 Jan 12:00 pm ET	COPAG Annual Meeting (with Executive Committee)
TBD (rescheduled due to AAS cancelation)	Joint PAG Meeting (with Paul Hertz)

Stars Science Interest Group: Transition leadership

First Name	Last Name	Institution
Yuan Sen	**Ting**	**IAS / ANU / Carnegie**
Racheal	**Beaton**	**Princeton / Carnegie**
Keith	Hawkins	University of Texas - Austin
Jennifer	Johnson	Ohio State University
David	Weinberg	Ohio State University
Ting	Li	University of Toronto
Kathleen	Kraemer	Boston College
Philip	Mocz	Lawrence Livermore National Laboratory
Rosemary	Wyse	Johns Hopkins University



Now Hiring!

Cosmic Origins is actively recruiting for the following positions:

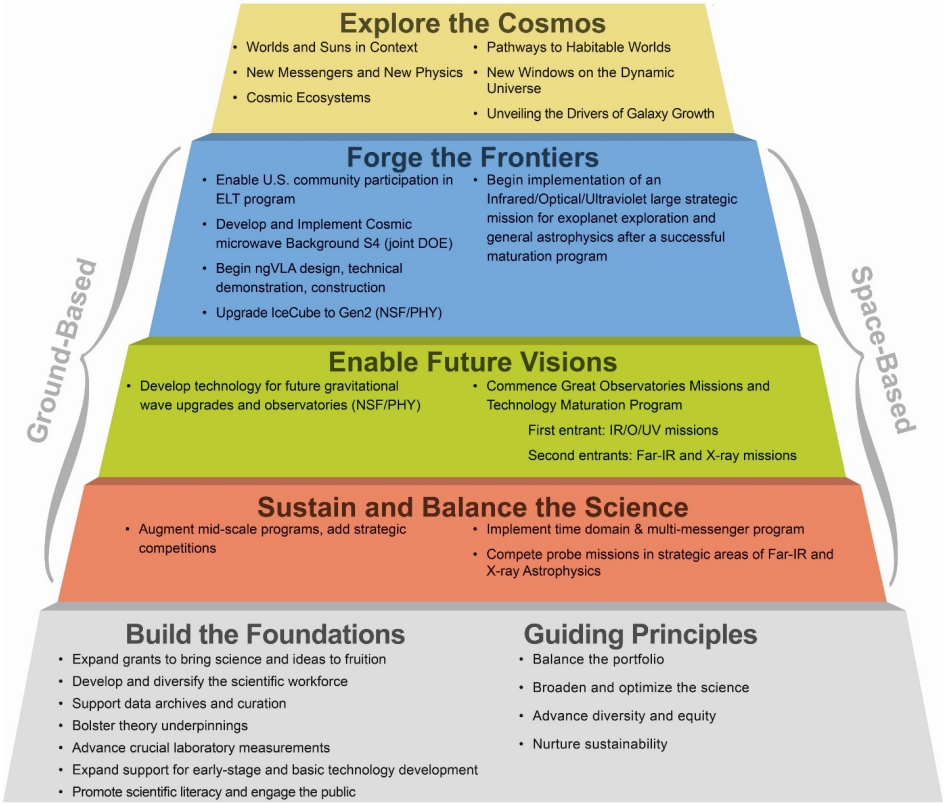
Support Scientist (0.5 WYE): Managed through CRESST

Contact: Katherine McKee *katherine.s.mckee@nasa.gov*

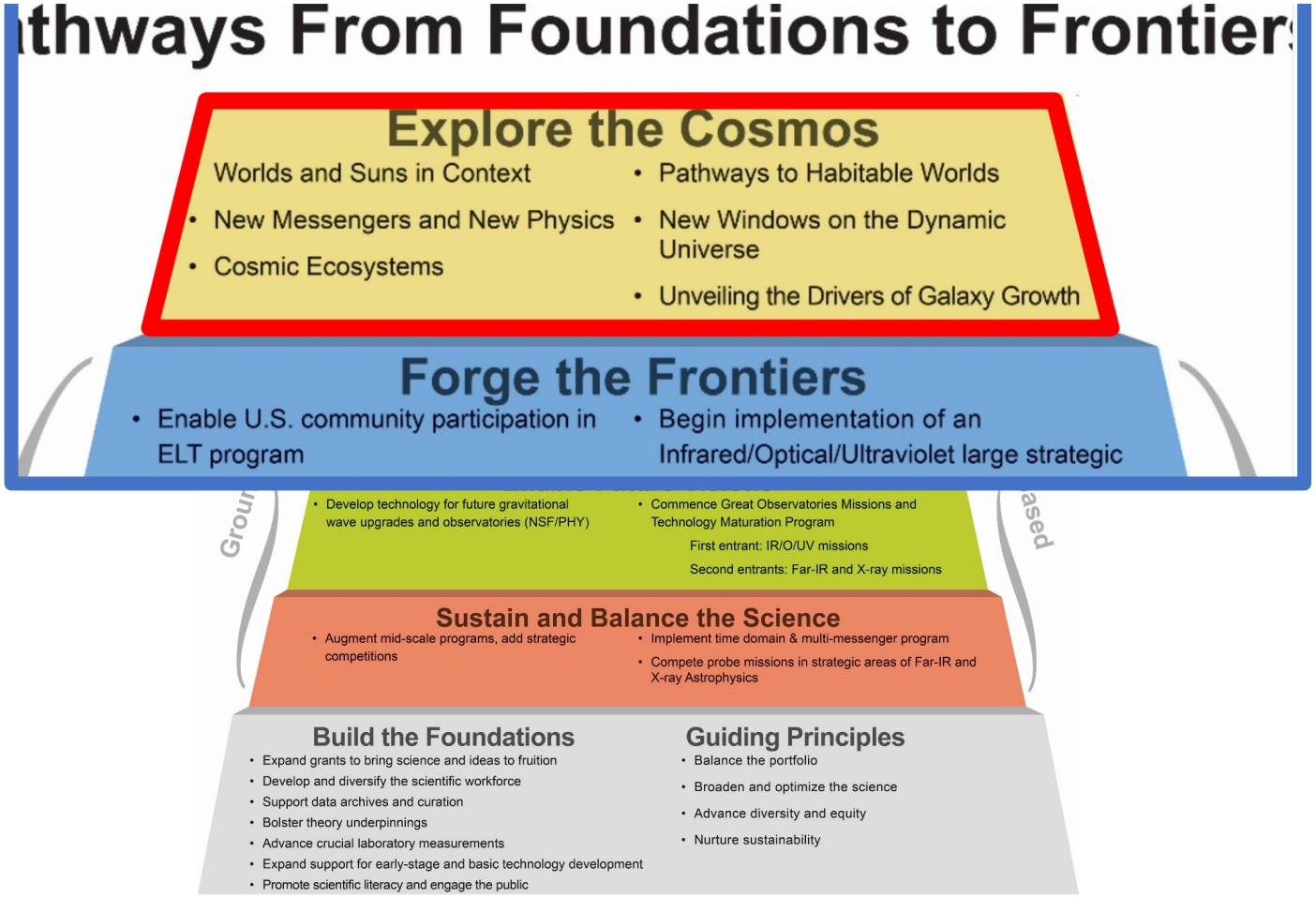
Highlights of Astro 2020 Decadal Survey:

Pathways to Discovery in Astronomy and Astrophysics for the 2020's

Realizing the Astro2020 Program: Pathways From Foundations to Frontiers



thways From Foundations to Frontier

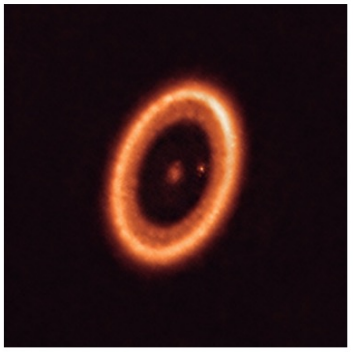


Science Theme: Worlds and Suns in Context

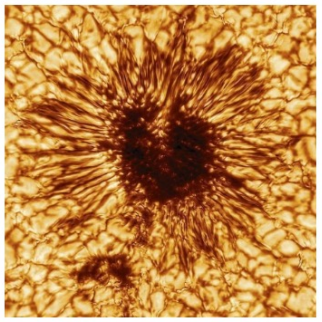
The quest to understand the interconnected systems of stars and the worlds orbiting them, from the nascent disks of dust and gas from which they form, through the formation and evolution of the vast array of extrasolar planetary systems so wildly different than the one in which Earth resides

This theme is forefront this decade because of:

- The extraordinary rate of discovery of new exoplanets–understanding the demographics and finding the nearest planets for detailed study
- The promise of JWST to make pioneering observations of exoplanet atmospheres
- The revolution DKIST will bring to understanding the Sun's atmosphere
- The revolution in studying planet formation by imaging protoplanets and their accretion disks using large ground-based telescopes (OIR and ALMA)



ALMA image of a young planet-forming star



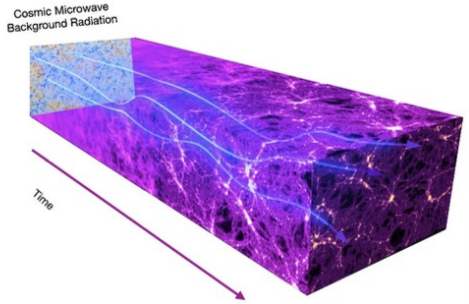
DKIST image of a sunspot

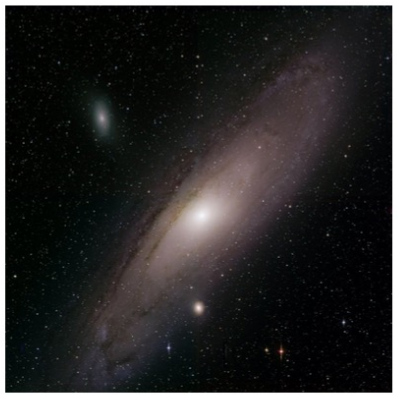
Science Theme: New Messengers and New Physics

New Messengers and New Physics captures the scientific questions associated with inquiries ranging from astronomical constraints on the nature of dark matter and dark energy, to the new astrophysics enabled by combined observations with particles, neutrinos, gravitational waves, and light

This theme is forefront this decade because of:

- Tremendous progress in observations of the Cosmic Microwave Background
- Time domain surveys that have uncovered an astounding array of transient phenomena
- The discovery of compact object mergers with LIGO, and the detection of electromagnetic counterparts
- Ice Cube's detection of high energy neutrinos of astrophysical origin





Science Theme: Cosmic Ecosystems

The universe is characterized by an enormous range of physical scales and hierarchy in structure, from stars and planetary systems to galaxies and a cosmological web of complex filaments connecting them

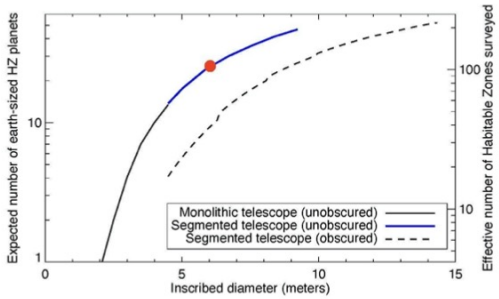
This theme is forefront because:

- JWST will provide definitive observations of the earliest stages of galaxy formation and evolution
- The Rubin Observatory, Roman, and Euclid will provide imaging and spectral energy information for millions of galaxies, complementing the in-depth observations from JWST
- Progress in numerical simulations is evolving rapidly and is driving our understanding of the observations

A Future IR/Optical/UV Telescope Optimized for Observing Habitable Exoplanets and General Astrophysics

IR/O/UV Telescope Characteristics

- ~6 m off-axis inscribed diameter provides robust sample of ~25 spectra of potentially habitable planets, and would be transformative for general astrophysics
- Estimated cost: 11B$
- Target launch: first half of 2040's



The scientific goals of this mission, when achieved, have the potential to change the way that we as humans view our place in the Universe

With sufficient ambition, we are poised to make this transformational step

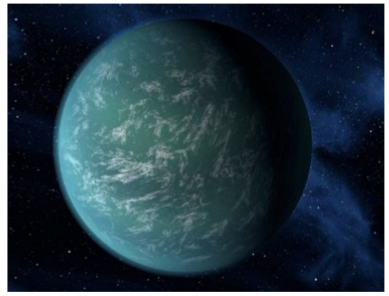
This is a quest at the technical forefront, and of an ambitious scale that only NASA can undertake, and where the U.S. is uniquely situated to lead

Thank you

Extra slides

Priority Area: Pathways to Habitable Worlds

We are on a path to exploring worlds resembling Earth and answering the question: "Are we alone?" The task for the next decades will be finding the easiest of such planets to characterize, and then studying them in detail, searching for signatures of life.

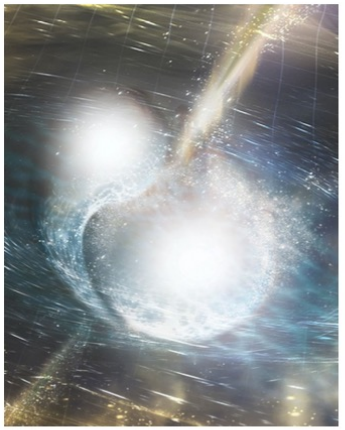


The needed capabilities include:

- Ground-based ELTs equipped with high-resolution spectroscopy, high-performance AO, and high-contrast imaging
- A large space-based IR/O/UV telescope with high contrast imaging and spectroscopy capable of observing planets 10 billion times fainter than their host star
- High spatial and spectral resolution X-ray observations to probe stellar activity across the entire range of stellar types
- Laboratory and theoretical studies

Priority Area: New Windows on the Dynamic Universe

The New Windows on the Dynamic Universe priority area involves using light in all its forms, gravitational waves, and neutrinos to study cosmic explosions on all scales and the mergers of compact objects



The needed capabilities include:

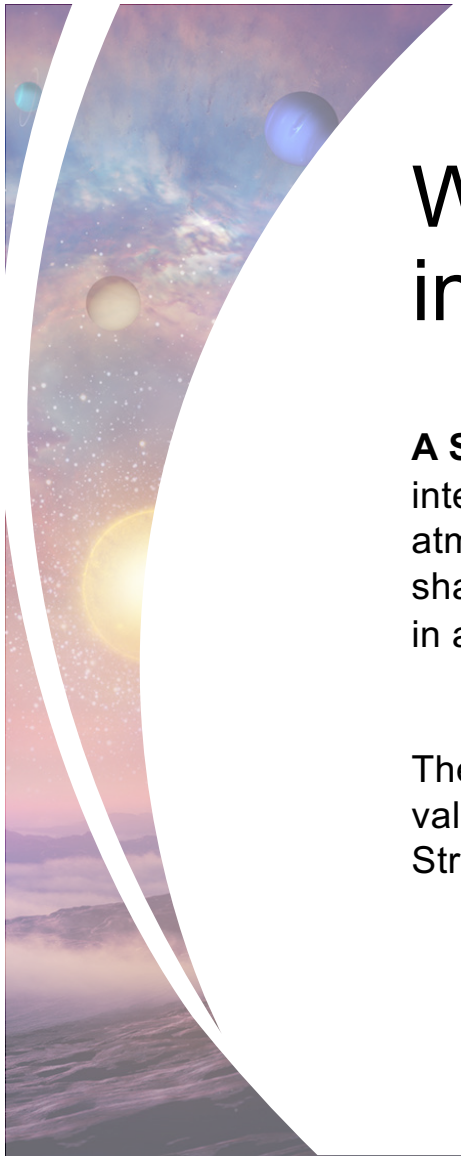
- Facilities to discover and characterize the brightness and spectra of transient sources as they appear and fade away
- Ground-based ELTs to see light coincident with mergers
- A next-generation radio observatory to detect the relativistic jets produced by neutron stars and black holes
- Next generation CMB telescopes to search for the polarization produced by gravitational waves in the infant universe
- Upgrades to current ground-based gravitational wave detectors, and development of next generation technologies
- Improvements in the sensitivity and angular resolution of high energy neutrino observatories

Priority Area: Unveiling the Drivers of Galaxy Growth

The priority area involves unveiling the drivers of galaxy growth, focusing on processes affecting galactic scales

The needed capabilities include:

- ELTs to observe galaxies in the young universe
- A next generation radio telescope to map emission lines of molecular gas, tracing cold gas
- A next generation IR/O/UV space telescope to trace the details of the nearby, evolved universe
- FIR and X-ray missions to peer into the dusty hearts of galaxies to reveal enshrouded black holes, and trace the hottest gas phases
- Investments in theory to realize a new scientific foundation for understanding galaxy evolution



What is a science (& technology) interest group?

A Science Interest Group is a long term science affinity group consisting of members interested in a specific sub-field of Cosmic Origins science (e.g. stars and stellar atmospheres, or galaxies, etc.). The group typically meets regularly to discuss and share scientific results, analysis techniques, and scientific gaps, as well as the role of NASA in advancing the state of the art for that sub-field.

These groups value a community that is diverse and inclusive, consistent with NASA's core value of inclusion and strategy 4.1 of the NASA Science Mission Directorate Science Strategy (Explore Science 2020-2024: A Vision for Scientific Excellence 2020)

NASA Astrophysics Organization

NASA Headquarters

- Astrophysics Division Director: Paul Hertz
- Cosmic Origins Program Scientist: Eric Tollestrup

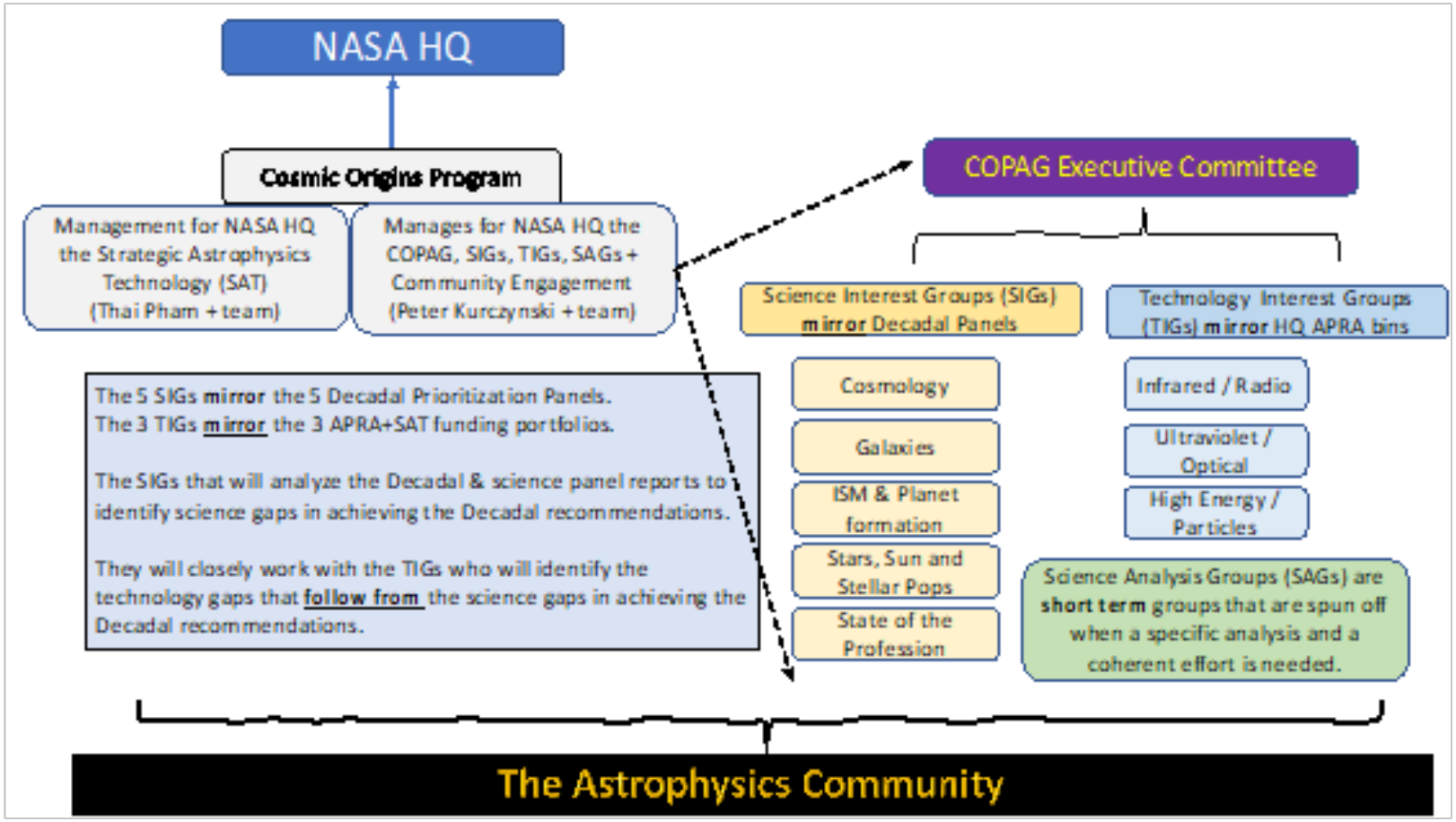
Cosmic Origins Program Office (officially part of NASA HQ; resident at GSFC)

- Chief Scientist: Peter Kurczynski
- Science Program Manager: Stephanie Clark
- Website and list-serv support: Pat Tyler

Cosmic Origins Program Analysis Group (COPAG): Astrophysics community

- Executive Committee: Chairperson – Janice Lee
- Science Interest Groups / Science & Technology Interest Groups

Why now?


NASA HQ
Cosmic Origins Program
Management for NASA HQ the Strategic Astrophysics Technology (SAT) (Thai Pham + team)
Manages for NASA HQ the COPAG, SIGs, TIGs, SAGs + Community Engagement (Peter Kurczynski + team)
COPAG Executive Committee
Science Interest Groups (SIGs) mirror Decadal Panels
Technology Interest Groups (TIGs) mirror HQ APRA bins
The 5 SIGs mirror the 5 Decadal Prioritization Panels.
The 3 TIGs mirror the 3 APRA+SAT funding portfolios.
The SIGs that will analyze the Decadal & science panel reports to identify science gaps in achieving the Decadal recommendations.
They will closely work with the TIGs who will identify the technology gaps that follow from the science gaps in achieving the Decadal recommendations.
Cosmology
Galaxies
ISM & Planet formation
Stars, Sun and Stellar Pops
State of the Profession
Infrared / Radio
Ultraviolet / Optical
High Energy / Particles
Science Analysis Groups (SAGs) are short term groups that are spun off when a specific analysis and a coherent effort is needed.
The Astrophysics Community