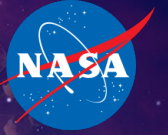


National Aeronautics and
Space Administration



Get involved with NASA!

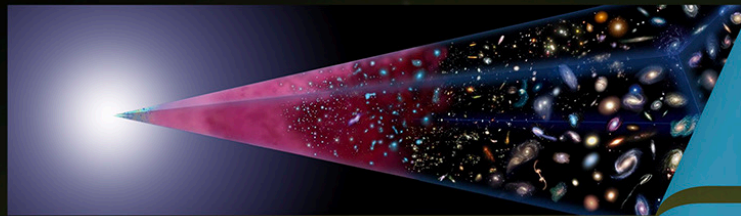
EXPLORE SOLAR SYSTEM & BEYOND

Peter Kurczynski

Chief Scientist, Cosmic Origins Program Office

NASA Goddard Space Flight Center peter.kurczynski@nasa.gov

Why Astrophysics?



How did our universe begin and evolve?

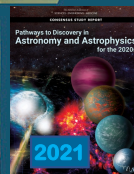


How did galaxies, stars, and planets come to be?



Are we alone?

Enduring National Strategic Drivers



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

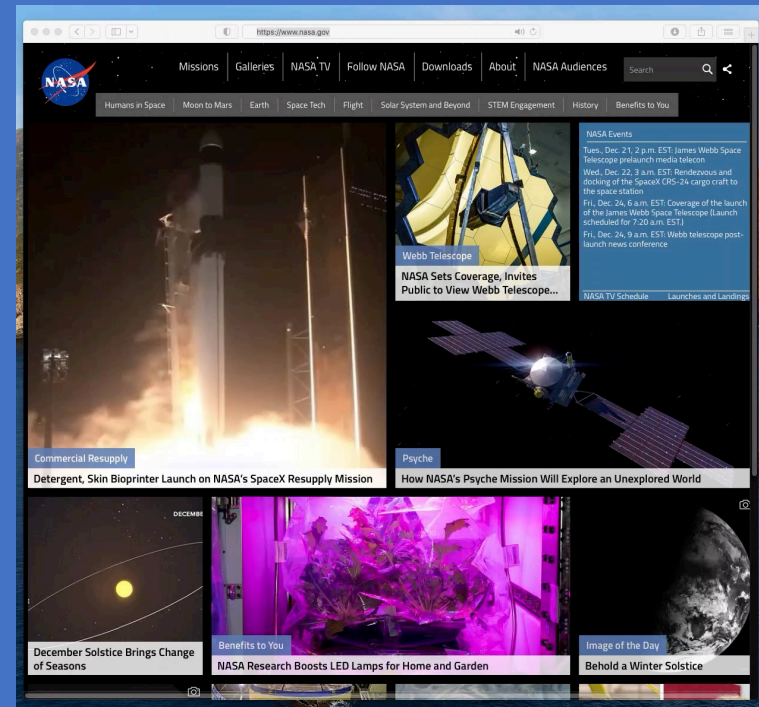
Cosmic Origins

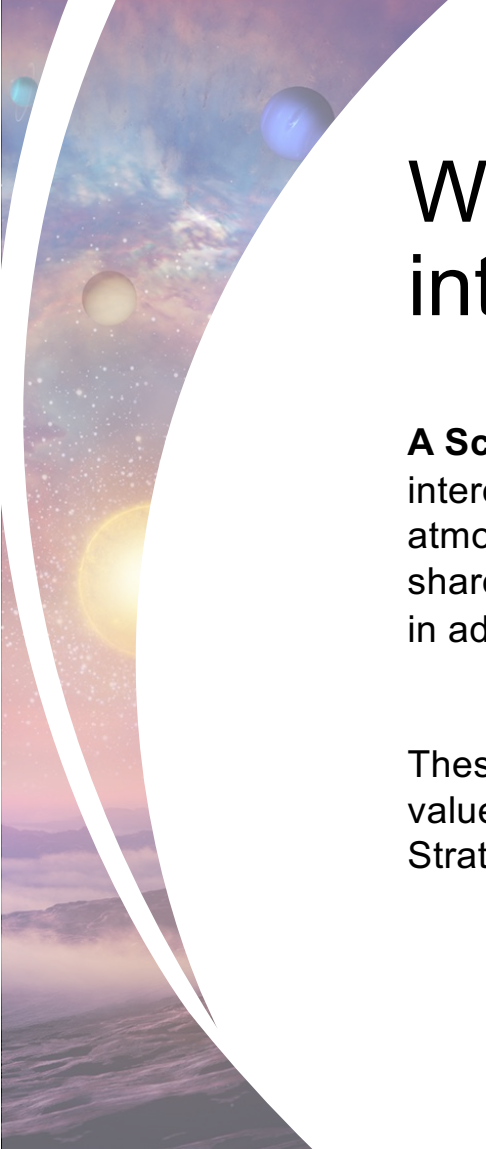
<https://cor.gsfc.nasa.gov>

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





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](#)).



How to Join

Galaxies Science Interest Group

Send email to: galaxies-sig-request@lists.nasa.gov

Subject: join

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
Yesterday	Stars Science Interest Group
Today! 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)



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

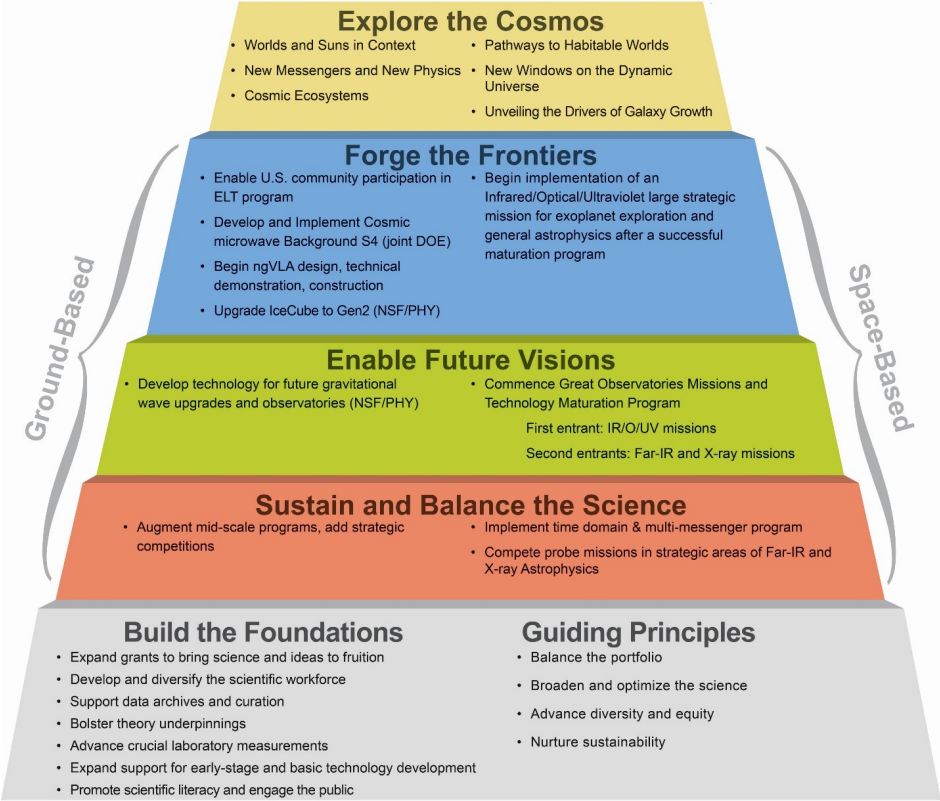


Highlights of Astro 2020 Decadal Survey:

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

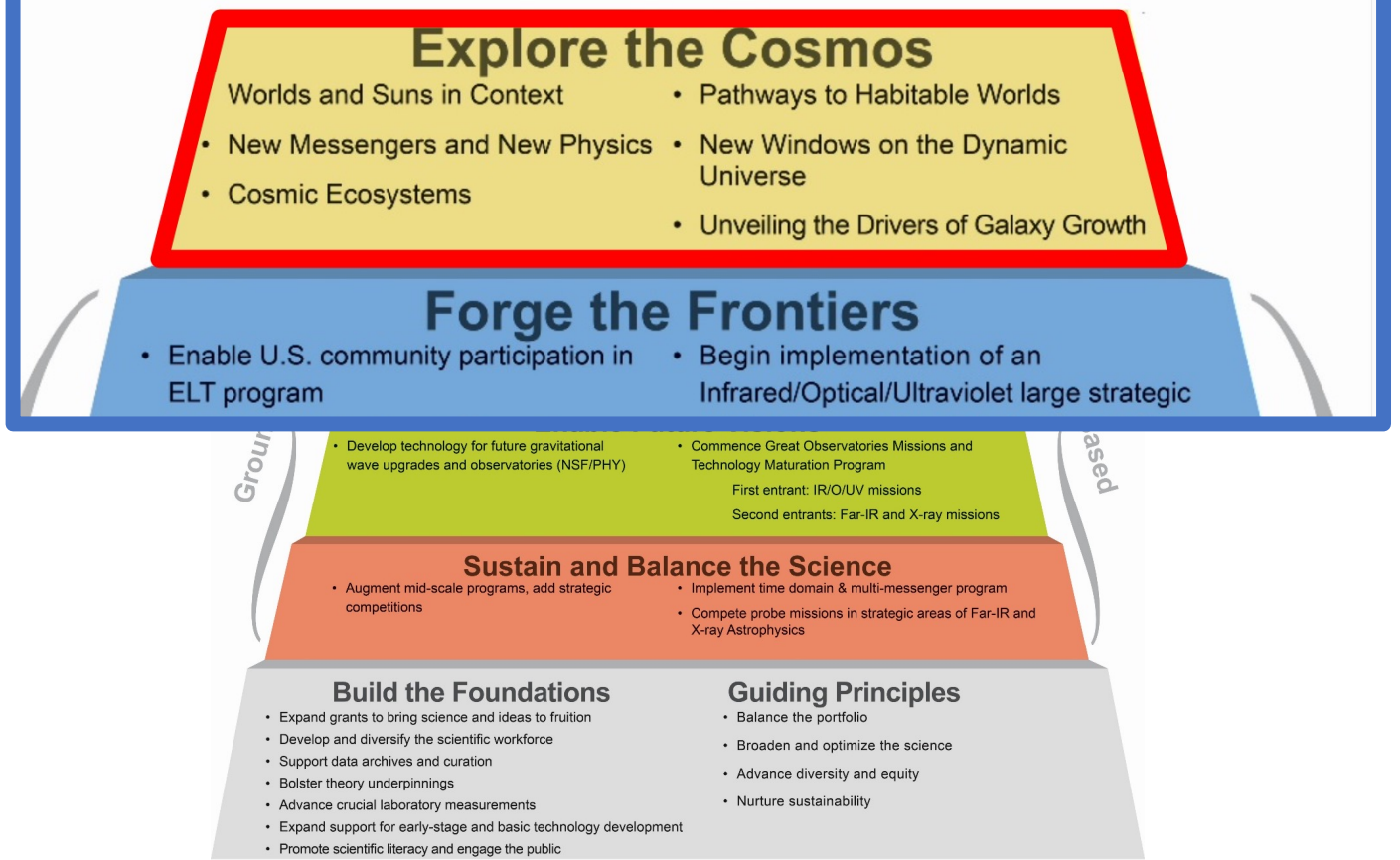


Realizing the Astro2020 Program: Pathways From Foundations to Frontiers



The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Pathways From Foundations to Frontiers



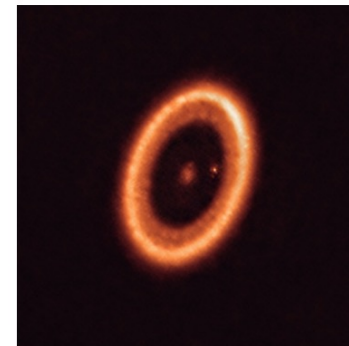
The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Science Theme: Worlds and Suns in Context

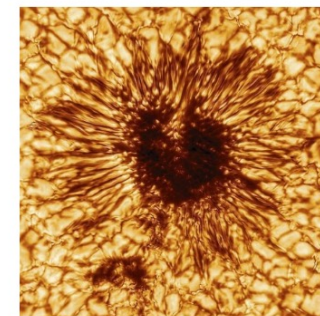
The quest to understand the interconnected systems of stars and the worlds orbiting them, from the nascent disks of dust and gas from which they form, through the formation and evolution of the vast array of extrasolar planetary systems so wildly different than the one in which Earth resides

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



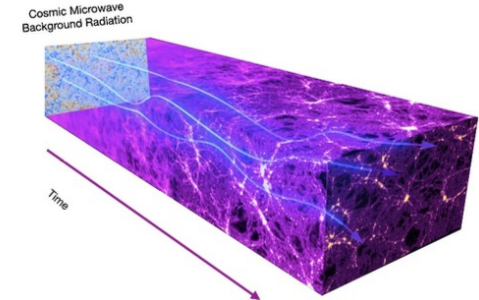
DKIST image of a sunspot

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

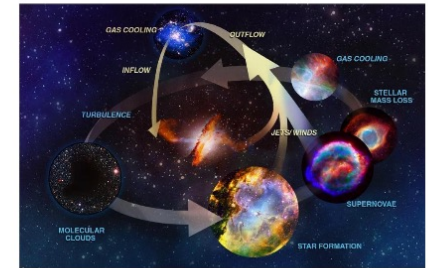


Science Theme: Cosmic Ecosystems

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:

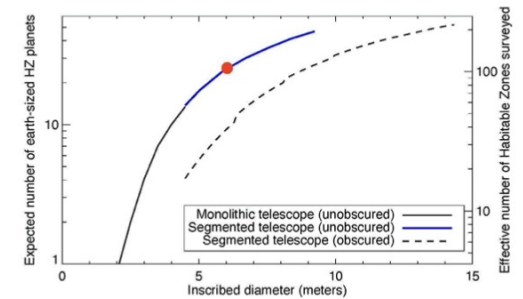
- JWST will provide definitive observations of the earliest stages of galaxy formation and evolution
- The Rubin Observatory, Roman, and Euclid will provide imaging and spectral energy information for millions of galaxies, complementing the in-depth observations from JWST
- Progress in numerical simulations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

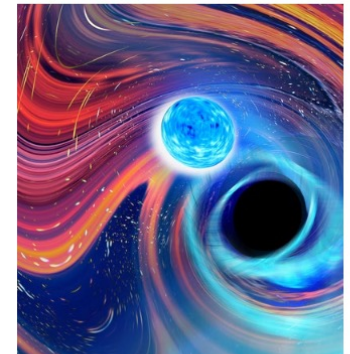
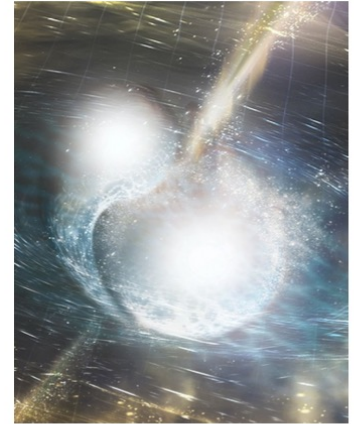
- Ground-based ELTs equipped with high-resolution spectroscopy, high-performance AO, and high-contrast imaging
- A large space-based IR/O/UV telescope with high contrast imaging and spectroscopy capable of observing planets 10 billion times fainter than their host star
- High spatial and spectral resolution 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

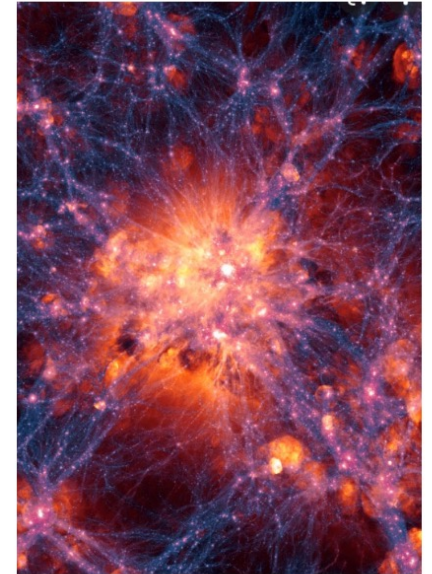


Priority Area: Unveiling the Drivers of Galaxy Growth

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





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?

