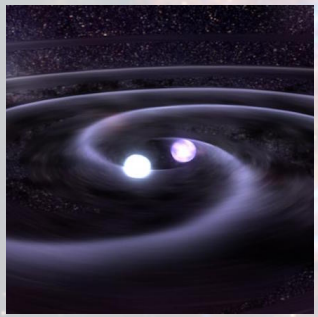
# The Physics of the Cosmos Program Office

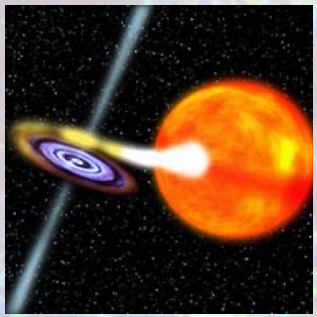
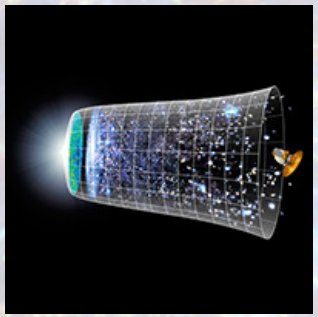
Francesca Civano and Brian Humensky

Chief Scientists, PhysCOS

# The PhysCOS Program Office

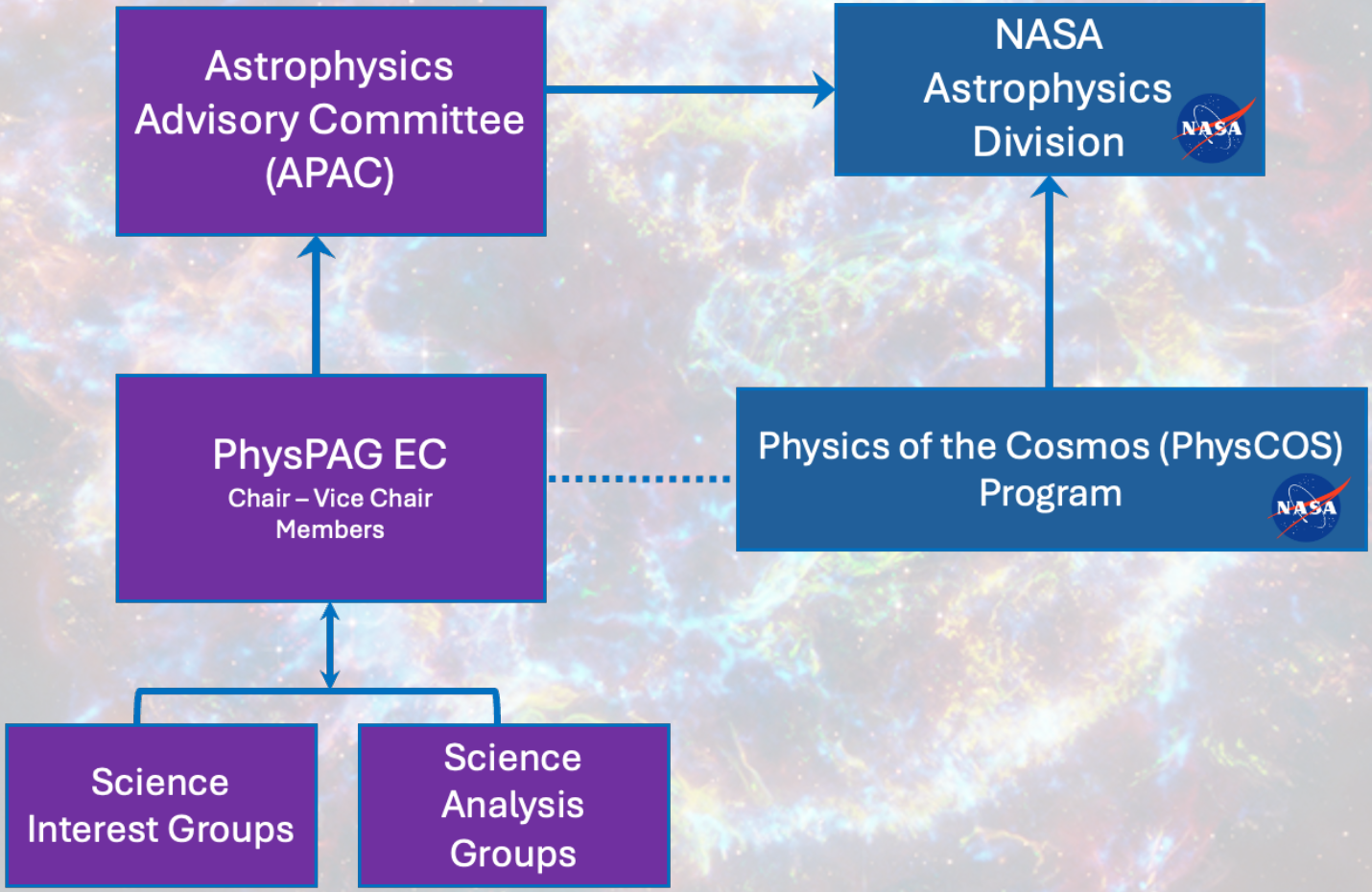
**Physics of the Cosmos** spans the fields of high-energy astrophysics, cosmology, and fundamental physics, to explore some of the most fundamental questions regarding the physical forces and laws of the universe:




- Manages strategic technology development
- Provides a two-way communication conduit between community & NASA
- Works with sibling program offices: **Cosmic Origins** and **Exoplanet Exploration**

# Phys… What?!?


Astrophysics Advisory Committee (APAC)
NASA Astrophysics Division
PhysPAG EC
Chair – Vice Chair
Members
Physics of the Cosmos (PhysCOS) Program
Science Interest Groups
Science Analysis Groups

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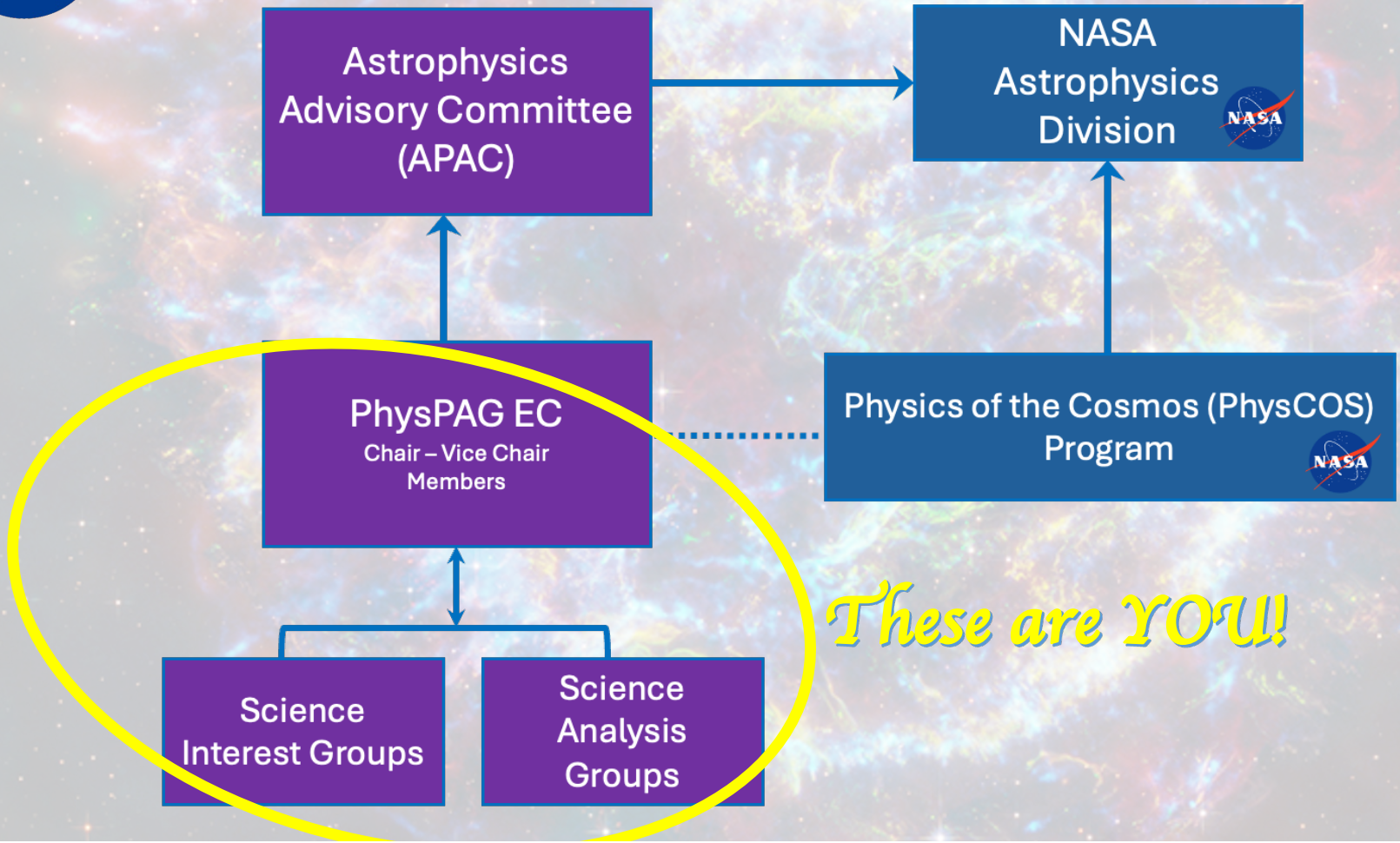
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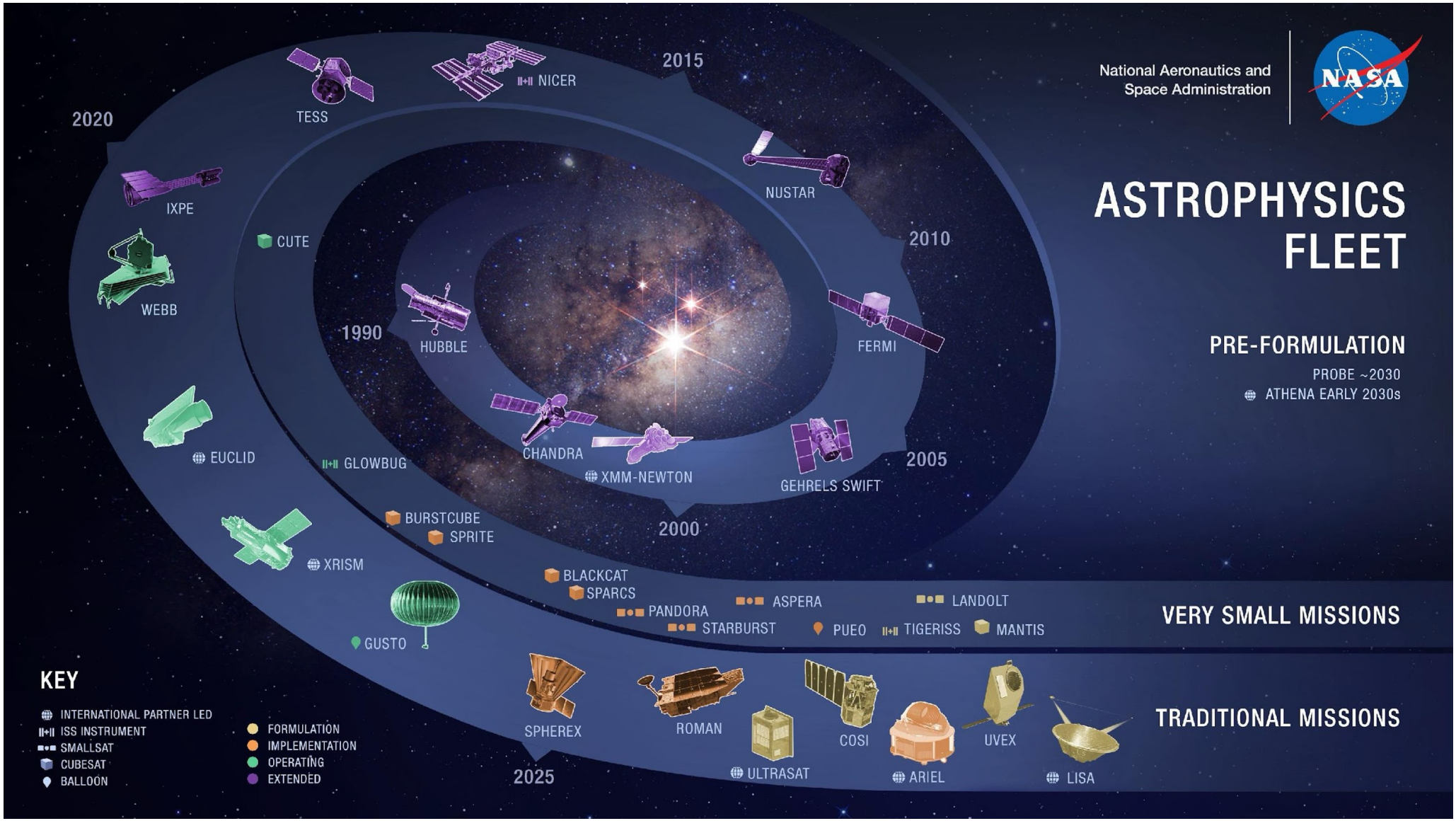
These are YOU!


National Aeronautics and Space Administration
NASA
ASTROPHYSICS FLEET
PRE-FORMULATION
PROBE ~2030
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CUTE
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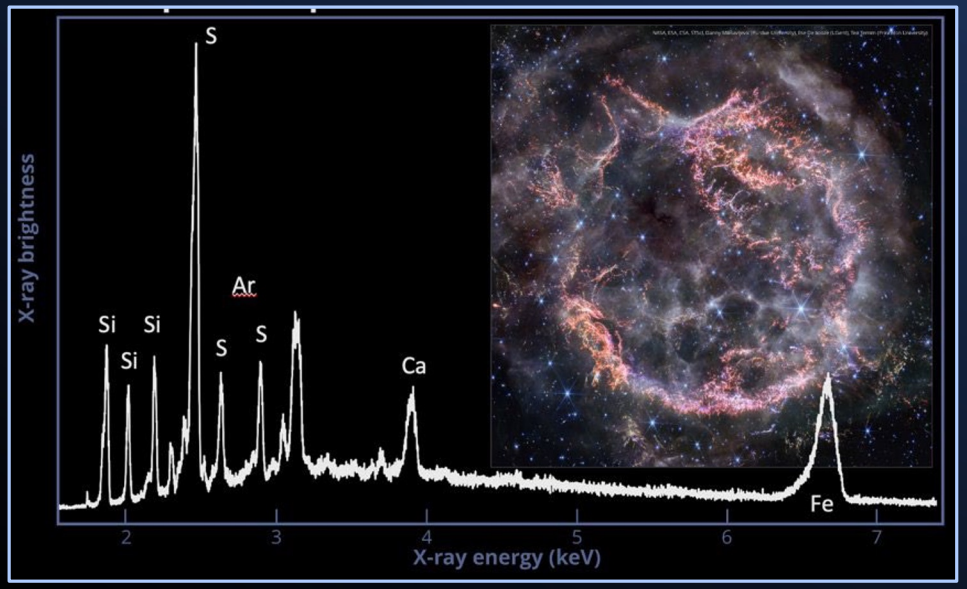
HUBBLE
FERMI
EUCLID
GLOWBUG
CHANDRA
XMM-NEWTON
GEHRELS SWIFT
BURSTCUBE
SPRITE
XRISM
BLACKCAT
SPARCS
PANDORA
ASPERA
LANDOLT
STARBURST
PUEO
TIGERISS
MANTIS
GUSTO
VERY SMALL MISSIONS
SPHEREX
ROMAN
COSI
UVEX
ULTRASAT
ARIEL
LISA
TRADITIONAL MISSIONS
KEY
INTERNATIONAL PARTNER LED
ISS INSTRUMENT
SMALLSAT
CUBESAT
BALLOON
FORMULATION
IMPLEMENTATION
OPERATING
EXTENDED

# XRISM

- The two instruments are performing exceptionally:
  - Resolve reaching a spectral resolution of 5 eV (exceeding the 7 eV requirement)
  - Xtend performing as expected.

- The XRISM Post Launch Assessment Review (PLAR) was held on February 6, 2024 to mark the satellite transition to nominal operations and the project transition from code 461 to code 662.

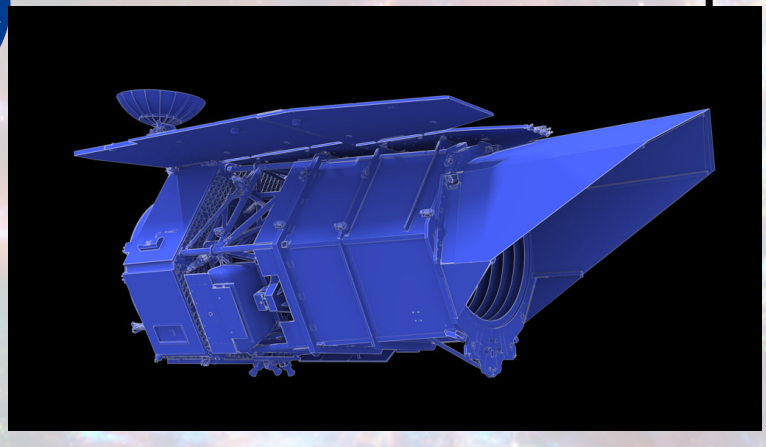
- Cycle 1 important dates:
  - April 4:
    - Cycle 1 Type-1 Phase-1 proposals - due at 4:30 p.m. (EDT)
    - Type-2 proposals - due at 11:59 p.m. (EDT)
  - Late June: Cycle 1 peer review
  - August: Cycle 1 observations begin



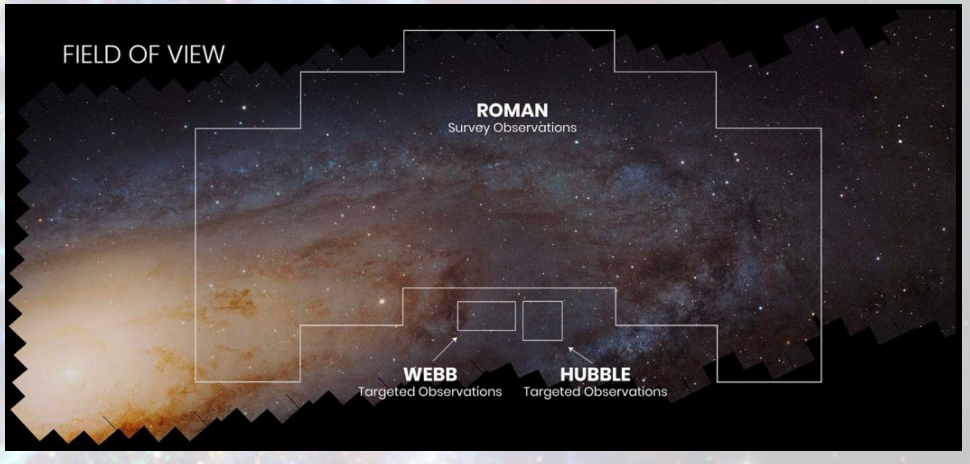

*XRISM (X-ray Imaging and Spectroscopy Mission), a partnership with the Japanese Space Agency (JAXA) has released a first look at the supernova remnant CAS-A. The spectrum shows elements produced in the supernova explosion and the extreme velocities of the ejected material. The image of CAS-A is a recent JWST observation.*

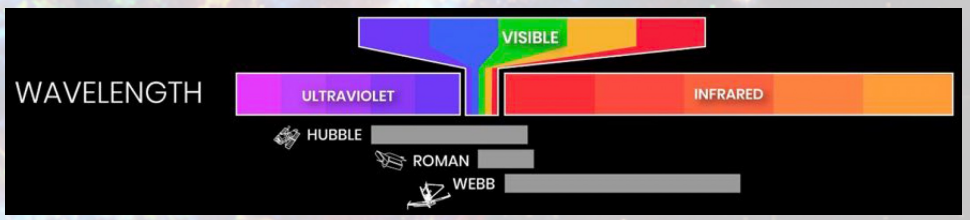
*Credit: JAXA/NASA/XRISM*

# Roman Space Telescope



- NASA's next Great Observatory, a visible/infrared survey mission, to launch in 2026-27.
- Science: exoplanets, cosmology with Type Ia SNe and gravitational lensing, time-domain astrophysics of all kinds
- Get involved: https://roman.gsfc.nasa.gov/index.html



DIVISION

# COSI

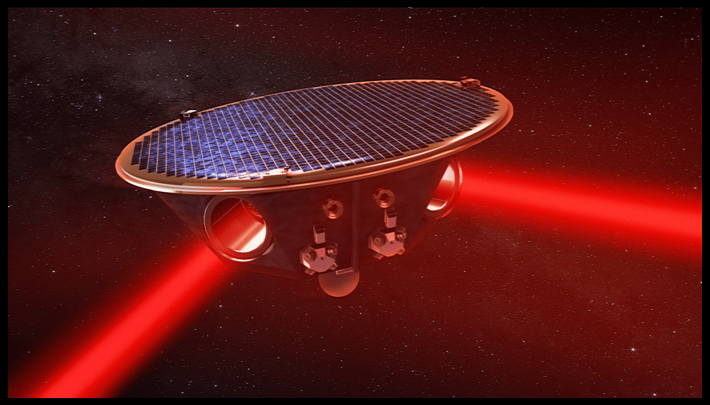
## The Compton Spectrometer and Imager

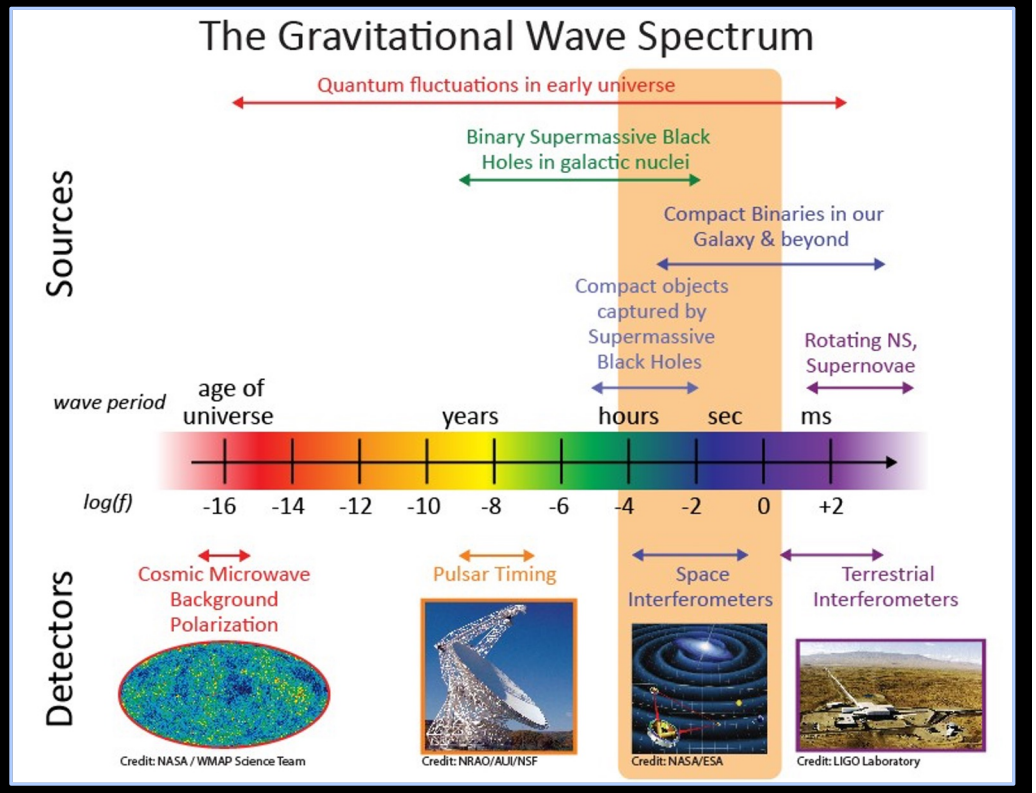
- The Compton Spectrometer and Imager (COSI) is a space telescope that will study the recent history of star birth, star death, and the formation of chemical elements in the Milky Way.
- The gamma-ray telescope is expected to launch in 2027 as NASA's latest small astrophysics explorer mission.
- Opening a new window on the sky in the 0.2 – 5 MeV band.
- COSI's principal investigator is John Tomsick at the University of California, Berkeley.

*Image by Jim Willis, courtesy of Northrop Grumman Corporation ½ Space Systems; background image courtesy of European Southern Observatory*

# LISA
## Laser Interferometer Space Antenna

- LISA will be the first space-based gravitational-wave observatory, launching in 2035.
- NASA is partnering with ESA to provide key technologies and a science center for LISA.






*Sources in LISA's mHz band range from white dwarf binaries in our galaxy to merging massive black holes at extreme redshift.*

# PhysCOS Program Office Activities

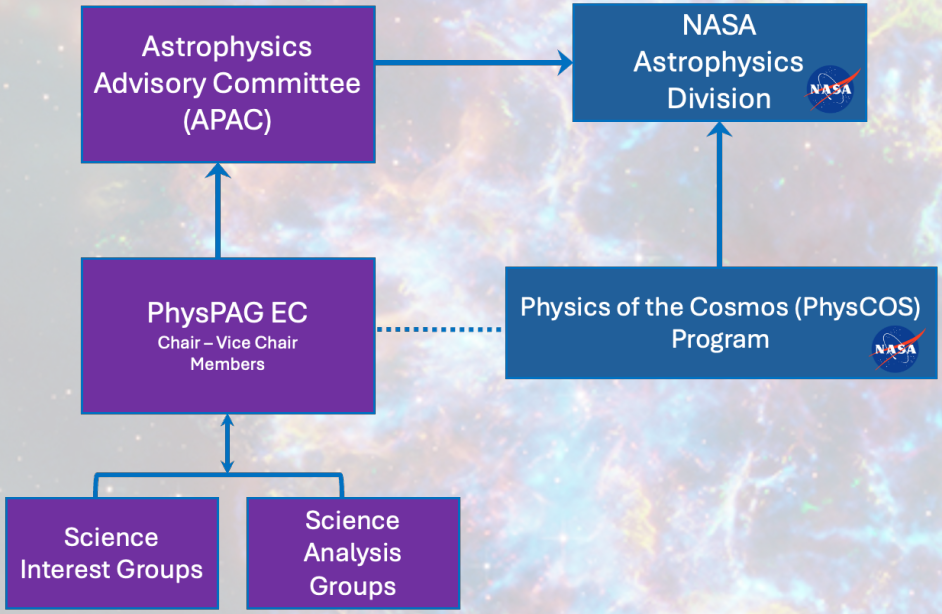
- The program office supports the community by
  - Facilitating the PhysCOS Program Analysis Group (PhysPAG);
  - Supporting the activities of Science Interest and Analysis Groups (SIGs and SAGs)
  - Informing members of upcoming funding and engagement opportunities;
  - Soliciting community-identified science and technology gaps;
  - Managing funded technology projects with benefits to PhysCOS science;
  - Maintaining science cognizance to enable more successful NASA strategic planning;
  - Community engagement: AAS, HEAD, APS, SACNAS, NSBP, …
  - Supporting mission studies: LISA just went through adoption and NewAthena is returning to the PO.





2024 Astrophysics Biennial Technology Report Released:
https://apd440.gsfc.nasa.gov/images/tech/2024_ABTR.pdf

# Science Interest Groups & Science Analysis Groups




- **Science Interest Groups** are community-led affinity groups focused on a particular area that are long-term.
  - Meet regularly to discuss science and technology developments, concerns in field
- **Science Analysis Groups** are stood up for a short term (1-2 years) to analyze a specific issue and deliver a report to APAC & Astrophysics Division.
  - Proposed by SIGs or requested by HQ
  - Membership open to any who are interested

# Science Interest Groups & Science Analysis Groups


- **Science Analysis Groups**
  - Gamma-ray Transient Network studied future opportunities for localization of Gamma Ray Bursts and Magnetar Giant Flares.
  - Future Innovations in Gamma Rays (FIG) SAG is laying out the science and technology priorities for the next generations of gamma-ray telescopes in space.
  - Astrophysics With Equity: Surmounting Obstacles to Membership (AWESOM) SAG is studying how to broaden participation in the astrophysics community

# Commitment to Diversity, Equity and Inclusion

## Cosmic Pathfinders Program

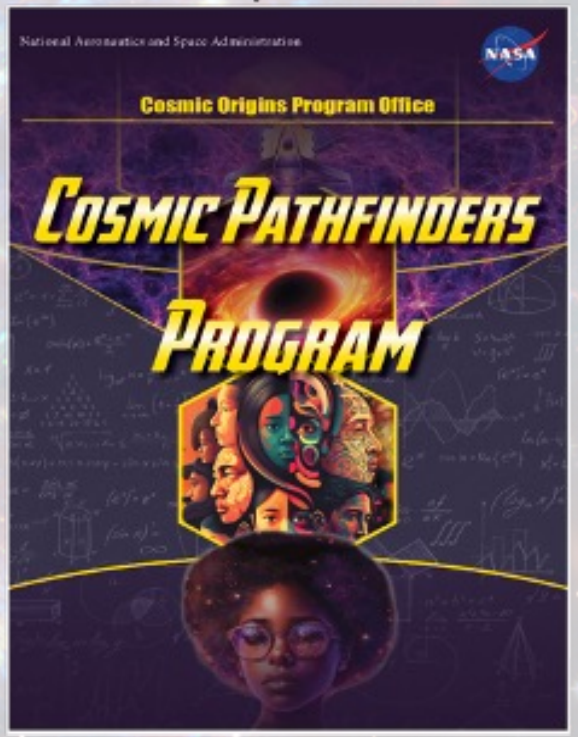
**Directed by Ronald Gamble, NASA/GSFC/UMCP**

**Current student leadership includes:**

- **Amethyst Barnes (NASA GSFC/CRESST-II Post-Bac, Roman/STScI)**
- **Jordan Forman (NASA GSFC/CRESST-II Post-Bac, FERMI)**
- **Gokul Srinivasaragavan (Doctoral Candidate, UMCP Department of Astronomy)**
- **Isiah Holt (NASA Pathways Intern & Doctoral Candidate, UMCP Department of Astronomy)**

- **Cosmic Chatter**
  - **Career Roadmap Discussion — Career pathways for Missions**
  - **Science Communication Panel — Communication**
  - **(~12) Student Presentations [March - June] — Engagement**
- **Hack-a-thons**
  - **JWST, XRISM, COSI…Roman (?), HWO (?), LISA (?) , along with the potential to extend to many others.**
- **Professional Societies/ Conference Participation & Sessions**
  - **AAS, APS, NSBP, SACNAS, NSBE, SPIE, Great Minds in STEM**
- **University Chapters**

**Current student membership across the Cosmic Pathfinders footprint has eclipsed ~500 students & Early-Careers**



https://pcos.gsfc.nasa.gov

Site QR Code:


Mailing List QR Code:

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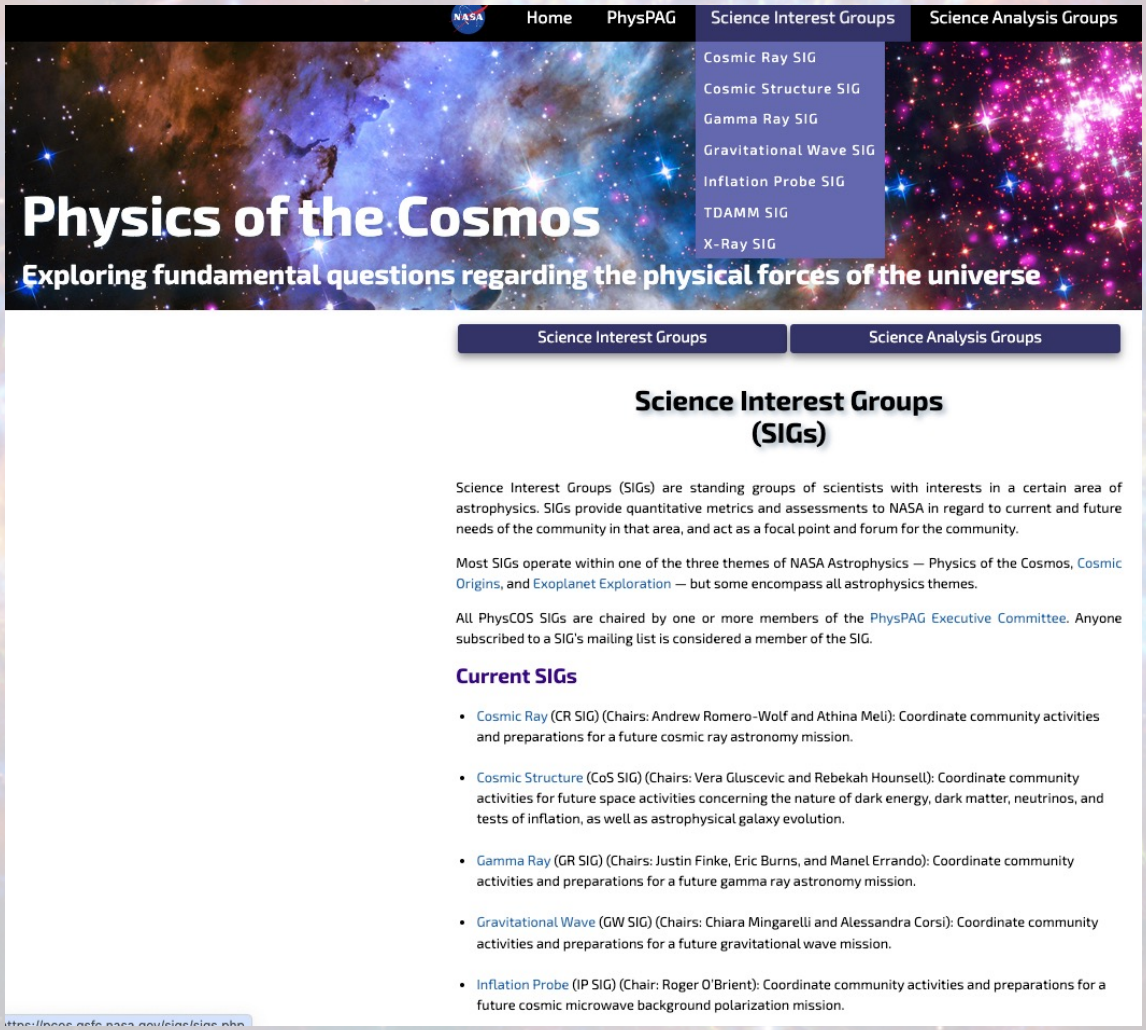


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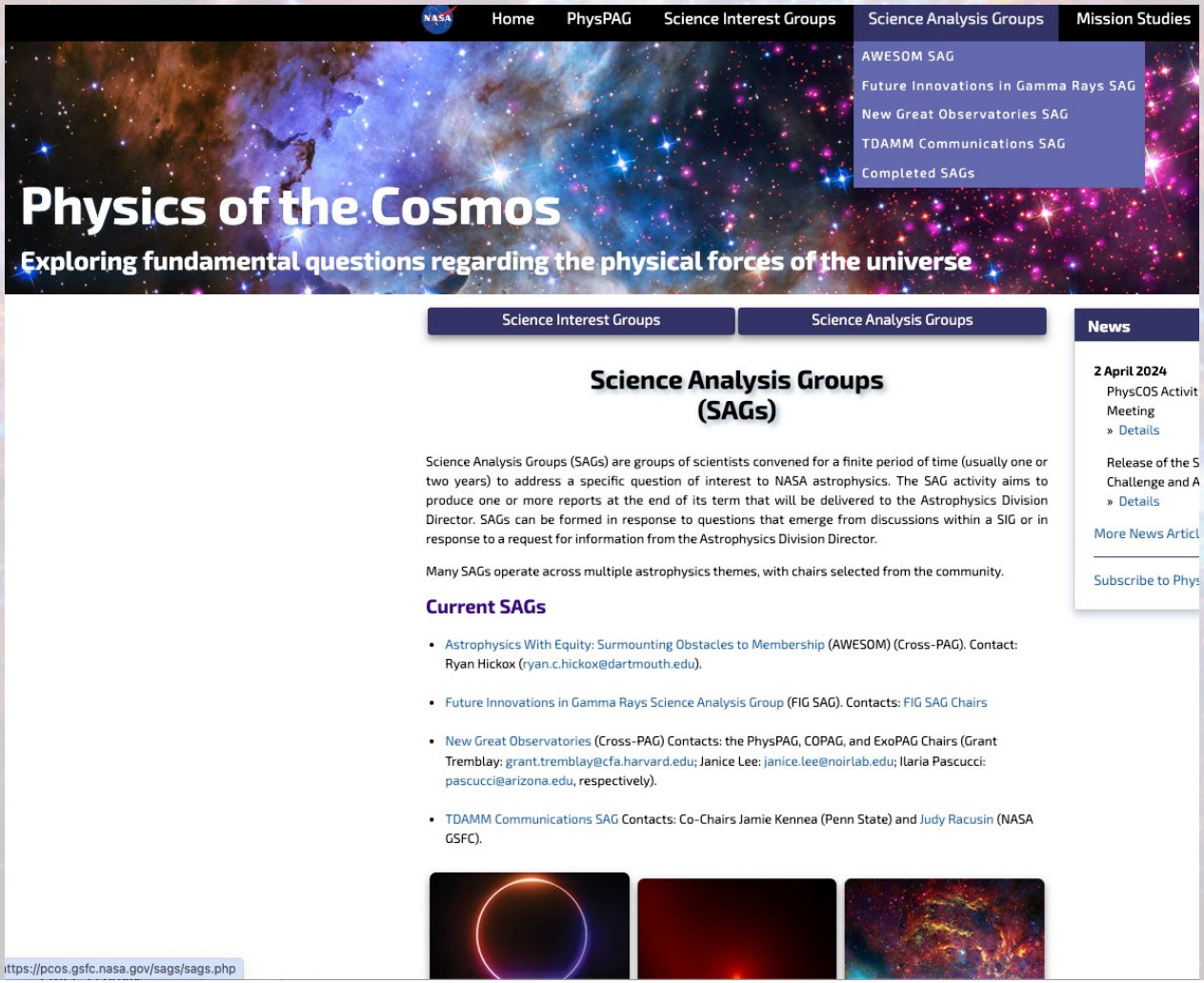


# Summary & How to Get Involved

- Sign up for PhysPAG mailing list and join any Science Interest Groups that are related to your interests.
- Sign up for Cosmic Pathfinders and keep an eye out for upcoming events!

Site QR Code:

**Upcoming PhysPAG events:**

- CR SIG virtual forum on future of Ultra High Energy Cosmic Rays –Frank Schroeder, U. Delaware (Monday, October 7th, 1-2pm).
- Early Career Workshop: November 19-21, 1-4pm (virtual), with talks and discussions on science, missions, and careers

**If you're attending Winter AAS (National Harbor, MD):**

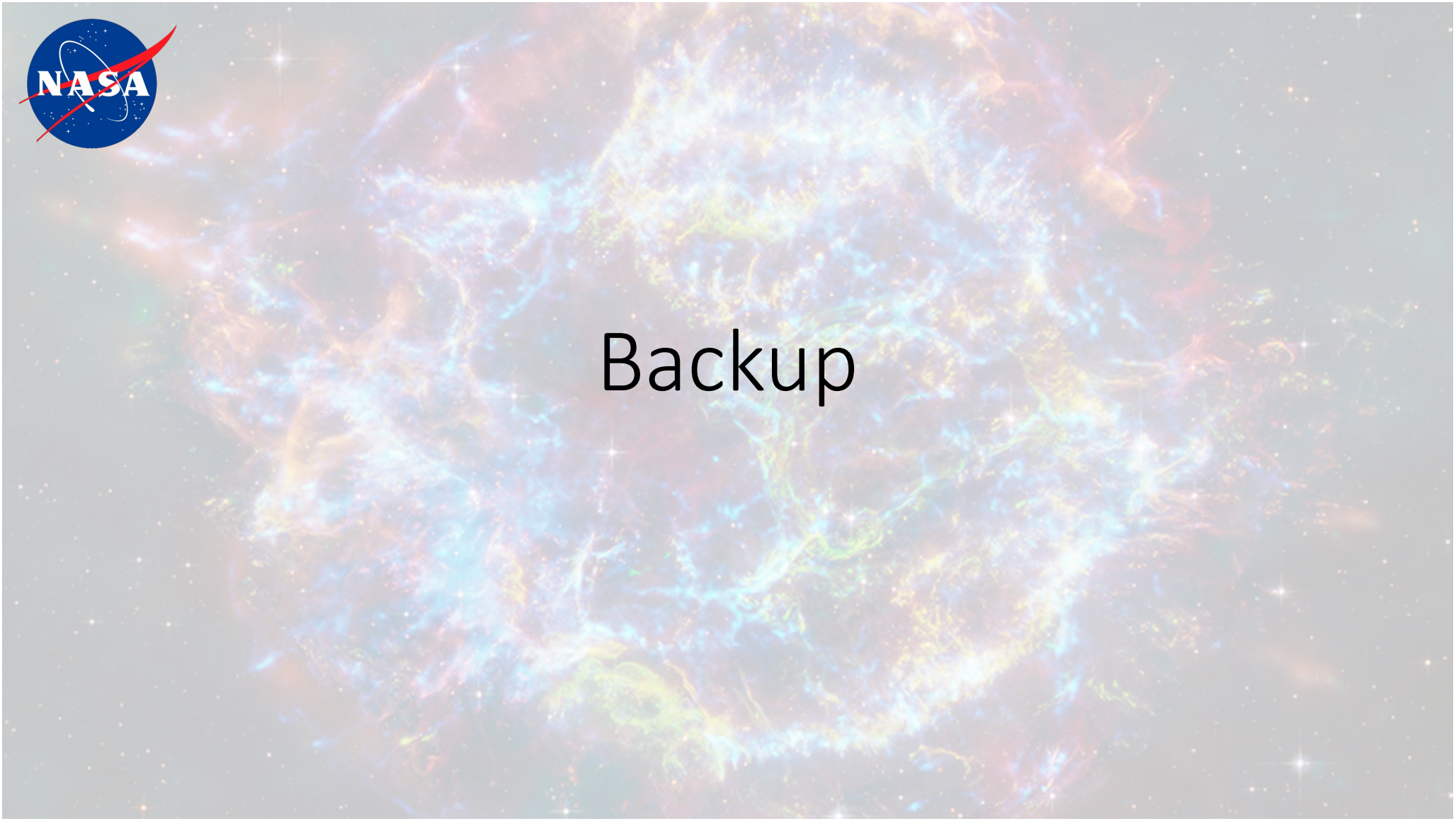
- Come to the PhysPAG session on Sunday, January 12th to see the breadth of activities going on.
- Look out for the Cosmic Pathfinders, FIG SAG, AWESOM SAG and NGO SAG splinter sessions.

Mailing List QR Code:

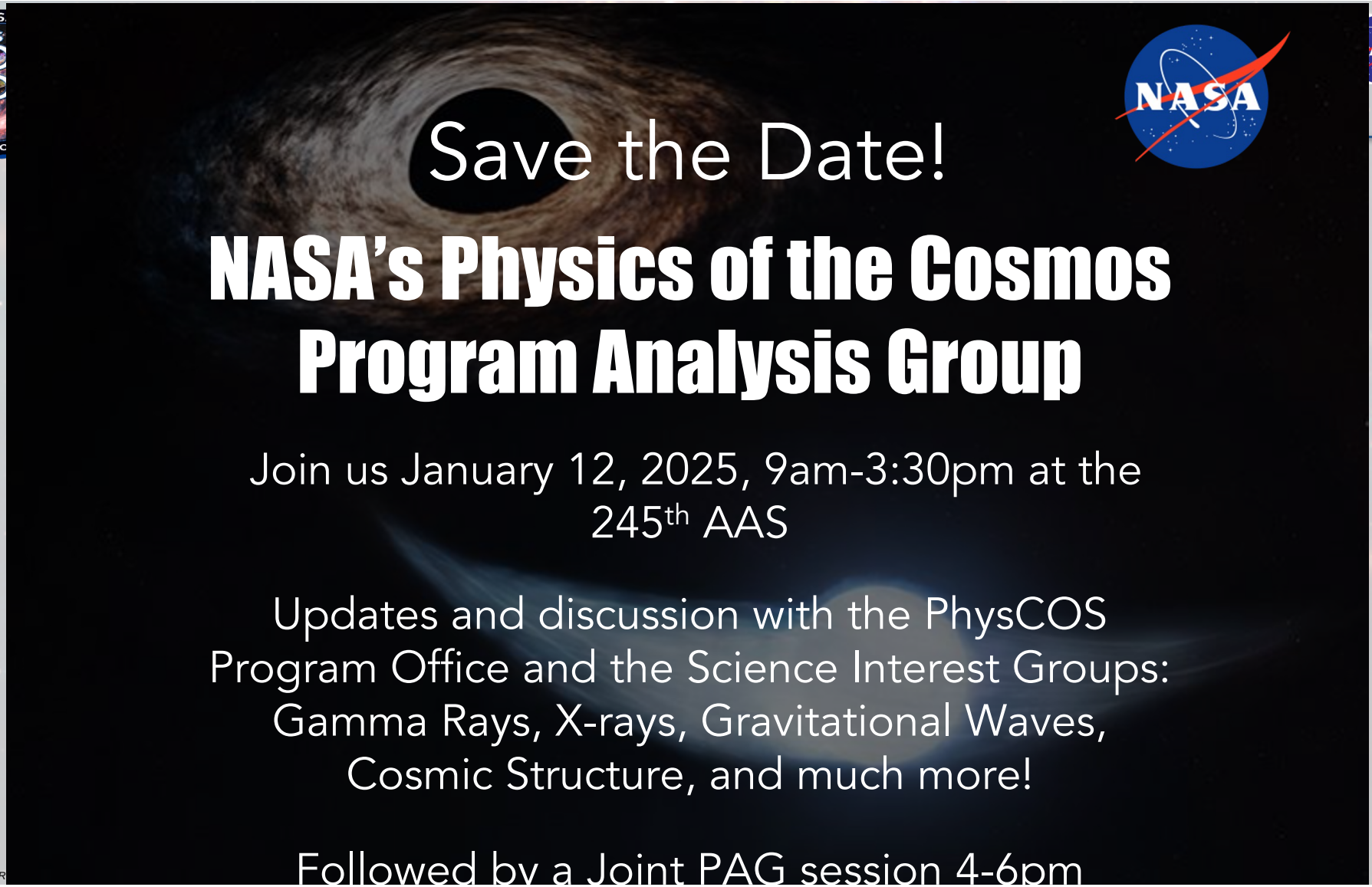
Brian Humensky
brian.Humensky@nasa.gov

# THANK YOU!

Francesca Civano
francesca.m.civano@nasa.gov




# Backup


Save the Date!
NASA's Physics of the Cosmos Program Analysis Group
Join us January 12, 2025, 9am-3:30pm at the 245th AAS
Updates and discussion with the PhysCOS Program Office and the Science Interest Groups: Gamma Rays, X-rays, Gravitational Waves, Cosmic Structure, and much more!
Followed by a Joint PAG session 4-6pm

# Strategic Technology Development

The Program Office

- Monitors and manages PhysCOS and COR Strategic Astrophysics Technology (SAT), Internal Scientist Funding Model (ISFM), Roman Technology Fellowships (RTF) and other direct-funded technologies;
- Focuses on Astro2020-related technology development (FGOs, Probes); and
- Conducts Technological Readiness Level (TRL) assessments.

- PhysCOS/COR Technology Website https://apd440.gsfc.nasa.gov/technology.html
  - Program Overview, Tech Gaps, Technology Photo Gallery, Publications
- AstroTech Database http://www.AstroStrategicTech.us/
  - Published PI Annual Reports 2023
- Astrophysics Biennial Technology Report (ABTR) 2024 & Astrophysics Technology Update (ATU)

# Compiling Science Gaps

**GOAL:** produce a list of precursor and preparatory science gaps for PhysCOS-related science as a resource for the community

- Precursor Science informs the mission architecture and trades
  - Needed soon for HWO and over coming years for X-ray/FIR future great observatories
  - Looking for natural gaps, thresholds, and gradients in the science return vs. measurement parameters
- Preparatory Science informs data / interpretation or early operations; potentially from new observations, but needed just before or soon after launch to help inform the best way to conduct investigation
- Started a process similar to the Technology Gaps process:
  - Science Gaps site with link to google form for submissions
  - Next steps: (1) review and iteration by SIGs and program office; (2) review by HQ; (3) Publish the list on PhysCOS website; (4) annually/biennially update the list