



National Aeronautics and
Space Administration

NASA Astrophysics Update

Town Hall, October 23, 2024

Dr. Mark Clampin

Director, NASA's Astrophysics Division

Science Mission Directorate



Science Mission Directorate
ASTROPHYSICS
 Organizational Chart

Legend
 C - Contractor
 D - Detailee
 IPA - Intergovernmental Personnel
 Act Detail Program Scientist

DIVISION MANAGEMENT



Dr. Mark Clampin
 Director



Sandra Cauffman
 Deputy Director

ADMINISTRATIVE SUPPORT
 Jennifer Baker (C), Balam "Orby" Yaxkin (C), James Jackson(C)

DIVISION LIAISONS

Resource Management Elijah Owuor (Lead) Jenna Robinson (Detail) Jennifer Holt	Policy Mariah Baker
Communications Alise Fisher	OIIR Peyton Blackstock
	Program Support Specialist Paola Ortiz Perez

CROSS CUTTING

Technologist
 Mario Perez (Chief)
 Dominic Benford (Deputy)

Executive Officer
 Rhiannon Roberts (C)

Science Activation Lead
 Hashima Hasan

APD Communications
 Liz Landau (C - OCOMM Liaison)
 Julie Stoltz (C - Strategic Communications)

Inclusion, Diversity, Equity, and Accessibility
 David Morris (Lead)
 Antonino Cucchiara (Deputy)

FLIGHT PROGRAMS

Associate Director
 Joe Smith

PROGRAM EXECUTIVES

Rosa Avalos-Warren
 Rachele Cocks
 Lucien Cox
 Julie Crooke
 Ed Griego
 Shahid Habib
 Janet Letchworth
 Lucas Paganini
 Miles Skow
 Mark Sistilli

RESEARCH & ANALYSIS

Associate Director
 Eric Smith

R&A Lead
 Roopesh Ojha

PROGRAM SCIENTISTS

Alessandra Aloisi (D)	Hannah Jang-Condell
Megan Ansdell	Patricia Knezek
Dominic Benford	David Morris
Valerie Connaughton	Roopesh Ojha
Antonino Cucchiara (C)	Pablo Saz Parkinson (IPA)
Doris Daou	Joshua Pepper (IPA)
Michael Garcia (D)	Mario Perez
Thomas Hams (IPA)	Linda Sparke
Hashima Hasan	Sanaz Vahidinia
Stefan Immler	John Wisniewski

RESEARCH PROGRAM SPECIALIST
 Ingrid Farrell (C)

ASTROPHYSICS STRATEGIC MISSIONS

Program Director
 Sandra Cauffman

Program Manager
 Garth Henning

PROGRAM EXECUTIVES

Ed Griego
 Lucas Paganini
 Miles Skow

PROGRAM SUPPORT
 Tony Comberiate (C), Andre Davis (C)

APD Changes 2024



Tahani Amer
Associate Director
Flight Programs



Joshua Diaz Calo
Sr. Project Support
Specialist



Stefan Immler
Scientist Supervisor
Returned from OMB detail



Joe Smith
Associate Director
Flight Programs
Returned from detail



Pablo Saz Parkinson
Program Scientist
XMM, Pioneers, TDAMM,
ADAP



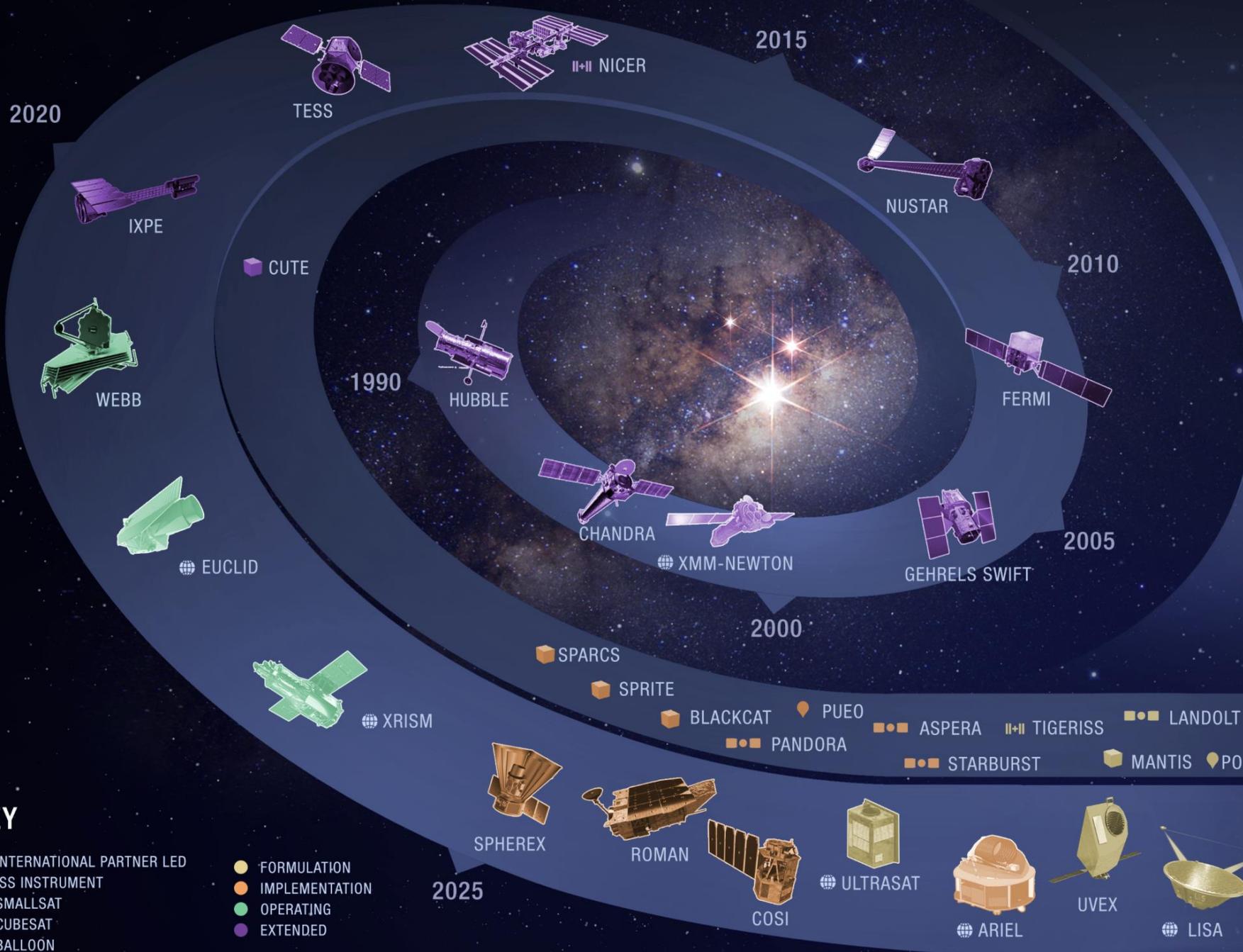
James Jackson
Sr. Project Support
Specialist

APD →

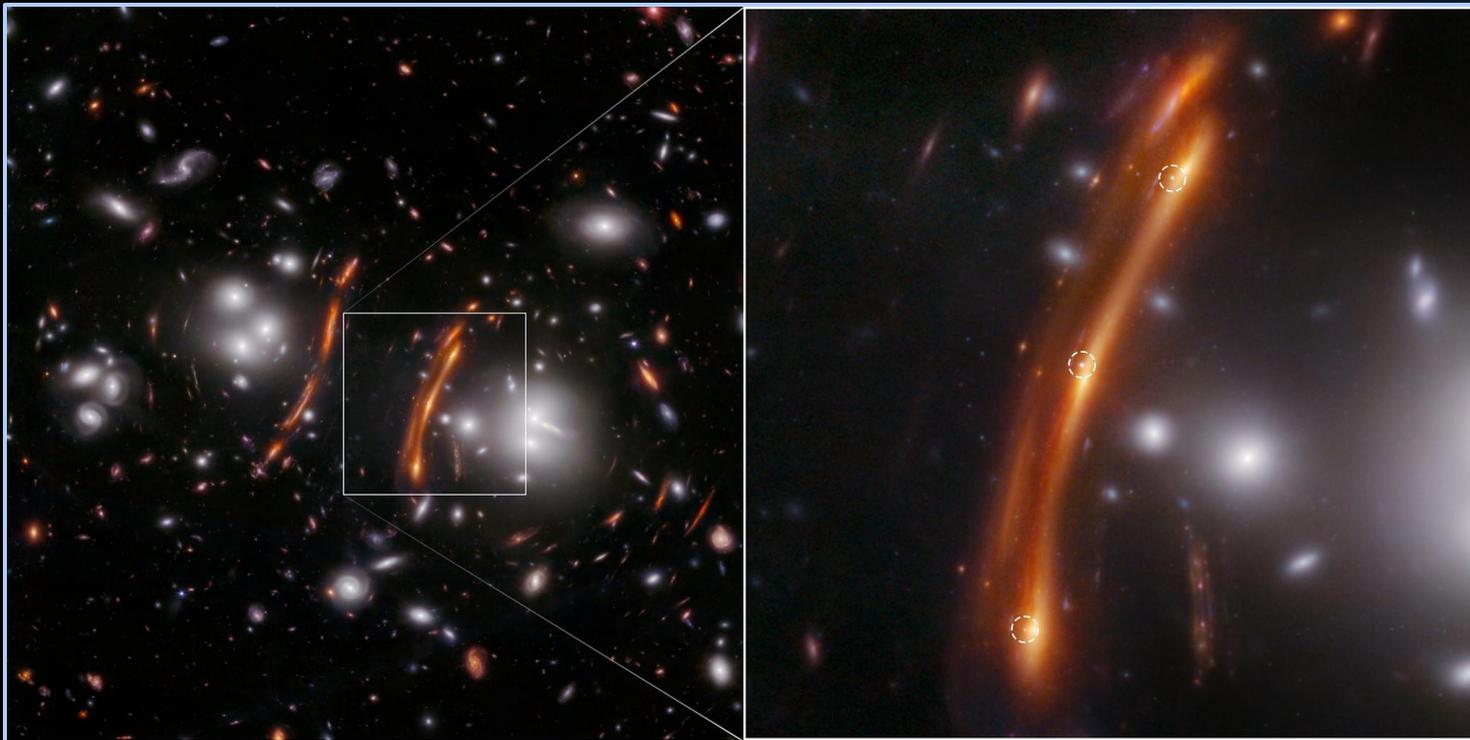
→ APD



ASTROPHYSICS FLEET



Webb: Lensed Supernova Confirms Hubble Tension



- Webb is measuring the expansion of the universe, by observing a gravitationally lensed supernova SN H0pe.
 - Supernova H0pe was discovered when scientists saw three points of light in a Webb image of a galaxy cluster that were not present in the Hubble data.
 - Having “trifold” images of this supernova allow scientists to use the time delays, its distance, and the gravitational lensing properties to calculate a value for the Hubble constant: the rate at which the universe is expanding.

Credit: NASA, ESA, CSA, STScI, B. Frye (University of Arizona), R. Windhorst (Arizona State University), S. Cohen (Arizona State University), J. D’Silva (University of Western Australia, Perth), A. Koekemoer (Space Telescope Science Institute), J. Summers (Arizona State University).

Astrophysics Priorities

Explore/Innovate/Partner/Inspire

- Maintain a **balanced portfolio** during this decade and the next, by balancing investments in missions under development and future missions, against funding for large missions in extended science operations.
- Investment to advance the Astro2020 Decadal Priorities, including technology maturation for the **Habitable Worlds Observatory**, selection of an **Astrophysics Probe** mission and Time Domain and Multi-Messenger astrophysics.
- Ensure successful completion of the **Roman Space Telescope**, within the Agency commitment
- Protect international **partnerships** such as the Laser Interferometer Space Antenna (LISA)

Astrophysics Division Budget Outlook

- Currently on Continuing Resolution until Dec 20th
- Key decisions on HST/Chandra have been suspended pending full FY25 appropriation
 - No further steps forward with Chandra or Hubble
 - Holding over implementation of OPCR findings
 - Tabled discussion of other Chandra/HST options such as archival proposal options
- FY26 & beyond are embargoed pending President's Budget for FY26

FY25 Senior Review of Operating Missions

The 2025 Senior Review includes the following missions:

Chandra	Hubble
Fermi	NuStar
IXPE	TESS
Swift	XMM Newton

**NICER is excluded, and will be reviewed after a planned repair in Nov 2024*

Timeline

- August 5, 2024: FY25 Astrophysics Senior Review Final Call for Proposals
- December 12, 2024: Senior Review final proposals due

Strategy

- Schedule designed to provide recommendations for input to FY26 Budget process
- Proposals are being prepared using FY25 President's Budget Request
- A single panel will review all the proposals together
- OPCR findings will be provided to the review committee

Nancy Grace Roman Space Telescope

Science

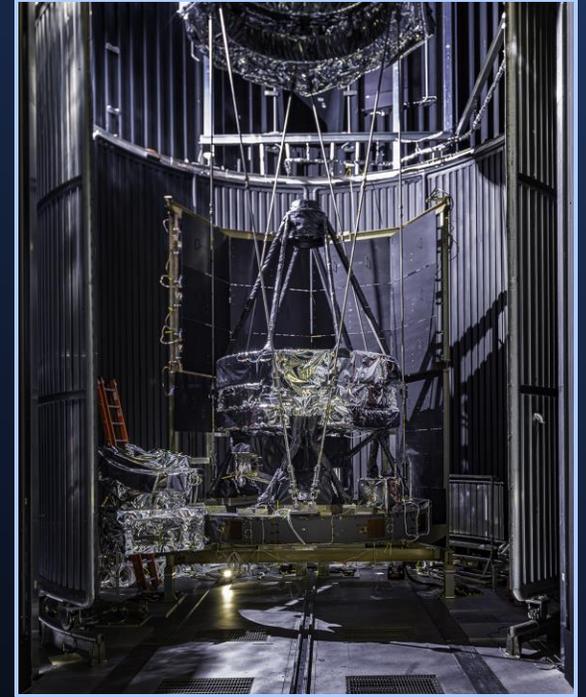
- Using a wide field instrument, Roman will conduct a survey to study dark energy, dark matter, and exoplanet systems.

Status

- Roman instruments, the Widefield Instrument (WFI) and the Coronagraph Instrument (CGI), are complete, tested, and ready for integration at GSFC.
- The telescope's thermal vacuum (TVAC) testing completed.
- Systems Integration Review completed in Sept. 2024 with a pass.
- Amended solicitation for Roman preparatory work to be released shortly.
- Office of the Inspector General's review of Roman was positive
- The project remains on cost and schedule with a launch NET May 2027.

Upcoming Milestones

- January 2025: Key Decision Point (KDP) D marks the start of Phase D.
- September 2026: KDP-E and Launch Readiness Review (LRR)



*Imaging Optical Assembly (IOA) in L3 Chamber A
Copyright © 2024 L3Harris Technologies Inc.*



Roman's spacecraft bus in GSFC's clean room. Credit: NASA/Chris Gunn

Roman Instruments

- CGI was delivered to GSFC on May 19th, meeting performance requirements in both the Hybrid-Lyot and Shaped Pupil modes. After communications testing, CGI is ready for integration.
- WFI, delivered on August 7th, has completed final closeouts and is ready for integration into the Integrated Payload Assembly (IPA).



The Wide Field Instrument upon delivery to the clean room at NASA GSFC



The Coronagraph Instrument, Roman's Technology Demonstration

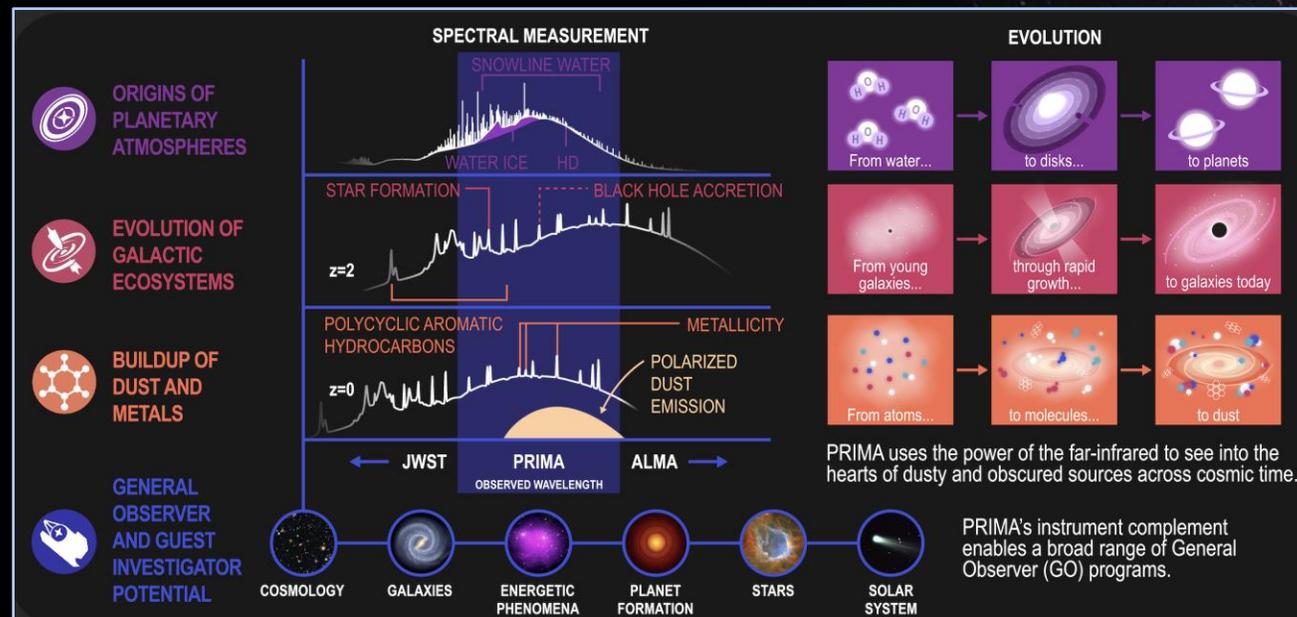
Astrophysics Probe Explorers (APEX)

- Astrophysics Probe Announcement of Opportunity (AO) proposals
 - Selections of Phase A studies was made October 2024
- Concept study reports due: Q4 CY 2025
- Down-selection: Q2 CY 2026
- AO-Required Launch Readiness Date: NLT July 2032

PRIMA

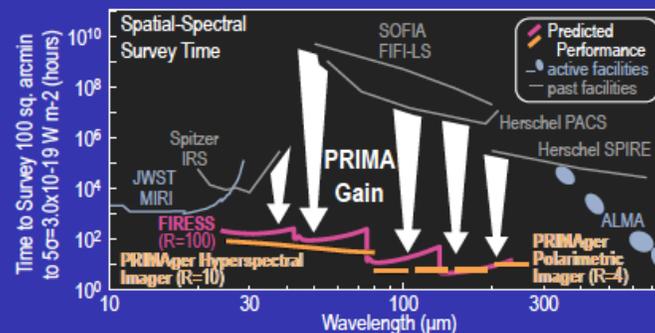


- PI: Jason Glenn, Goddard Space Flight Center
- PRIMA has two instruments.
 - *FIRESS* is a multimode spectrometer with a bandpass of 24-235 μm at $R > 85$ & a high resolution mode of $R > 2000$ over the whole band and 4400 at 112 μm .
 - *PRIMAger* is a hyperspectral imager from 28-84 μm with $R=10$ & polarimetric imaging in 4 bands from 80-261 μm .



GENERAL OBSERVER SCIENCE

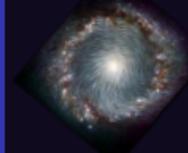
PRIMA's 3-5 orders of magnitude gain in spectral mapping speed unlocks science discovery space between JWST and ALMA. With 75% of observing time dedicated to GO science, PRIMA can obtain spectra of hundreds more protoplanetary disks, young stars, and distant galaxies than Herschel.



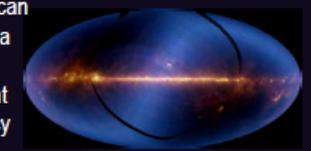
In 1200 hours: PRIMA can measure the D/H isotopic ratio of water in a statistically-significant sample of solar system comets - a key constraint to the origin of water on Earth



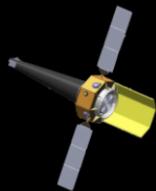
In 100 hours: PRIMA can map magnetic fields in the diffuse gas of local galaxies, revealing their role in how star forming clouds are born.



In 5000 hours: PRIMA can survey the entire sky to a sensitivity 100x deeper than IRAS and Akari that would engender a legacy of discovery.



AXIS



- PI: Christopher Reynolds, University of Maryland
- AXIS is a high spatial resolution (<math><1.5''</math> Half Power Diameter) X-ray imaging observatory with a 0.3-10 keV bandpass and 24 arcmin diameter field of view. It has an effective area FOV- average of 3600 cm^2 (1keV) and 570 cm^2 (6keV).

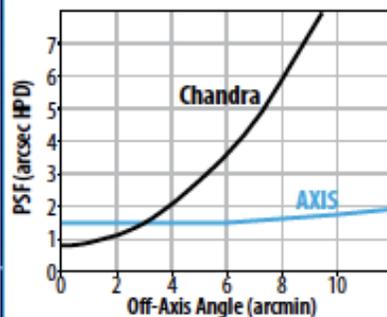
AXIS is a huge leap forward

AXIS vs Chandra

- 5-10x larger effective area
- 6x better FoV-ave PSF

AXIS vs XMM-Newton

- 4x larger area below 2 keV
- 10x better PSF



AXIS has 70x the survey grasp (FoV x area) at $1.6''$ than Chandra

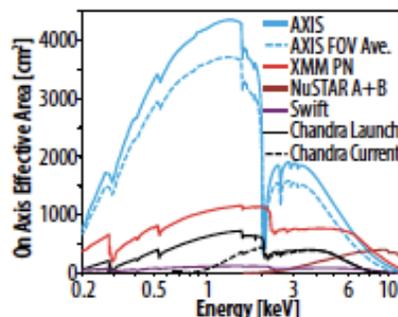
enabling surveys that probe further, wider, and faster

AXIS vs Swift

- Same fast ToO Response Time
- 60x better sensitivity

AXIS vs NuSTAR

- Superior area below 8 keV
- 40x better PSF



AXIS answers the big questions posed by the Astro2020 Decadal Survey

AXIS Deep Extragalactic Survey

The AXIS Science Pillars

Astro 2020 asks...

Why X-rays?

...AXIS answers

Why AXIS?

Pillar 1: "What seeds supermassive black holes and how do they grow?"

AXIS determines the origin of massive black holes
X-rays identify clean census of black holes in distant JWST galaxies
AXIS' PSF and large area enable imaging of distant, faint sources

Pillar 2: "How do gas, metals, and dust flow into, through, and out of galaxies?"

AXIS shows how supernovae and AGN transform galaxies
X-rays uniquely probe the million-degree gas that drives gas flows
High contrast imaging separates diffuse gas and bright sources

Pillar 3: "What powers the diversity of explosive phenomena across the electromagnetic spectrum?"

AXIS discovers explosive transients both near and distant
X-rays uniquely encode information on transient progenitors
AXIS enables transient alerts, TDAMM surveys and fast followup

The Extragalactic Surveys will find >20,000 AGN over cosmic time, >50x more than the Chandra Deep Field.

The Galactic Plane Survey will discover >1M new sources in crowded fields, 10x deeper and 5x wider than current best X-ray surveys.

AXIS is the Probe for the entire astronomical community

AXIS offers >68 Ms over 5 years to General Observers for investigations beyond what we can even imagine in 2023

AXIS sensitivity and spatial & spectral resolution impacts broad range of astrophysics, from photoevaporation of exoplanet atmospheres to X-ray reionization of the high- z Universe

AXIS' Transient Alert Monitor alerts the community in 10 minutes, and rapid response allows for a powerful GO Target of Opportunity program that addresses TDAMM charge by Astro2020



SPHEREx

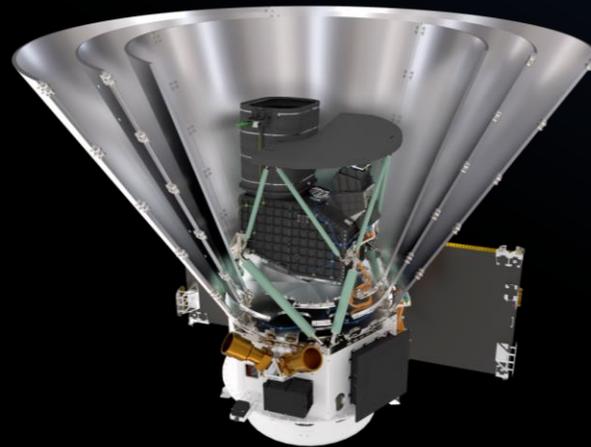
SPHEREx will map entire sky in near-infrared light to study the origin of stars, galaxies, and the chemical composition of the universe.

Status:

- Reaction wheels have been reworked, re-integrated into the spacecraft and are currently undergoing regression testing.
- Maintaining schedule towards LRD

Upcoming milestones

- December 10-12, 2024: ORR
- February 4, 2024: KDP-E
- LRD: April 2025



SPHEREx observatory being lifted and installed onto the vibration table, in the Z-axis configuration, at BAE Systems in Boulder CO in early August 2024.

COSI

The Compton Spectrometer and Imager

Science

- Source of 511 keV γ -ray lines, the signature of positron annihilation
- Reveal galactic element formation
- Insight into extreme environments with polarization
- Probe the physics of multi-messenger events

Status

- The second of 16 flight germanium detectors successfully was completed (current schedule calls for all 16 flight detectors completion by mid-2025).
- SpaceX Falcon 9 selected as the COSI LV in July 2024.

Upcoming Milestones

- December 4-6, 2024: COSI CDR at Northrup Grumman (Dulles, VA)
- August 2026: SIR
- September 2026: KDP-D
- August 27, 2027: LRD



LISA

Laser Interferometer Space Antenna

Status

- January 25, 2024: ESA adopted the mission and is now in a process to finalize the industrial contractor for the construction and integration of the spacecraft.
- August 1, 2024: NASA established a project office at GSFC.
- NASA is providing key technological subsystems such as lasers, telescope and charge management devices for the 3-spacecraft constellation.
- NASA technologies have now mostly achieved TRL 5 stage after a significant investment in resources with plans to achieve TRL6 for all technologies by Mission PDR.
- NASA plans to initiate a production of multiple copies of these technologies after a successful completion of KDP-B milestone review in March 2025.
- ESA with the help of NASA has established a formal science team where NASA has one third membership

Upcoming Milestones

- January 2025: NASA Systems Requirement Review
- March 2024: NASA KDP-B - March 2025



EDU1 being inspected at GSFC after delivery from L3Harris

CubeSats, SmallSats, Balloons and ISS Payloads

- Pandora (SmallSat): Multiwavelength Characterization of Exoplanets and their Host Stars
 - Launch date: 09/2025
 - Completed flight integration of the Near-Infrared Detector Assembly (NIRDA) detector. The payload electronics module (PEM) was assembled and tested. The flight cryocooler electronics (CCE) were received and verified.
- PUEO (Balloon): A Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies
 - Launch date: 12/2025 in Antarctica
 - All flight antennas have been tested. Completed RF chain thermal test.
- Aspera (SmallSat): IGM Inflow/outflow from galaxies via OVI 10^5K emission line imaging
 - Launch date: 02/2026
 - CDR dPMP occurred on 07/22/2024, approval is pending open actions from dPMP.
- StarBurst (SmallSat): Gamma-ray ASM, Simultaneous detection of NS/NS mergers with LIGO
 - Launch date: ~Mid 2027
 - CDR dPMP planning is underway. The Integration & Testing facility has been identified, TVAC and vibration testing facilities costs are within expectations.

CubeSats, SmallSats, Balloons and ISS Payloads

- TIGERISS (ISS): Measuring ultra-heavy (r-process) cosmic rays on ISS
 - Launch date: 02/2027
 - SRR/MDR dPMP took place on 8/27/24 at HQ. APD formally submitted ISS location request to SMD/DAAP on 08/27.
 - Submitted the TIGERISS overview to the ISS POC. ISS Payload Integration Manager (PIM) assignment has been requested from ISS.
- Landolt (SmallSat): Absolute stellar photometry to $<0.5\%$, PI Peter Plavchan, George Mason University
 - Launch date: 2028
 - Interagency Agreement (IAA) process in underway.
- POEMM (Balloon): High resolution FIR tomography of protoplanetary disks, PI Gordon Stacey, Cornell
 - Launch 12/2029 from Antarctica (TBD)
 - Start date TBD

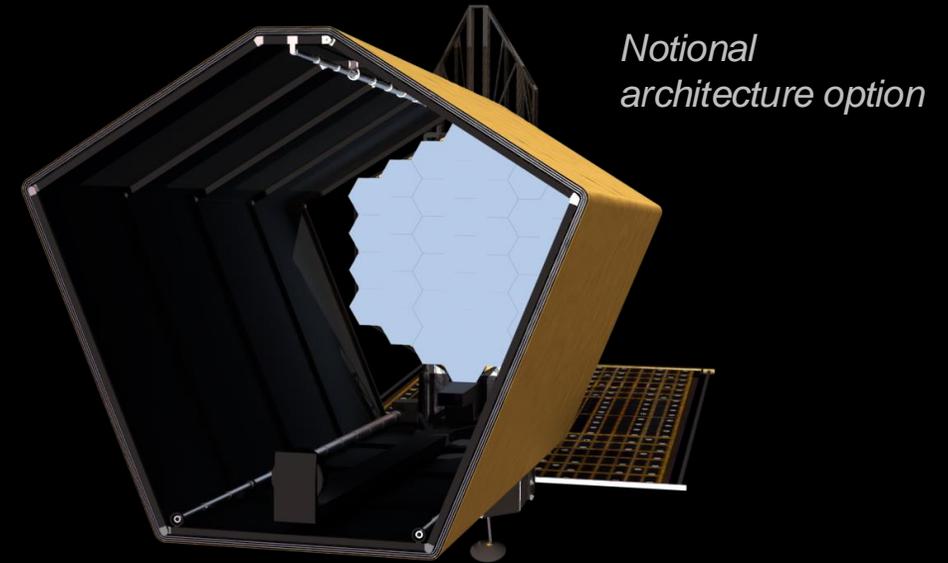
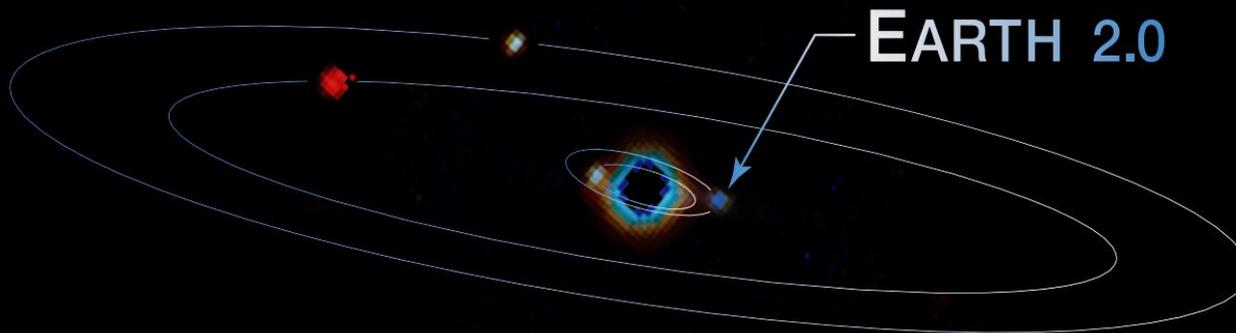
Time-Domain Multimessenger Astrophysics (TDAMM)

- **October 3, 2024:** The international agency TDAMM working group met for the 3rd time with representatives from 3 US funding agencies and 11 countries discussing recently-launched missions and progress on coordinating TDAMM activities between space and ground observatories.
- The 3rd TDAMM workshop was held at Louisiana State University, sponsored by LSU, NASA, DoE and NSF, to discuss multidisciplinary science enabled through TDAMM observations, and the facilities and infrastructure needed to maximize scientific return. A White Paper will be written for consideration by the Agencies by year end.
- The 4th TDAMM workshop will be held in Fall '25, hosted by NASA's Physics of the Cosmos TDAMM pilot initiative, ACROSS. This workshop will develop community-driven coordinated observation plans for space and ground facilities based on specific TDAMM science cases.

Habitable Worlds Observatory (HWO)

First telescope designed specifically to search for signs of life on planets outside our solar system

First telescope designed to search for **signs of life** on planets outside our solar system



Large-aperture UV / Optical / NIR observatory performing **transformative astrophysics**

FY24 Appropriations for HWO

Habitable Worlds Observatory

The Senate Report language regarding “Habitable Worlds Observatory” is adopted and the agreement provides no less than \$10,000,000 for the mission. In addition, the agreement directs NASA to establish a Habitable Worlds Observatory project office at Goddard Space Flight Center to leverage expertise in astrophysics and segmented mirror technology.

Senate Report Language - Habitable Worlds Observatory

The Committee supports the Great Observatory Maturation Program (GOMAP) as recommended by the Decadal Survey on Astronomy and Astrophysics, “Pathways to Discovery in Astronomy and Astrophysics for the 2020s” [Astro2020]. GOMAP will mature science and technologies needed for future flagship missions starting with the Habitable Worlds Observatory to observe habitable exoplanets. In order to cement continued American leadership in astronomy, the Committee provides the requested level for GOMAP to implement the Astro2020 recommendations. NASA is encouraged to articulate funding for GOMAP separately in future budget requests.

Recent Achievements

- **May 31:** ROSES grants awarded to 3 industry partners to develop HWO technologies.
- **August 1:** Established the HWO Technology Maturation Project Office (HWO TMPO) in response to direction from Congress
- **August 12:** HWO participation in NASA MOSAICS Program: New York Institute of Technology's Mechanical Engineering Department and Physics Department were selected for 2 MOSAIC awards. With mentors at GSFC.
- **August:** Boston Micromachines Corporation (BMC), ALPAO, and AOX will study how to build 96x96 deformable mirrors (DMs) for JPL, report coming March 2025.
- **October 8:** Splinter Session at DPS on HWO's status and mission planning, and HWO's potential for studying solar system bodies including icy worlds, giant planets, small bodies, etc.

Upcoming Events and Milestones

- **HWO Fall F2F (Oct. 22-24):** Hosted in Rochester, NY, with tours of L3Harris. HWO TMPO updates including science, systems engineering, modeling, mentorship, technology, and look-ahead schedule.
- **Winter AAS (Jan. 2025):** 90-min special session on HWO progress and current activities. 4-hour splinter session discussing Working Group science cases, including future science teams and Working Group status and plans forward.

HWO Technology Development

- The HWO Technology Plan is organized along three *tracks*:
 - Coronagraph System Technologies (CST)
 - Ultra-stable Telescope System Technologies (UTST)
 - High-sensitivity UV and Instrument Technologies (HUVIT)
- Gaps will be classified as one of the following:
 - **Technology Gap:** An element for which the required function/performance, form, fit, environment, or interface is novel or not bounded by existing demonstration.
 - **Engineering Gap:** An element for which the required function/performance is bounded by existing demonstration, but not necessarily in the same form, fit, environment, or interface as needed for HWO.
 - **Modeling / Testbed / Facility Gap:** A capability needed to support the development or modeling of a critical technology element or improve the manufacturability, testability, yield, or reliability of an element.



WORKSHOP
**Emerging Technologies for
Astrophysics Missions**

March 25-27, 2025
NASA Ames Conference Center
Mountain View, CA

More details to come in Fall 2024



Summary

- Astrophysics seeks to maintain a **balanced portfolio** during this decade and the next, by balancing investments in missions under development and future missions, against funding for large missions in extended science operations.
- Senior Review is in progress and timed to provide input to next year's budget process
- Decisions on Chandra and Hubble are suspended pending FY25 appropriations
- Two Astrophysics Probe Explorer (APEX) missions have been downselected for Phase A study
- Habitable Worlds Observatory has formed a Project Office at the Goddard Space Flight Center

The image is a composite of various astronomical phenomena. In the center, a circular inset with a white border shows a colorful, multi-layered galaxy with a blue-green core and reddish outer rings. The background is a collage of other galaxies and nebulae, including a blue and purple nebula on the left, a reddish and white nebula at the top, and a blue and purple galaxy on the right. The word "QUESTIONS?" is written in white, bold, sans-serif capital letters across the center of the circular inset.

QUESTIONS?



THANK YOU!