



National Aeronautics and  
Space Administration

# NASA Astrophysics Update

Dr. Mark Clampin

Director, Astrophysics Division

NASA Science Mission Directorate

March 20, 2024





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), Pamela King-Williams (C)

**DIVISION LIAISONS**

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

**CROSS CUTTING**

**Technologist**  
 Mario Perez (Chief)  
 Omid Noroozian (Deputy)

**Executive Officer**  
 Rhiannon Roberts (C)

**APD Communications**  
 Liz Landau (C - OCOMM Liaison)  
 Julie Stoltz (C - Strategic Integration & Engagement Lead)

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

**FLIGHT PROGRAMS**

**Associate Director**  
 Tahani Amer (D)

**PROGRAM EXECUTIVES**

Rosa Avalos-Warren  
 Rachele Cocks  
 Lucien Cox  
 Julie Croke  
 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)	Joshua Pepper (IPA)
Doris Daou	Mario Perez
Michael Garcia (D)	Linda Sparke
Thomas Hams (C)	Sanaz Vahidinia
Hashima Hasan	John Wisniewski
Stefan Immler	

**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)



**Sandra Cauffman**  
Program Director

The **ASTROPHYSICS STRATEGIC MISSIONS PROGRAM** develops, launches, and operates large strategic observatories in accordance with NASA's goals to understand the universe and our place in it.



**Garth Henning**  
Program Manager



**Ed Griego**  
Program Executive



**Lucas Paganini**  
Program Executive



**Miles Skow**  
Program Executive

## FLIGHT PROGRAMS



**Tahani Amer**  
Associate Director (Acting)

**PROGRAM EXECUTIVES** represent the mission for "up and out" HQ-level activities by tracking and reporting objectively on the status, risk, and issues; advocate for the mission within SMD; manage and coordinate communication among project, stakeholder, and community members.



**Rosa Avalos-Warren**  
Pioneers, MidEx



**Rachele Cocks**  
MidEx, TDAMM



**Lucien Cox**  
GUSTO, SOFIA, COSI,  
Balloons



**Julie Crooke**  
GOMAP



**Ed Griego**  
Roman, CGI



**Shahid Habib**  
Ultrasat, LISA, Athena,  
Ariel/CASE, PhysCOS &  
COR



**Janet Letchworth**  
Operating missions,  
Sr. Review



**Lucas Paganini**  
Roman, CGI, ExEP



**Miles Skow**  
Roman, CGI, ASMP



**Mark Sistilli**  
SPHEREx, COSI,  
Probes, Explorers



RESEARCH & ANALYSIS



**Eric Smith**  
Associate Director



**Roopesh Ojha**  
R&A Lead

**PROGRAM SCIENTISTS** are the senior NASA Scientists responsible for the science content of an SMD Science investigation. They ensure that the science NASA selects is the science NASA gets and advocates at HQ for the science of the mission.



**Alessandra Aloisi**  
Data Lead



**Megan Ansdell**  
GOMAP



**Dominic Benford**  
Roman, APRA



**Valerie Connaughton**  
HEA Portfolio, PhysCOS, TDAMM



**Antonino Cucchiara**  
Fermi, FINESST, NHFP, Bridge Program, TDAMM



**Doris Daou**  
Euclid, NEO Surveyor, New Horizons, Precursor, EPRV, ADAP Deputy



**Michael Garcia**  
Hubble, Pioneers, CubeSats, UVOIR Portfolio, Sounding Rockets Deputy



**Thomas Hams**  
GUSTO, LISA, Balloons, Sounding Rockets, Particle Astro, Funda Phys, IR portfolio



**Hashima Hasan**  
IXPE, NuSTAR, Citizen Science, Keck, ADCAR Deputy



**Stefan Immler**  
Chandra, Spectrum X-Gamma, COSI



**Hannah Jang-Condell**  
TESS, Explorers, XRP, ExEP



**Patricia Knezek**  
Explorers, SOFIA, Probes, ADCAR Deputy, NHFP Deputy, COR



**David Morris**  
Athena, Explorers Deputy, Cubesats Deputy, APRA Deputy



**Joshua Pepper**  
GOMAP, Pioneers, ADAP



**Mario Perez**  
Swift, ISFM, RTF, SAT, UVOIR Portfolio Deputy, Keck



**Linda Sparke**  
Explorers Deputy, COSI Deputy, ADCAR



**Sanaz Vahidinia**  
XRISM, ATP, TCANN, IR Portfolio Deputy



**John Wisniewski**  
SPHEREx Deputy, XRP Deputy



**CROSS CUTTING** staff are responsible for managing and developing the technology programs, coordinating IDEA activities and programs, as well as APD communications in support of the division.



**Mario Perez**  
Chief Technologist



**Omid Noroozian**  
Deputy Technologist



**Rhiannon Roberts**  
Executive Officer



**Elizabeth Landau**  
Multimedia Lead and  
OCOMM Liaison



**Julie Stoltz**  
Strategic Integration  
& Engagement Lead



**David Morris**  
Inclusion, Diversity,  
Equity, and Accessibility  
(Lead)



**Antonino Cucchiara**  
Inclusion, Diversity,  
Equity, and Accessibility  
(Deputy)

# APD Changes 2023 → 2024



**Doug Hudgins**  
(PS)  
→ DAR



**Sangeeta Malhotra (PS)**  
→ GSFC



**Alessandra Aloisi**  
(Data Lead)



**Tahani Amer**  
Associate Director  
Flight Projects  
(Acting)



**Bill Latter**  
(PS)  
→ Retired



**Shawn Domagal-Goldman(PS)**  
→ GSFC



**David Morris**  
(PS)



**Rosa Avalos-Warren**  
(PE)



**Kartik Sheth**  
(PS)  
→ OCS



**Stefan Immler**  
(R&A lead)  
→ OMB Detail



**John Wisniewski**  
(PS)



**Rhiannon Roberts**  
(XO)



**Manuel Bautista**  
(PS)  
→ DOE



**Megan Ansdell**  
(PS)



**Julie Stoltz**  
(Engagement)

APD →

→ APD



## RESEARCH

~**365** U.S. Science PIs Funded  
 ~**130** Individual Institutions Selected  
 ~**\$136M** Awarded Annually

## SMALLSATS/CUBESATS

**4** Science Missions Launched  
**1** Mission complete  
**3** Operating/commissioning  
**11** Science Missions in Development  
**9** Free-flying CubeSats  
**1** ISS-attached Science Mission  
**1** Supporting Technology Development Project

## TECHNOLOGY DEVELOPMENT

~**\$160M** Invested Annually

## REFEREED PUBLICATIONS

>**23,432** Total Publications  
 (2019-Current)  
 >**21,249** Hubble Publications  
 (1991-Current)  
 >**542** Webb Publications  
 (July 2022-Current)

## MISSION SUMMARY

**15\*** Missions Operating  
**18\*** Missions in Development  
**2** Tech. Demos  
 \*Including international

# Astrophysics by the NUMBERS

## SOUNDING ROCKETS

**16** Science Missions  
 Launched (Suborbital)  
**6** In Development

## BALLOONS

**23\*\*** Suborbital Balloons  
 Launched  
 \*\*Includes APD, HPD, PSD, ESD,  
 educational, & engineering missions  
**22** Missions in  
 Development

# Science Highlights

## James Webb Space Telescope

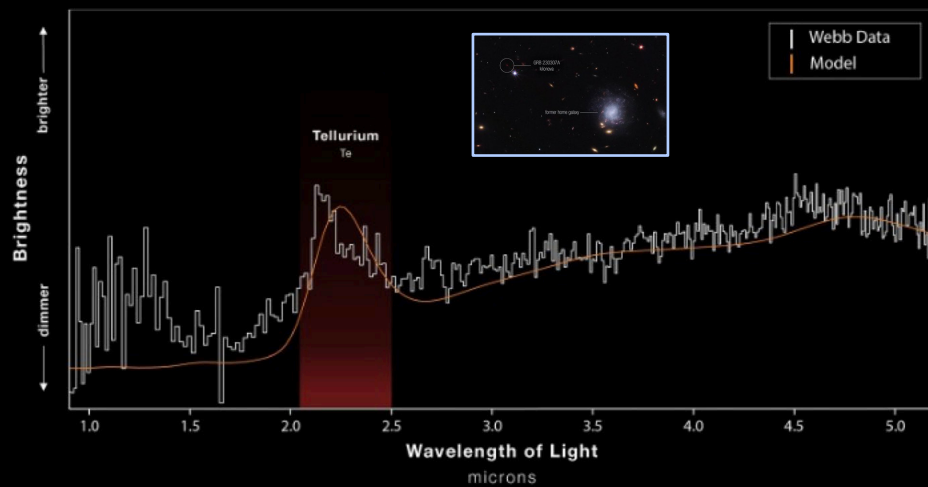


### JWST & Chandra Discover Most Distant Black Hole

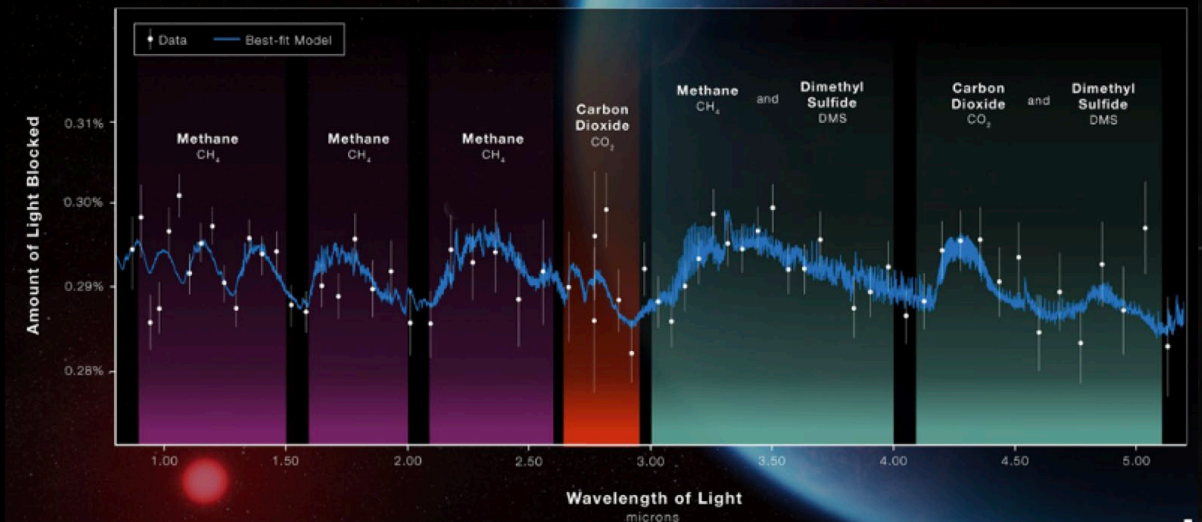
### JWST confirms Hubble Tension



### GRB 230307a Kilonova Explosion: Te detection



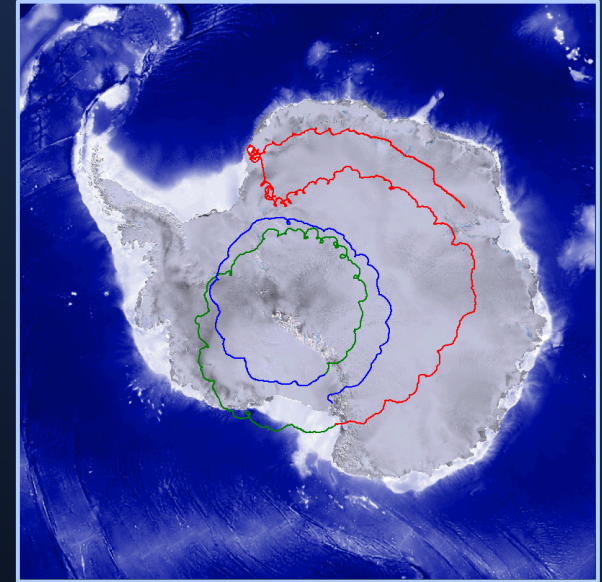
### Discovery of CH<sub>4</sub>, CO<sub>2</sub> in Atmosphere of K2-18 b



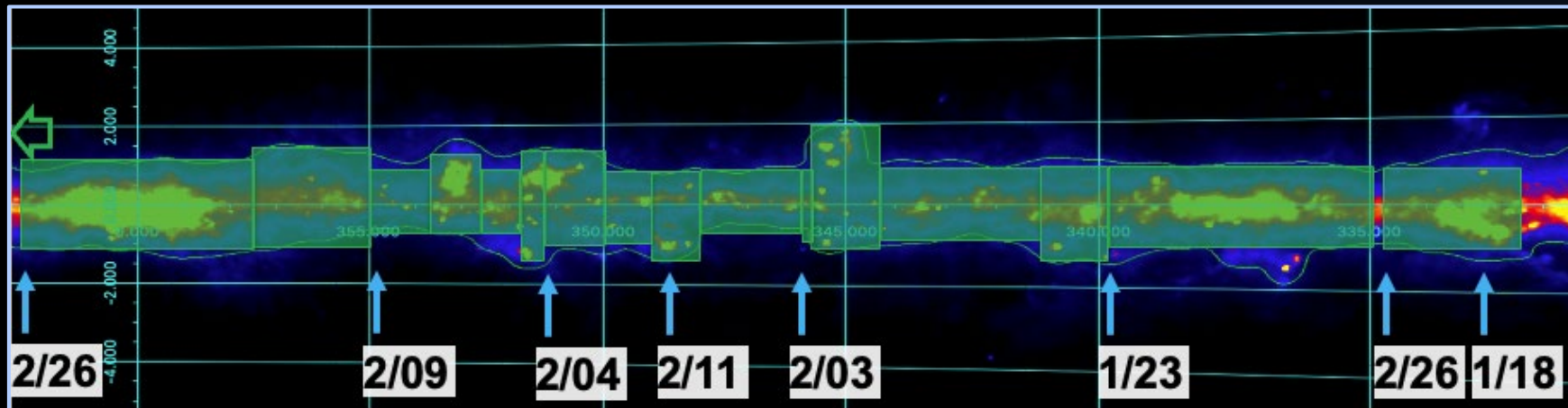


# GUSTO

- The GUSTO mission had a very successful flight, launched on zero pressure balloon from McMurdo late in the Antarctica season Dec. 30, 2023.
- The GUSTO balloon was terminated Feb. 26 at 6:24 p.m. EST, setting a new duration record for a NASA heavy-lift balloon flight with 57 days, 7 hours at float.
- The GUSTO Observatory consumables would have lasted until March 1, but repeated day-night cycles over the last 8 days forced an end to the balloon flight.
- GUSTO survey covered 62.5 deg<sup>2</sup> in the Galactic plane and 12,750 line of sights in the LMC.



**GUSTO has met and exceeded success criteria and will address all five science questions for which the mission was selected.**



On The Fly (OTF) mapping proceeding on schedule

# Budget





# FY24 Committee Report

## *Astrophysics*

The Committee recommendation for Astrophysics includes no less than \$98,300,000 for the Hubble Space Telescope, \$407,300,000 for the Nancy Grace Roman Wide-Field InfraRed Survey Telescope [Roman], and up to \$259,300,000 for Astrophysics Explorers. The Committee is encouraged by NASA's commitment to accelerate the cadence of Astrophysics Explorer missions and to continue a new line of small Pioneer-class missions that leverage advancements in low-cost platforms such as CubeSats and balloons to support groundbreaking science. Such activities can improve scientific understanding while simultaneously developing the scientific workforce through increased research opportunities for students and faculty.

## *Roman Telescope Mission Cost Cap*

The Committee notes this telescope was the highest priority of the 2010 Astrophysics decadal survey to further investigate fundamental questions about the nature of dark energy. The Committee reiterates the expectation that NASA will use a \$3,500,000,000 development cost cap in its future execution of the mission. Roman and the Vera C. Rubin Observatory will provide data rich, large-scale observations of the universe. Combining data from these complementary facilities could speed breakthrough discoveries. As such, the Committee directs NASA to work with NSF to develop essential computational tools and interfaces, strengthen and formalize science and engineering collaborations, and enable joint data analysis.

# FY24 Committee Report

## *James Webb Space Telescope (JWST)*

The Committee congratulates NASA on the success of the JWST mission thus far and provides \$187,000,000. JWST observations are fundamentally changing our understanding of the universe and our place within it and demonstrate continued U.S. leadership in science and technology.

## *Stratospheric Observatory for Infrared Astronomy (SOFIA)*

Up to \$20,000,000 is provided for SOFIA to continue the orderly close-out of the mission.

## *Astrophysics Research*

The Committee recognizes the role of the Astrophysics Research program in supporting the development of novel astrophysics observation technologies that lay the foundation for future mission architectures.

Additionally, a strong research program maximizes the scientific value of space-based missions by ensuring that the data collected through such observations can continue to provide new insights into the mechanisms behind cosmological phenomena. The Committee also understands that supporting these activities through extramural grant funding contributes to the long-term viability of the U.S. astrophysics community. As such, the Committee recommends up to \$289,900,000 for Astrophysics Research



# FY24 Conference Language Report

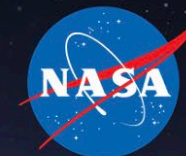
## *Habitable Worlds Observatory*

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 Space Flight Center** to leverage expertise in astrophysics and segmented mirror technology.

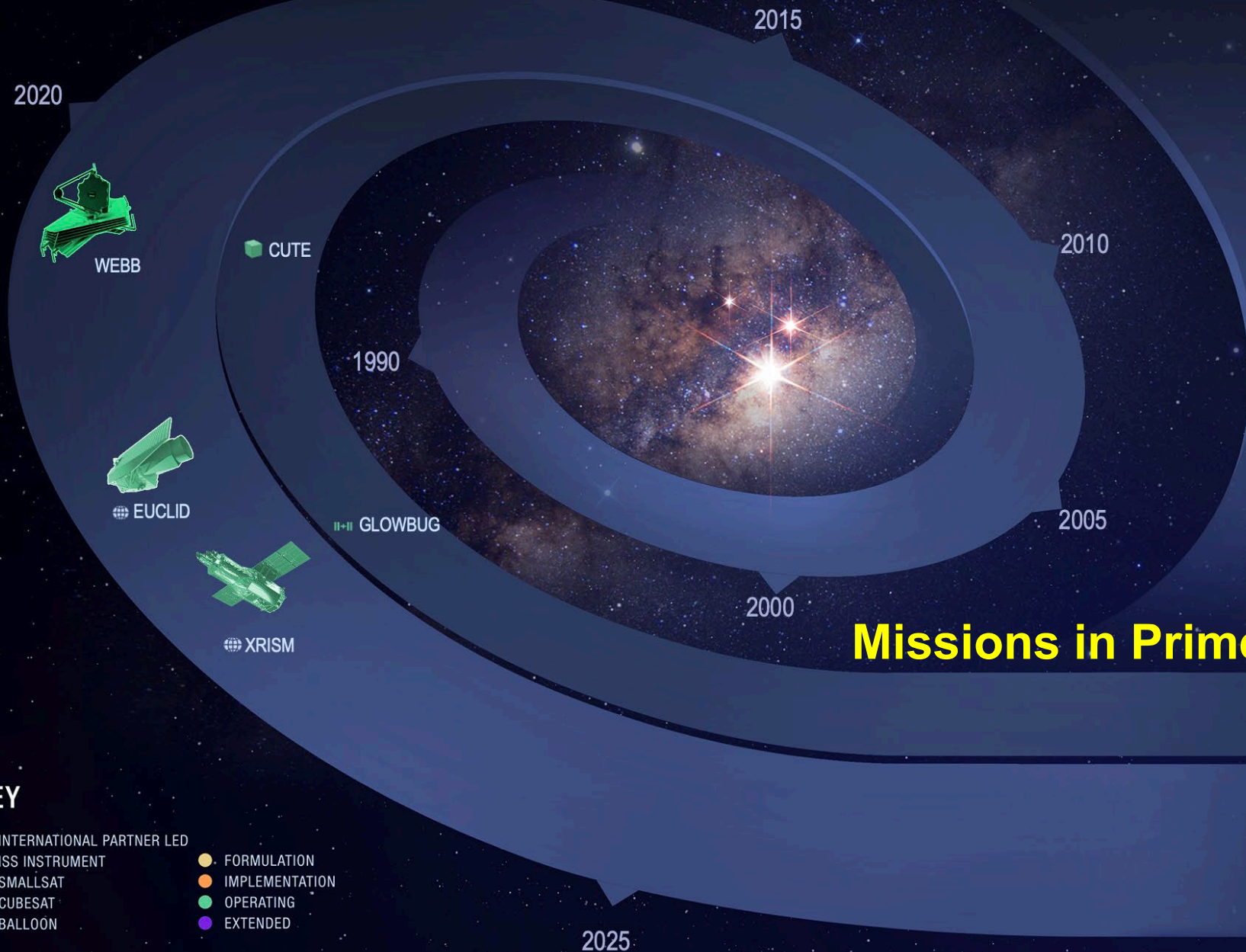
## *Senate Report Language - Habitable Worlds Observatory*

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.

National Aeronautics and Space Administration



# ASTROPHYSICS FLEET



## Missions in Prime Science Operations

VERY SMALL MISSIONS

TRADITIONAL MISSIONS

### KEY

- INTERNATIONAL PARTNER LED
- ISS INSTRUMENT
- SMALLSAT
- CUBESAT
- BALLOON
- FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED

2025



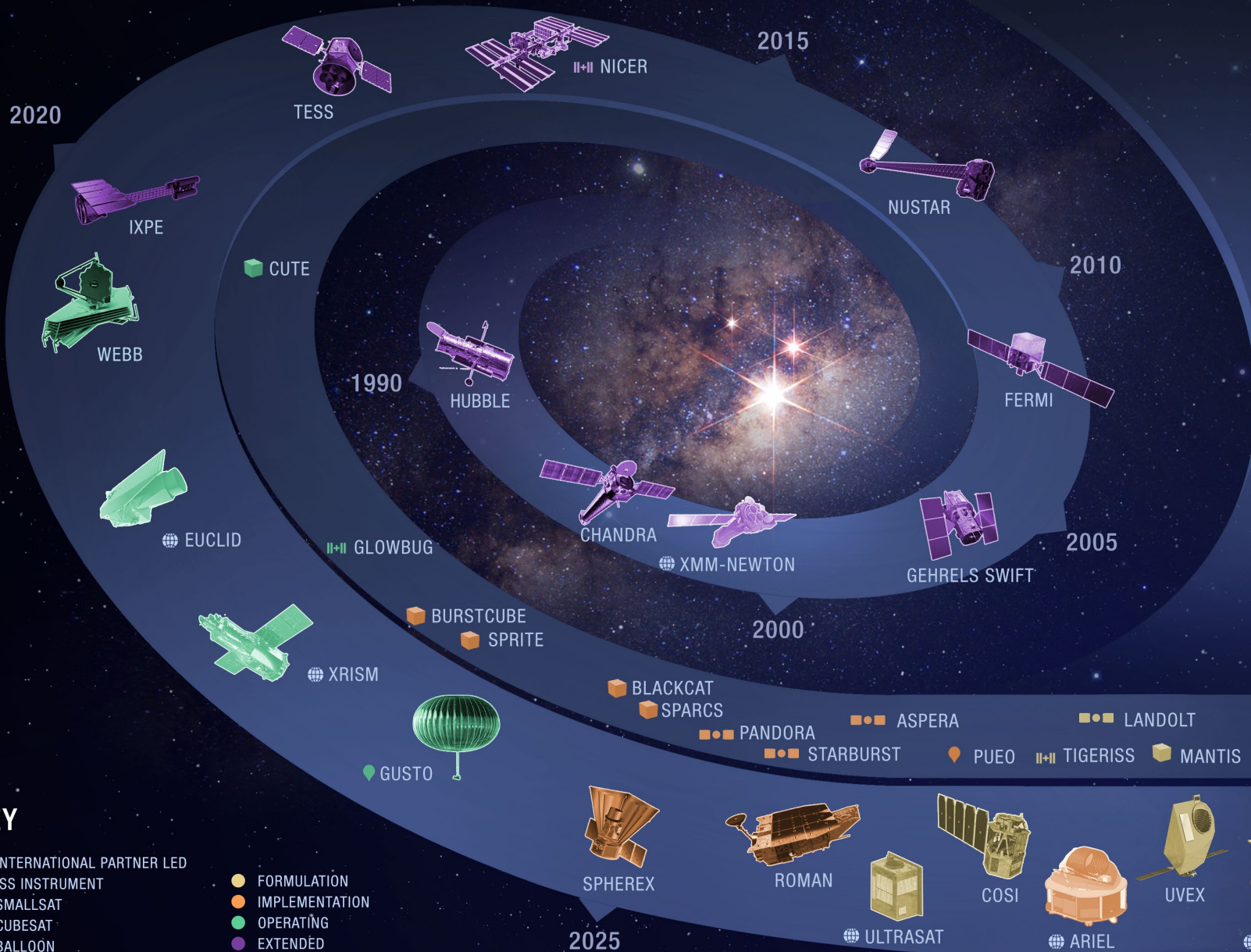
National Aeronautics and Space Administration



# ASTROPHYSICS FLEET

## PRE-FORMULATION

PROBE ~2030  
ATHENA EARLY 2030s



### KEY

- INTERNATIONAL PARTNER LED
- ISS INSTRUMENT
- SMALLSAT
- CUBESAT
- BALLOON
- FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED

## VERY SMALL MISSIONS

## TRADITIONAL MISSIONS



# FY25 President's Budget

	Actual 2023	CR 2024	Request 2025	2026	Out-Years 2027	2028	2029
<b>Astrophysics</b>	<b>\$1,510.0</b>		<b>\$1,578.1</b>	<b>\$1,587.0</b>	<b>\$1,613.6</b>	<b>\$1,647.1</b>	<b>\$1,673.4</b>
Astrophysics Research	\$284.8		\$300.5	\$378.7	\$390.5	\$390.3	\$377.1
Cosmic Origins	\$314.8		\$319.0	\$312.8	\$307.7	\$300.4	\$282.1
Physics of the Cosmos	\$180.7		\$210.8	\$184.3	\$168.6	\$176.1	\$133.7
Exoplanet Exploration	\$502.9		\$478.5	\$459.0	\$366.1	\$323.8	\$339.9
Astrophysics Explorer	\$226.8		\$269.3	\$252.2	\$380.6	\$456.4	\$540.6



# Astrophysics Priorities

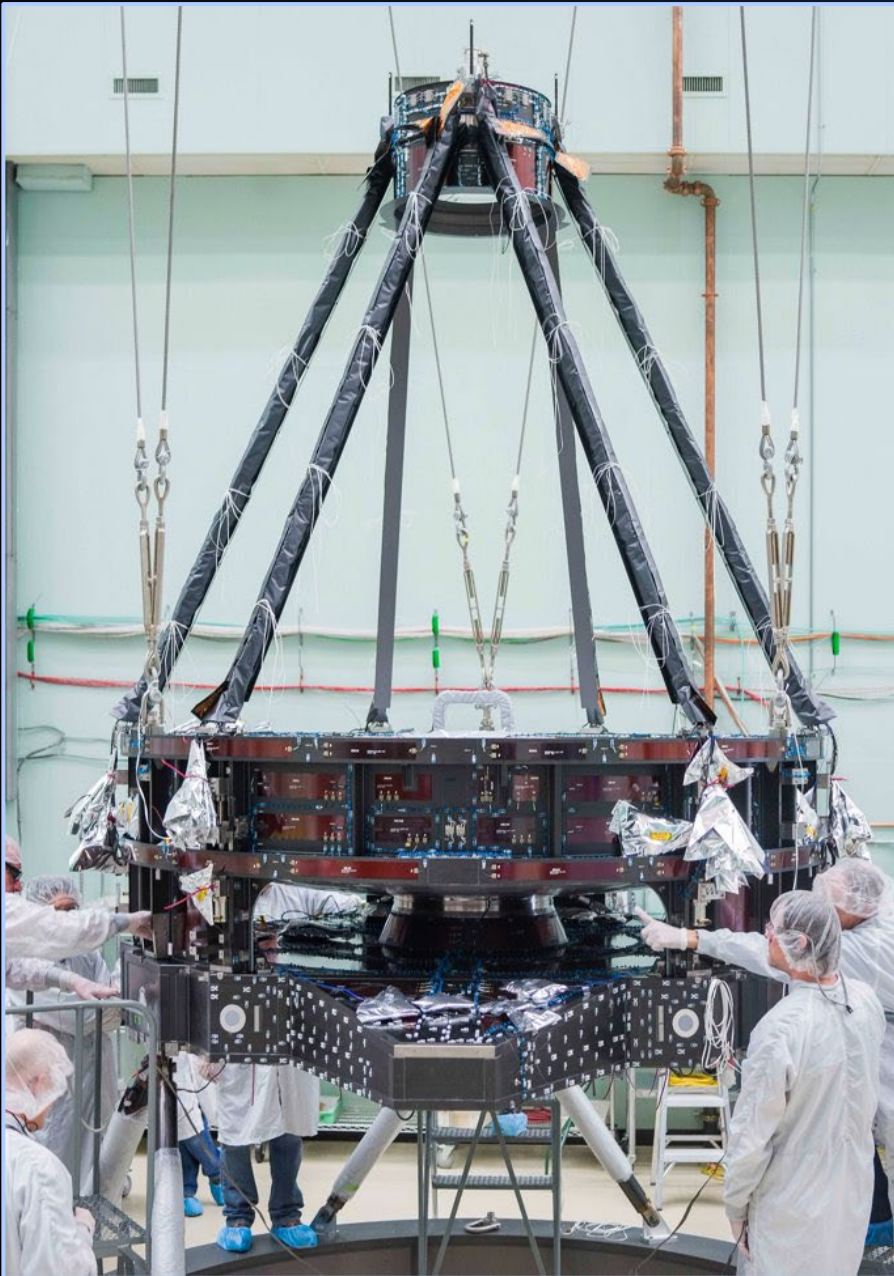
Explore/Innovate/Partner/Inspire

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**, and the selection of an **Astrophysics Probe** mission.

Ensure successful completion of the **Roman Space Telescope**, within the Agency commitment.

Protect international **partnerships** such as the Laser Interferometer Space Antenna (LISA).



*Nancy Grace Roman Telescope assembly*

## Astrophysics Budget Highlights

- **Nancy Grace Roman Space Telescope** is on track for launch in 2027. NASA's first survey astrophysics flagship, each year of **Roman** observations will comprise community defined and proposer-led surveys.
- Investments in future missions:
  - **Habitable Worlds Observatory** technology maturation increase in FY25
  - First Astrophysics Probe selections planned for Q1 in FY25
  - Support a healthy cadence of **Explorer** missions
    - SPHEREx (2025) preparing for launch
    - COSI proceeding towards confirmation;
    - UVEX will begin formulation activities
    - Future AOs for SMEX (2025) and MIDEX (2027)
- Mini-Senior Review planned for **Chandra** and **Hubble** to seek community guidance on options for future science operations model.



# Astrophysics Budget Highlights

- Operate **James Webb Space Telescope** with a robust competed science program (Webb Science)
- **Senior Review** funding allocated to remaining APD missions recommended for continued operations until next Senior Review in 2026
- **Balloon** program funding for new North American launch site and foreign campaigns
- **SOFIA** funding to complete shutdown with aircraft parts disposition in FY25
- **R&A** funding to maintain healthy selection rates as well as workforce development and early career faculty awards
- **Technology** investments in SR&T lines within each program to prepare for future missions and to drive innovation
- Key international **partnerships**: LISA, UltraSat

# Operations Paradigm Change Review (OPCR)

The APD will host an Operations Paradigm Change Review (OPCR) of the CXO and HST missions in 2024. The OPCR will assess proposed options for approaches to continue operations of missions in the extended operations phase, with reduced funding as proposed in the FY2025 President's Budget. The purpose of the review is to assist NASA in assessing the potential for limited scientific productivity and decreased operating efficiency of the HST and CXO missions under the current and future budget realities. NASA will use the findings from the OPCR to:

- Define an implementation approach consistent with astrophysics strategic objectives,
- Prioritize the operating mode(s),
- Provide programmatic direction to the missions concerned for FY25-FY28; and
- Issue initial funding guidelines for FY29 and FY30

NASA actions resulting from the OPCR could include authorizing a mission to; maintain the status quo; restructure the project; or terminate an ongoing science mission.

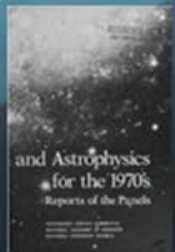


# Mission Progress

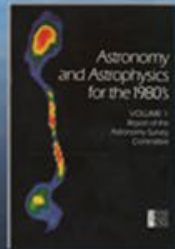


# Astrophysics

## Decadal Survey Missions



**1972**  
Decadal  
Survey  
*Hubble*



**1982**  
Decadal  
Survey  
*Chandra*



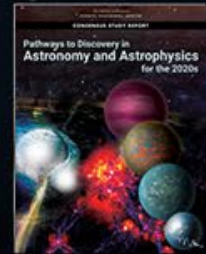
**1991**  
Decadal  
Survey  
*Spitzer*



**2001**  
Decadal  
Survey  
*Webb*



**2010**  
Decadal  
Survey  
*Roman*



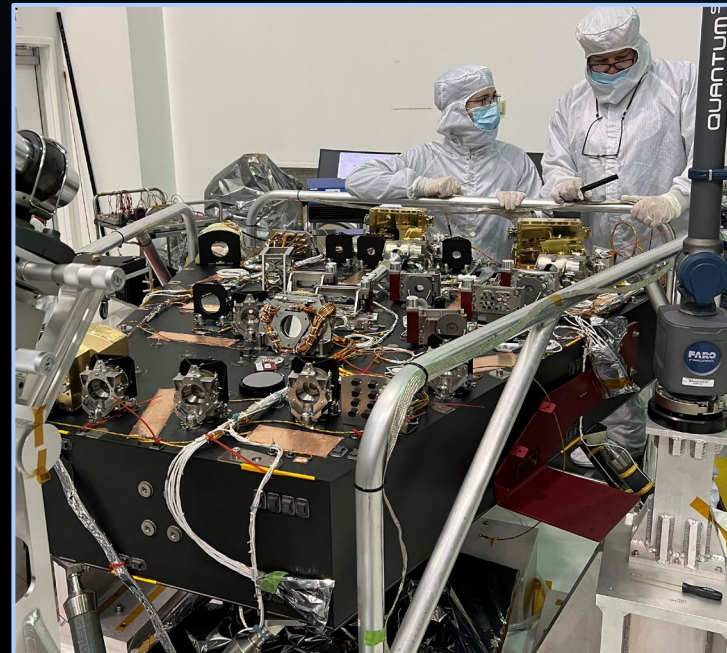
**2021**  
Decadal  
Survey



# Nancy Grace Roman Space Telescope

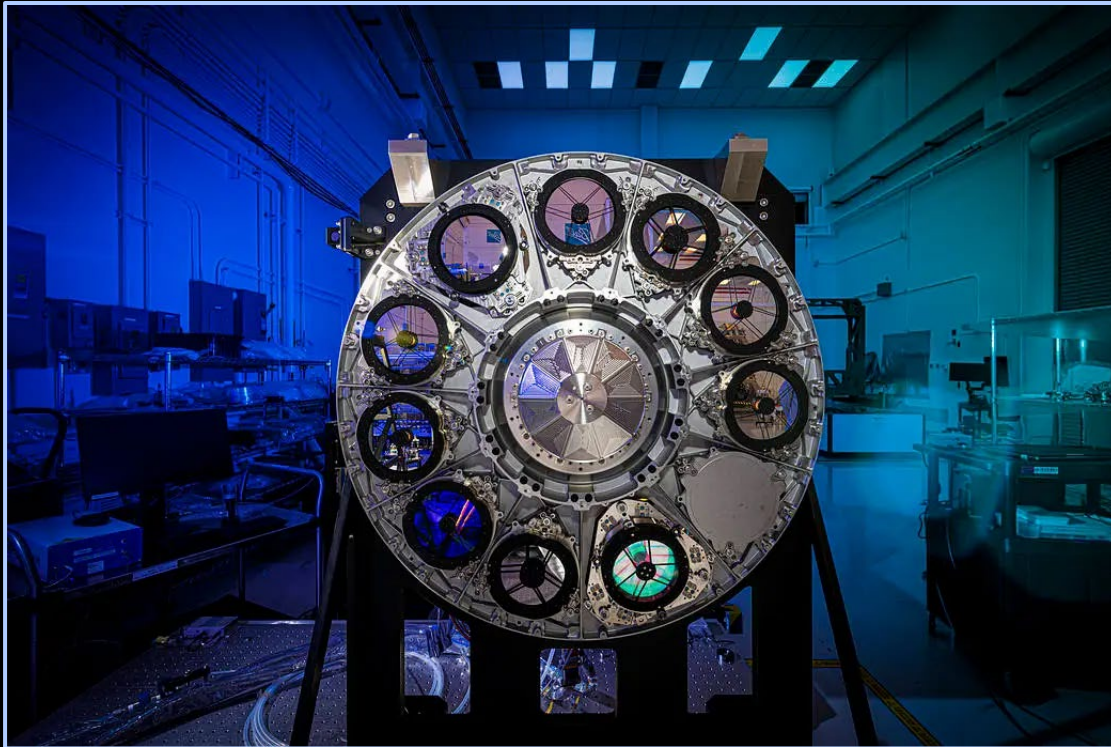
- Roman CGI
  - On track for May 15, 2024 delivery
    - Date moved due to hardware manufacture issues (14,292 thin film resistor replacement and some minor electronic redesign and fabrication for issues encountered in Chassis Thermal Vac).
    - This delivery date slip had no impact to the Roman master schedule. Pre-Ship review is the next milestone scheduled before shipment to GSFC.
- CGI completed a successful post-vibe Limited Functional Test (LFT), instrument integration, and a successful optical alignment test.
- Began Thermal Vacuum testing to evaluate performance in flight-like environment in early March

*CGI is now in thermal vacuum testing*



# Nancy Grace Roman Space Telescope

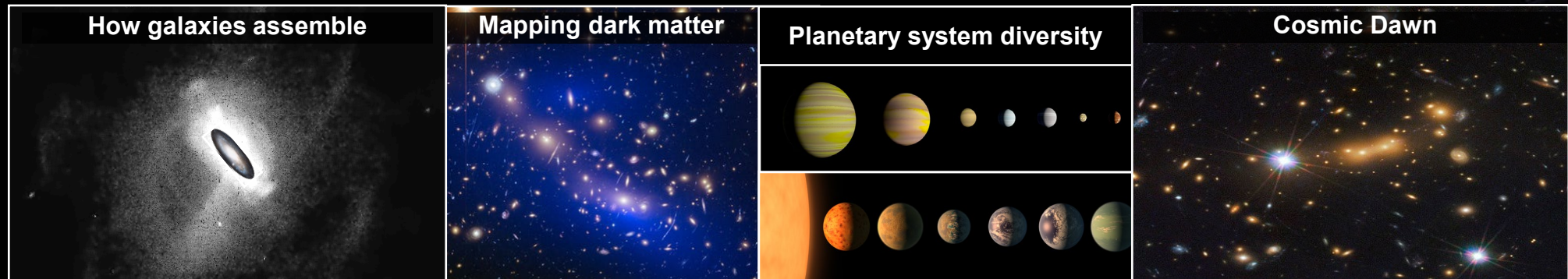
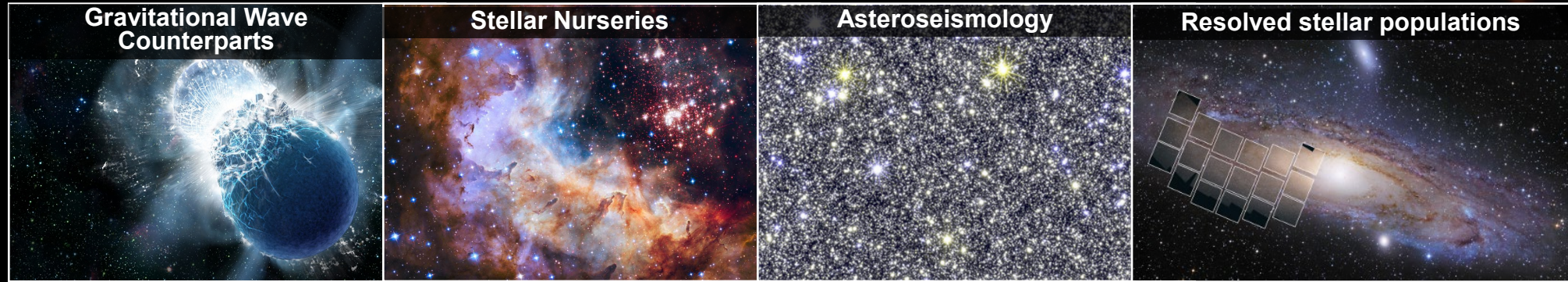
- Roman Telescope
  - The first optical tests on the IOA were performed at ambient temperature and pressure, achieving first images on IOA
  - Completed the OTA Pre-Environmental Review on Feb. 7, 2024.



ROMAN- First image of a point source  
(pre-optical alignment, in-air)



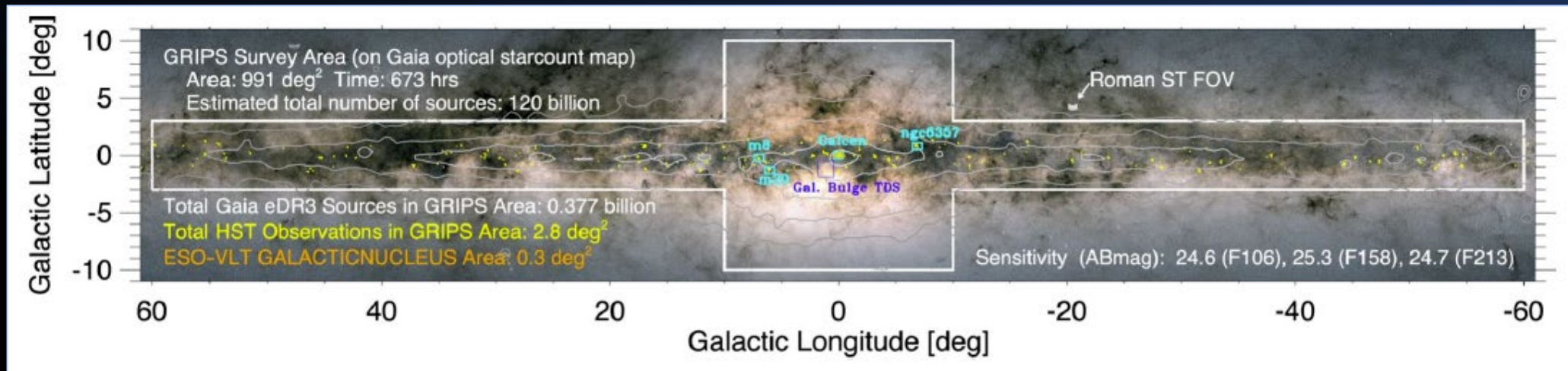
# Nancy Grace Roman Space Telescope: Science Areas





# Galactic Plane General Astrophysics Survey

Selected via panel review of community submitted white papers



- **Roman is only observatory that could survey complete inner galaxy to depths of 23-25 mag**
  - Improves on previous GP surveys by factor of 10 in resolution and factor 20 in depth
- **Huge Potential in this largely unexplored discovery space**
  - Includes studies of the **Galaxy's structure and dynamics** in stars and dust, the environmental dependence of **star formation**, the coevolution of the **Galactic nucleus** and its resident **supermassive black hole**, the evolution and properties of **flaring and variable stars**, **compact-object binaries**, and the potential for detecting **Galactic supernovae**
- **Strong synergies with Rubin**
  - Which could provide high cadence coverage at visible wavelengths
- **Reasons to define survey now:**
  - Such a survey would require a high level of coordination between stakeholders across multiple disparate subfields of astrophysics that have traditionally interacted relatively little
  - Enable development of coordinated surveys at other wavelengths to amplify science yields



# Roman Community

- Coordinating Science Community
  - WFI Working Groups - places for science community, science centers to engage together
    - Beta testing of Roman Science Platform this summer
    - Workshop on Roman version of Astronomers Proposal Tool in April
- Roman Science collaboration
  - Provides opportunities for collaboration and communication among researchers with complementary interests and expertise - Planning kickoff in July
- Coronagraph Community Participation Program (CPP)
  - Team working with the coronagraph instrument team to plan and execute its technology demonstration observations - First F2F meeting in February 2024

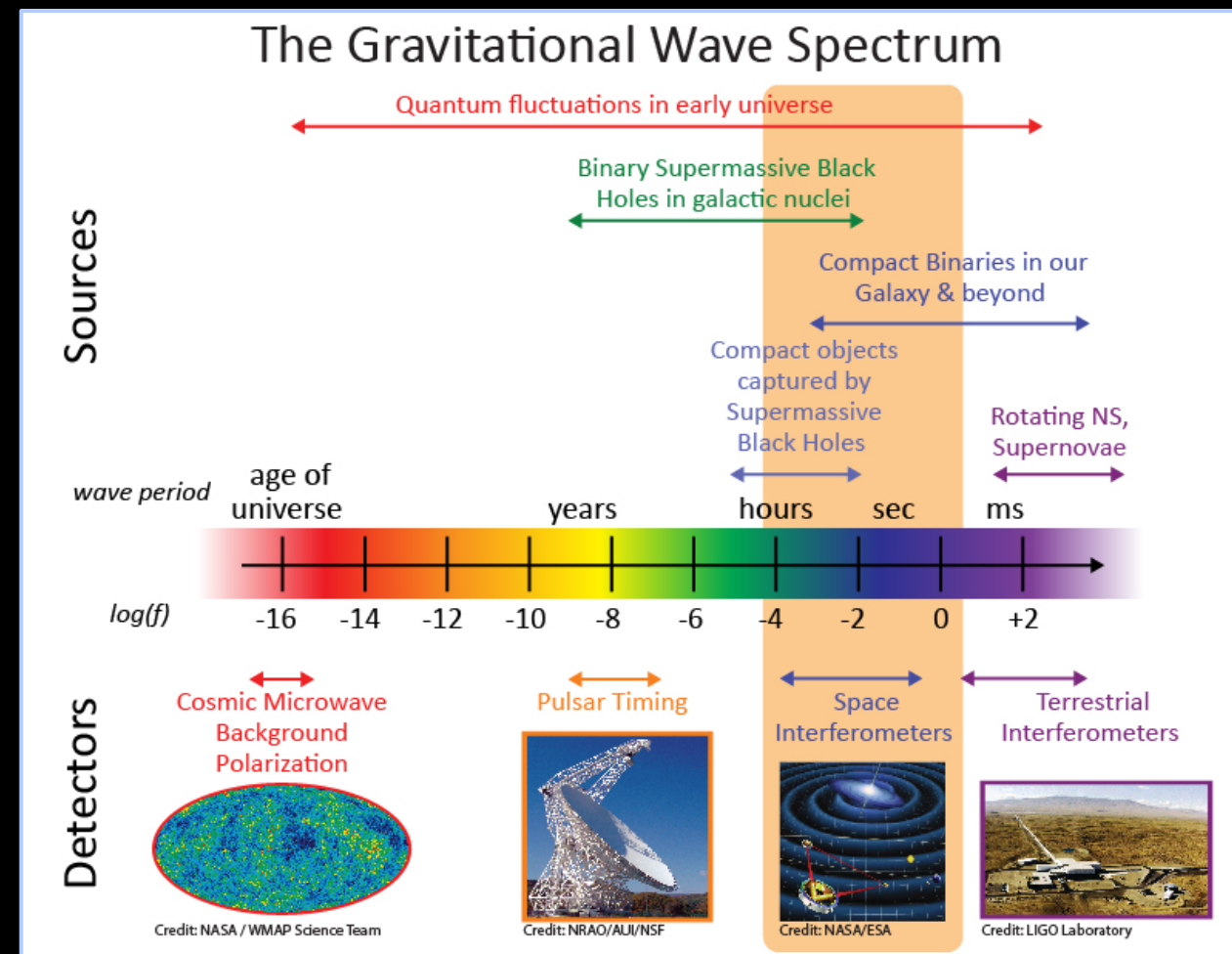
# LISA

## Laser Interferometer Space Antenna

- LISA will be the first space-based gravitational wave observatory
- NASA is partnering with ESA to provide key technologies and a science center for LISA
- NASA plans to formally establish LISA as a project in 2024

### Recent accomplishments:

- **Jan. 8:** LISA Mission Adoption Board Meeting
- **Jan 25:** Science Program Committee formally adopts the LISA mission



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



# Euclid

## Early Release Observations:

- The first science images from Euclid were released in a press event on November 7, 2023. Public data release expected May 23, 2024.
- Intent is to highlight Euclid's capabilities.
- Communications and Outreach merit took precedence over scientific merit.
- Each target is one standard observing block of 70 minutes covering one FOV of  $\sim 0.7 \times 0.7$  deg, with exception of Perseus (4 blocks).

## Recent Milestones:

- Mission Commissioning Results Review successfully concluded Feb 8, 2024
- Euclid's Science Survey started on Feb. 14, 2024

Horsehead Nebula



Perseus Cluster



*Image credit: ESA/Euclid/Euclid Consortium/NASA, image processing by J.-C. Cuillandre (CEA Paris-Saclay), G. Anselmi*

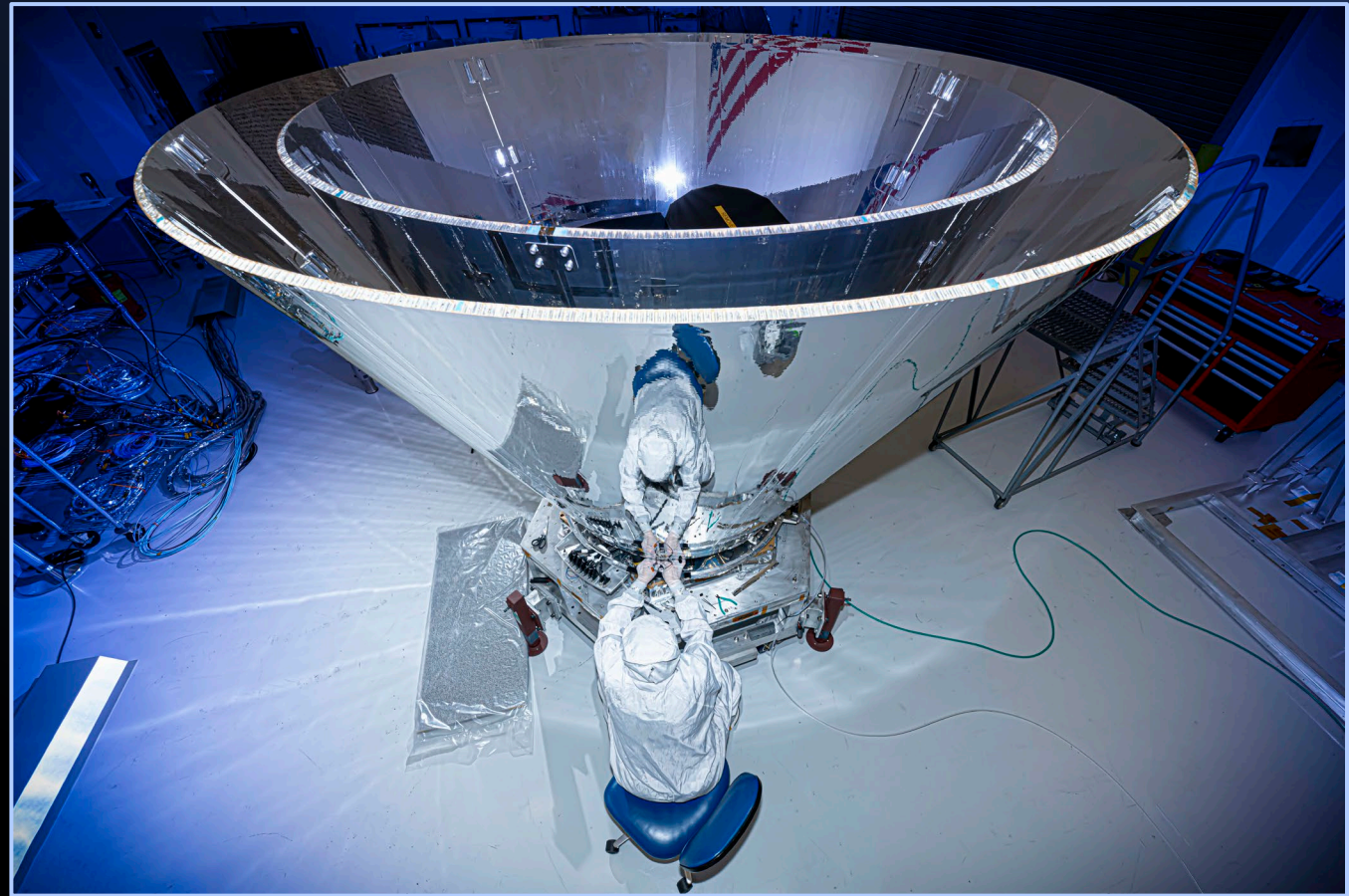
# SPHEREx

## Recent accomplishments

- KDP-D was successfully completed on January 30, 2024.
- Payload and photon shields have been delivered to BAE (formerly Ball Aerospace).
- Instrument control electronics will be delivered to BAE in a subsequent shipment.
- Ka-band downconverter arrived at Troll ground station, Antarctica.

## Upcoming milestones

- MA LRD remains February 2025. Agency LRD remains April 2025.
- ORR is scheduled for September 15, 2024.

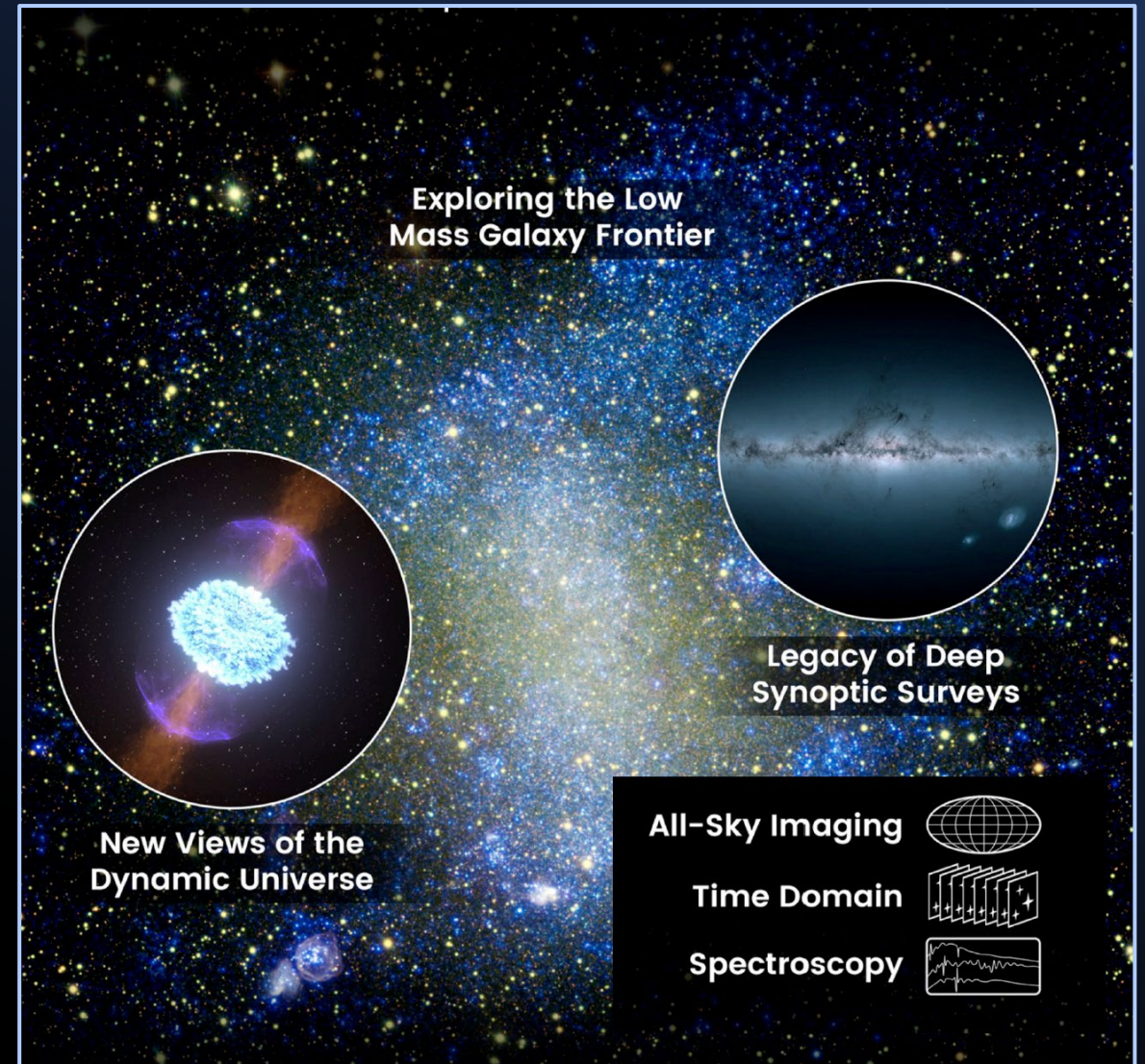


*JPL technicians assembling the inner and middle Photon Shields to the SPHEREx Payload in the cleanroom at BAE prior to Payload integration with the Spacecraft Bus, scheduled for later this month. Credit: BAE Space and Mission Systems (formerly Ball Aerospace)*



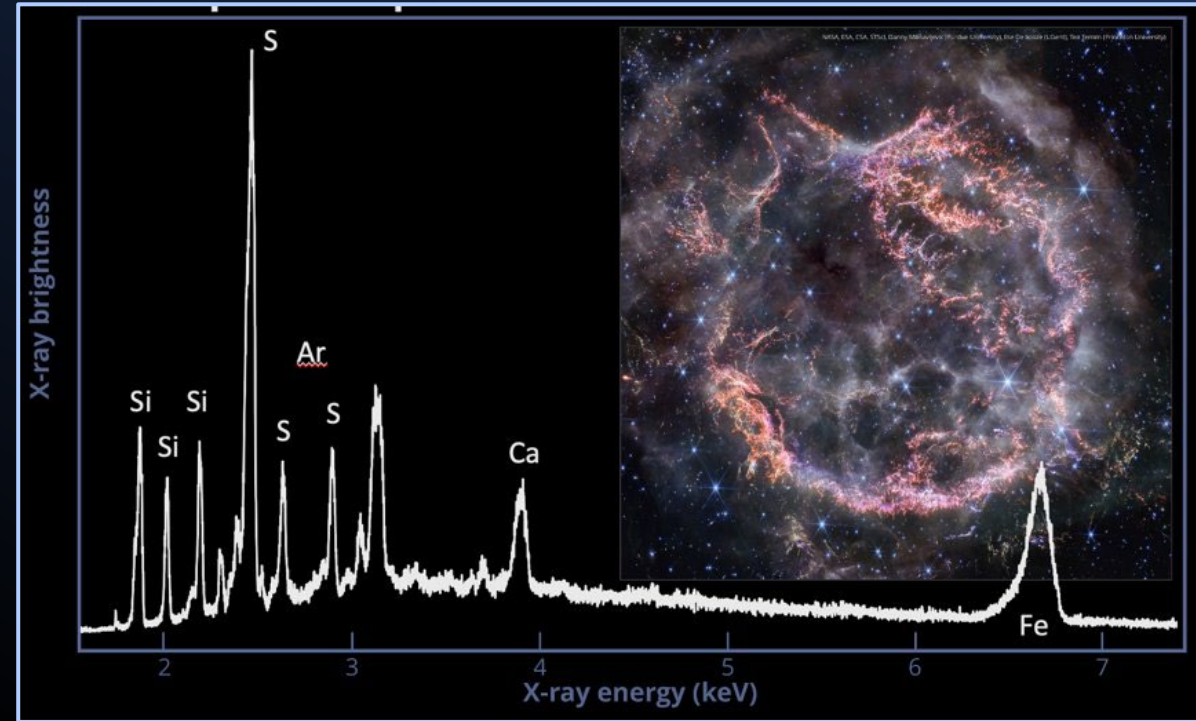
# MIDEX Selection: UVEX

- For the 2021 MIDEX/MO call, 2 MIDEX mission concepts and 2 Mission of Opportunity mission concepts were selected for a competitive Phase A study.
- On Tuesday, February 13, we announced that the MIDEX mission UVEX has been selected to continue into Phase B.
  - PI: Fiona Harrison
    - Sensitive wide-field imaging in 2 UV bands
    - High angular resolution
    - Broadband UV spectroscopy
    - All-sky survey
    - Rapid pointing capability



# 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*



# 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.
- COSI's principal investigator is John Tomsick at the University of California, Berkeley.
- KDP-C: ~April 2024



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

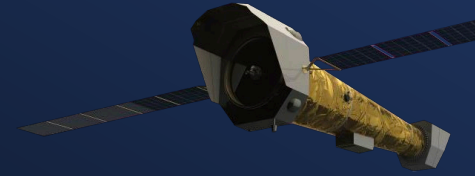
# Pioneers

- Aspera: IGM Inflow/outflow from galaxies via OVI  $10^5\text{K}$  emission line imaging. PI Carlos Vargas
  - Launch date: 10/2025
- Pandora: Multiwavelength Characterization of Exoplanets and their Host Stars
  - Launch date: 03/2025
- StarBurst: Gamma-ray ASM, Simultaneous detection of NS/NS mergers with LIGO
  - Launch date: 12/2025
  - CDR scheduled for April, 2-3, 2024
- PUEO: A Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies
  - Launch date: 12/2025 in Antarctica
- TIGERISS: Measuring ultra-heavy (r-process) cosmic rays on ISS
  - Launch date: 09/2026
  - Delta SRR/MDR completed on 2/15/2024.
- Landolt: Absolute stellar photometry to  $<0.5\%$ , PI Peter Plavchan, George Mason University
  - New Pioneers 2022 selection, started March 2024



# ATHENA

## Advanced Telescope for High Energy Astrophysics



### ESA and NASA Partnership

- ATHENA will look deep into the X-ray Universe, studying the evolution of super-massive black holes and hot gas in and out of galaxies over the life of the Universe.

### Status:

- Mission reformulation study was concluded by ESA in November 2023. Athena still remains as a Flagship mission with some requirement changes, e.g.
- Mission adoption is now scheduled for 2027.
- Mission profile results in reductions to performance relative to original Athena, with an approximately ~15% reduction in mirror size (Mirror diameter: 2.5m -> 2.3m), the X-IFU calorimeter with at least 4 eV energy resolution and a 4' FoV (2.5 eV and 5' previously), and the Wide-Field Imager (WFI) unchanged.
- The details of the science requirement changes are being prepared by the ESA in a report based on the work performed by the Science Redefinition Team (SRDT).
- ESA has sent out a solicitation the 7th of February 2024 to select the NewAthena Science Study Team NASST. Responses due by Feb 21st and member appointment expected in April 2024. NASA will appoint one US member to the NASST.
- NASA will provide cryocooler; XRCF support no longer required. An RFP for a demonstration model of a 50K to 4K cryocooler is being prepared for release in spring 2024

# Probes

Astrophysics Probe Announcement of Opportunity (AO)  
proposal submission upcoming dates:

- Selection for competitive Phase A studies: Q4 CY 2024 (target)
- Concept study reports due: Q4 CY 2025 (target)
- Down-selection: Q2 CY 2026 (target)
- AO-Required Launch Readiness Date: NLT July 2032





# NASA Scientific Balloon Independent Review

Team: W. Jones (Chair, Princeton U, APD), A. Ali (Templeton Foundation), L. Avallone(NSF), J. Gaskin (NASA/MSFC APD), D. Gregory, K. Jucks (NASA/HQ ESD), C. Kierans (NASA/GSFC APD), S. Nutter (NKU APD), J. Sample (Montana St U, HPD), J. Siles (JPL, APD) , N. Thakur (PG County Community College, J. Vieira (U Illinois), T. Hams(NASA/HQ), K. Sheth (NASA/HQ)

## Status:

- Fact Finding
  - Community outreach (BPO, CSBF, Science, Commercial, Int'l & private sector)
  - Contacts/Interviews with 80+ members of the ballooning community
  - Site visits (CSBF Palestine [Feb], Wallops Flight Facility [May])
- Deliberation
  - Deliberative meetings (public) - June and August
- Report Preparation
  - Discussion of Draft Report (public) – September
  - Final Report
  - Presentation to fall meeting of the APAC

# Time Domain and Multimessenger Astronomy

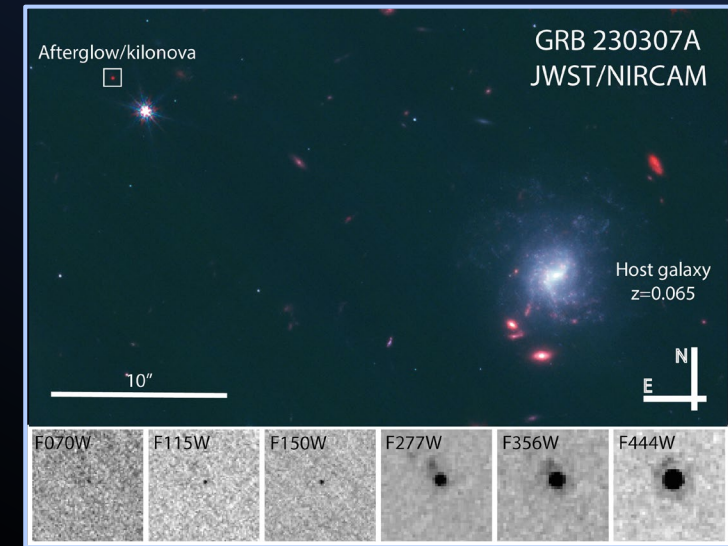
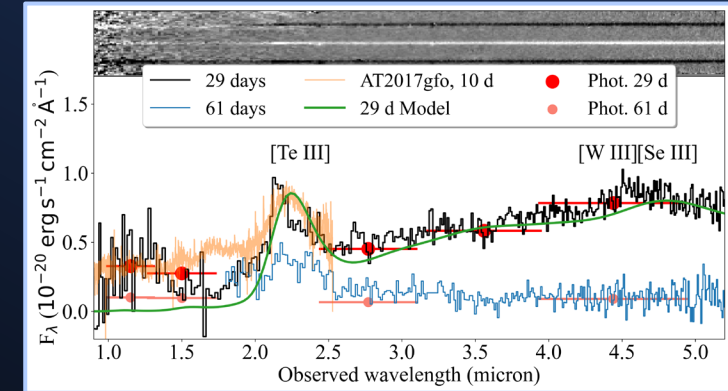
- **TDAMM Science Interest Group:** newly formed community-led effort focused on making the best use of NASA assets for TDAMM activities (PhysPAG, COR, & ExEP)
- **Science Analysis Groups**
  - *Gamma-ray Transient Network:* report received summer 2023
  - *TDAMM Space Communications:* working on requirements for ground-to-space and space-to-ground communications in post-TDRS, commercial era
  - *Future Innovations in Gamma Rays* kickoff was held on 1/19
- **ACROSS pilot initiative** focused on situational awareness, observational awareness, and cross-mission follow-up decision support tools + development of TDAMM-focused AO for tools and science
  - Phase II of TDAMM study focusing on understanding how to coordinate information sharing, tool development, and coordination with ground-based community
- **NSF NOIRLab workshop *Windows on the Universe*** focused on infrastructure and ground-space coordination; 2<sup>nd</sup> white paper released December 2023
- **General Coordinates Network** investment in infrastructure upgrade to modern, open-source, reliable, and secure alert distribution technologies, and deployed in the cloud



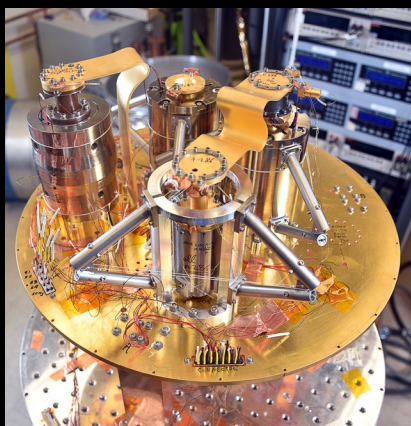
# Mission Highlights & Status

JWST observations of GRB 230307A reveal a kilonova associated with a long GRB and significant r-process nucleosynthesis

- **New missions and missions in development:**
  - **Glowbug:** operating on ISS since April 2023; reported detections of four gamma-ray bursts via the GCN
  - **BurstCube:** Arrived at Kennedy Space Center for a mid-March launch.
  - **Roman:** community survey to get inputs/definition on surveys, including TDAMM aspect
  - **ULTRASAT:** U.S. participating scientists selected
  - **StarBurst:** launch in 2027 to study neutron star mergers
  - **COSI:** launch in 2027 - Data challenge released
  - **NEO Surveyor:** Planetary defense, NIR mission launch in 2028 to identify near-Earth moving objects – astrophysics survey / transient capabilities
- **LVK O4 Run:** Began May 2023; *Swift* “zero latency ToO” follow-up capability tested, for use with early-warning GW candidate alerts



# From Innovation to Infusion



Active Maturation Programs:  
COR 17, ExEP 21, PhysCOS 20



Technology Management: Tech  
gap prioritization in 2024



Infusions: Over 140  
and counting...



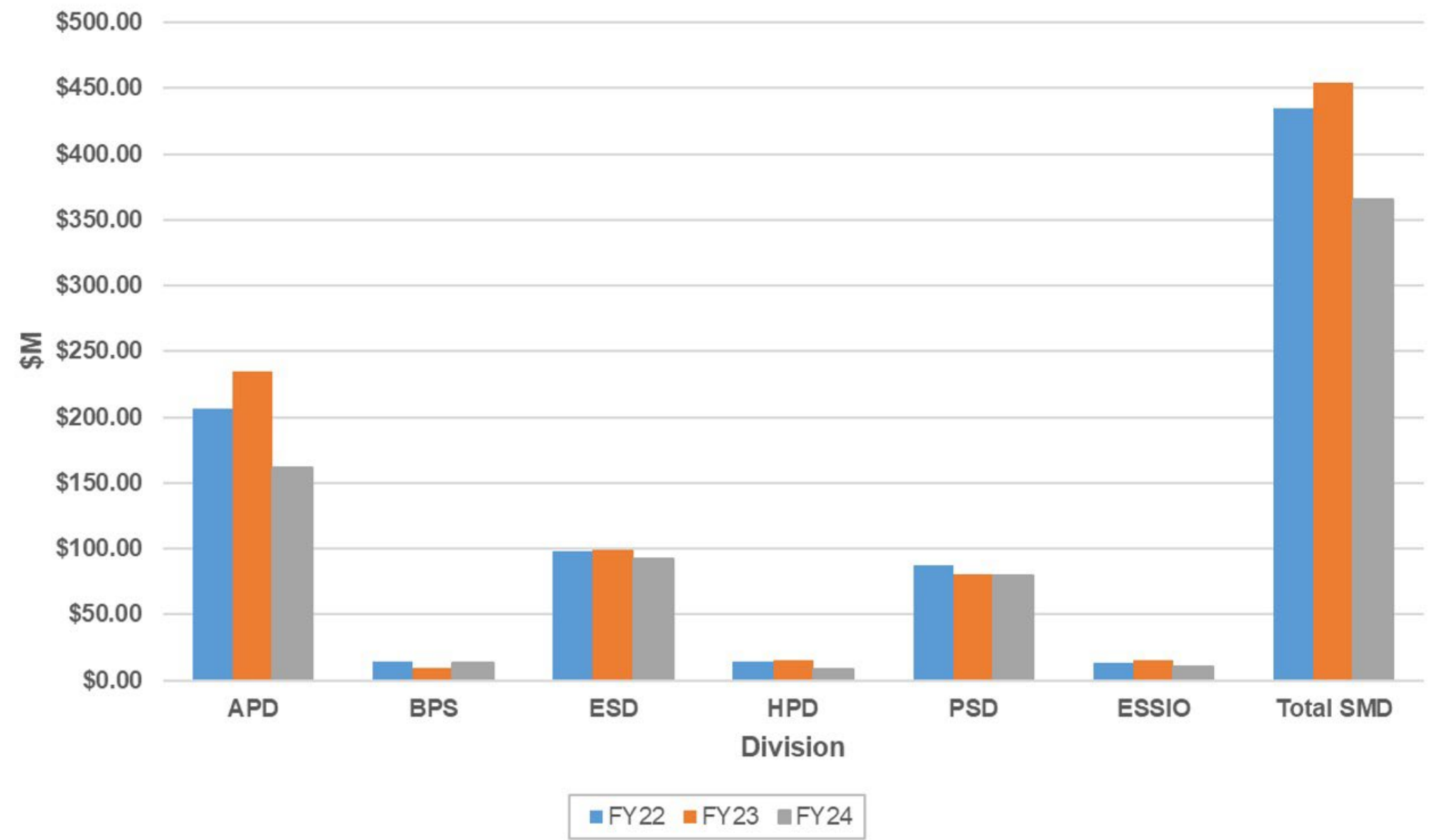
Workforce: Three new Roman  
Technology Fellows in 2023

**Upcoming  
Deadlines**

D.19 - Critical Technologies for Large Telescopes (Industry) - Proposals due:  
April 3, 2024



### SMD Technology Development Funding (by Division)



**IDEA / LGBTQIA+**





- From October APAC requests for information: The APAC requests an update on the status of initiatives to address equity, inclusion, and belonging for the LGBTQIA+ community within NASA, the astrophysics community, and in the public. If there are no initiatives, the APAC requests that APD consider ways to improve belonging and restore trust for this community.
- APD has reached out specifically to ERG leads and LGBTQ champions at several centers to better understand ongoing LGBTQ+ support initiatives and to help strengthen communication between APD HQ and the NASA LGBTQ community
  - At Wallops Flight Facility:
    - **David Pierce, Center Director**
  - At Goddard Space Flight Center:
    - **Rob Leahy, Chief Information Officer**
  - At Jet Propulsion Laboratory:
    - **Neela Rajendra, Chief Inclusion Officer**



- Progress:
  - Effort to support preferred pronouns in on-screen names; this was not without challenges but Rob Leahy at GSFC persisted after policy challenges and as of January 2023, preferred pronouns support was adopted NASA-wide using O365.
  - This effort has been expanded (championed by Rob) to seek similar naming flexibility to be adopted across all government agencies (NASA is leading change in this area).
  - Several centers are either renovating or planning renovations for gender-neutral bathrooms.
- Continuing concerns
  - Healthcare – Concerns are around continuing support for gender-affirming care for NASA employees.
  - Travel and safety
    - Concerns are around occasional requirements to travel for work-related activities to places where employees may not feel welcome/safe.
    - Virtual participation is an option but presents inclusivity concerns (in-person vs. remote).
- APD encourages input from the APAC regarding community concerns in these areas or others and thoughts on how APD can effectively support the community moving forward.

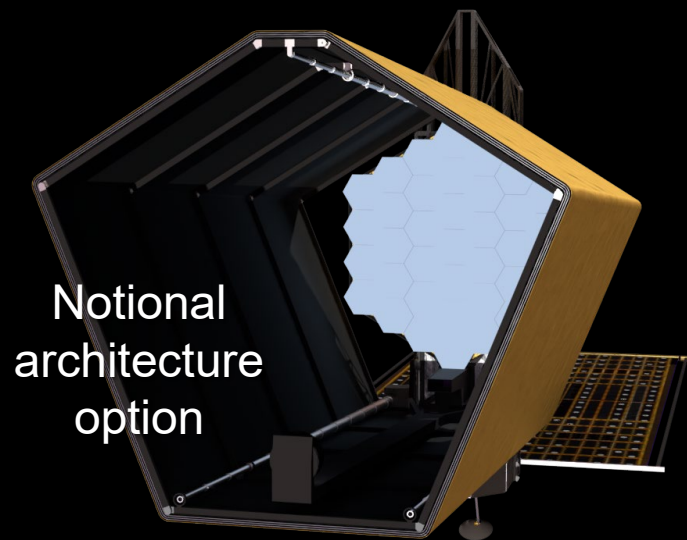


# GOMAP / HWO Update



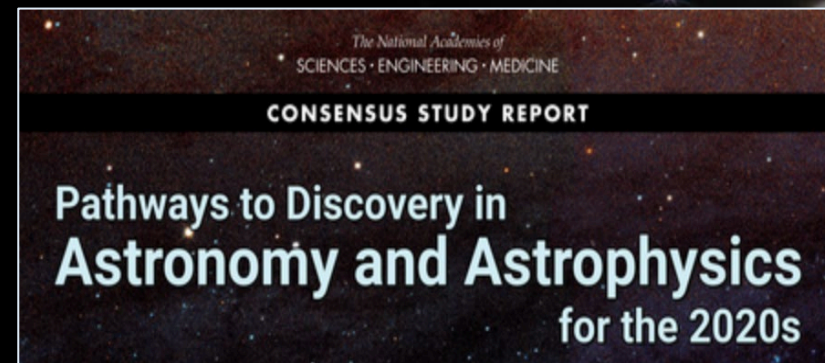
# What Is Habitable Worlds Observatory (HWO)?

NASA's next flagship mission concept  
recommended by Astro2020 Decadal Survey

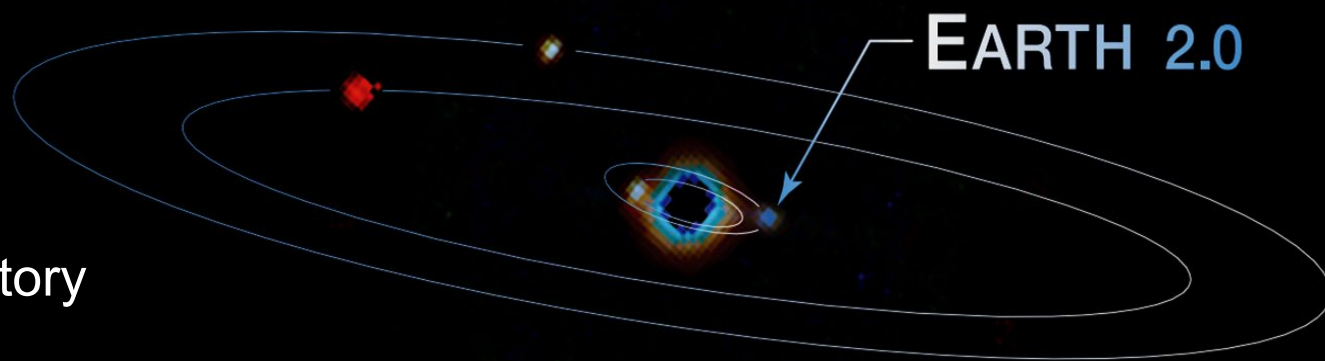


Notional  
architecture  
option

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



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





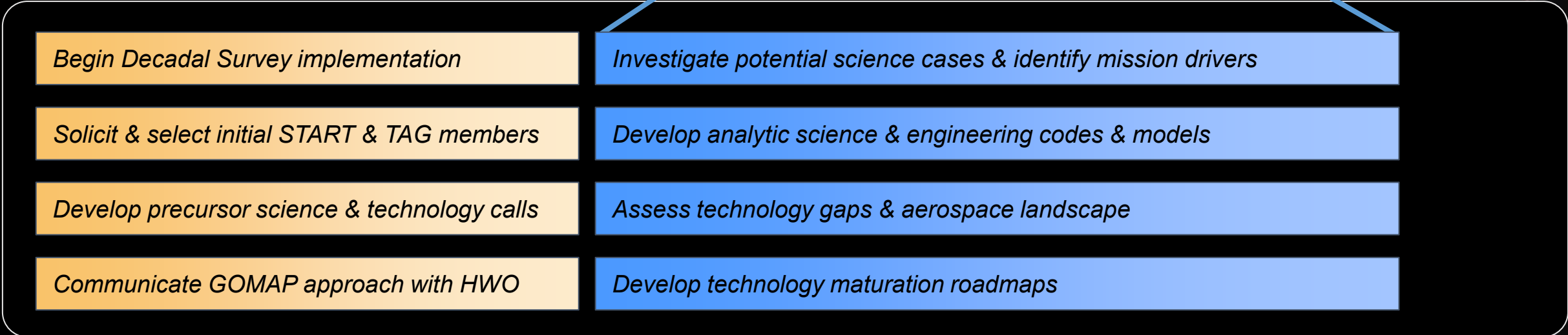
# Implementing HWO's GOMAP Phase

## MILESTONES

**DEFINE MISSION-DRIVING  
TRADE SPACES &  
HOW TO EXPLORE THEM**



## ACTIVITIES



*Planning [2023 ✓]*

*Trade Space Implementation [2024]*

# Habitable Worlds Observatory/GOMAP Teams

## APD - HQ



**Megan Ansdell (PS)**



**Julie Crooke (PE)**



**Joshua Pepper (Dep. PS)**

## Science, Technology, Architecture Review Team (START)



**Courtney Dressing**  
UC Berkeley  
Co-Chair



**John O'Meara**  
W. M. Keck Observatory  
Co-Chair

## Technical Assessment Group (TAG)



**Lee Feinberg**  
Engineer Co-Chair



**Aki Roberge**  
Scientist Co-Chair



**Bertrand Mennesson**  
Scientist Co-Chair



**John Ziemer**  
Engineer Co-Chair



# Research Software Sharing



# Sharing Research Software

## Software To Be Shared

- Software that provides users some degree of scientific utility
- Produces a scientific result or service
- Single use, e.g. generating a figure or plot
- Libraries developed using SMD funding
- Generalized software used to manipulate measurements or model results to visualize or gain understanding
- Software for modeling and simulation
- Processing uncalibrated sensor measurements into calibrated sensor data and derived data products

## Software You Don't Have To Share

- Preliminary analysis
- Plans for future research
- Communication with colleagues
- Restricted software (e.g. by law, export, ITAR)
- Commercial (e.g. off the shelf) software
- Enhancements to existing software

**Think in terms of scientific utility: would someone need that software in order to reproduce your (published) results or interested in reusing the software?  
Then it probably needs to be shared.**

For more details, see the [SMD Guidelines on Software Management and Sharing](#) and [SPD-41a](#).



# Sharing Research Software

## Where Should Software Be Shared?

- Locations that ensure its accessibility and preservation
- Supplement to a publication (e.g. scripts, notebooks)
- Example: Develop open on version control platforms like GitHub, Gitlab, Bitbucket
- Example: Create DOIs and preserve on services like Zenodo or Software Heritage

## Where You Shouldn't Share Software

- Personal web page
- By request only

*Note: You are not expected to maintain software developed under a research grant or provide storage beyond the grant period of performance.*

**Again, think in terms of scientific reproducibility and reuse.**

Use best practices – provide documentation, comments, provide testing, assign an open-source license and DOI, write a contribution guide, write a code of conduct.

***Include all of this in your Open Science Data Management Plan.***

For more details and examples, see the [SMD Guidelines on Software Management and Sharing, SPD-41a](#), and the [Open Code Module in TOPS Open Science 101](#).

# ROSES F.7 Open-Source Tools, Frameworks, & Libraries

*Support for existing open-source software tools, frameworks, and libraries (OSTFL) that have significant usage in the NASA science community.*

In ROSES-24, proposals should be one of two types:

## Foundational Awards

Open-source software tools, frameworks, and/or libraries that have a significant impact on two or more divisions of the SMD. These projects have significant usage by NASA missions, centers, repositories, and/or community.

*Cooperative agreements. Up to 5 years.*

## Sustainment Awards

Open source software tools, frameworks, and/or libraries that have significant impact in one or more divisions of the SMD.

*Grants or cooperative agreements. Up to 3 years.*

Anticipating 3-5 foundational awards, 8-10 sustainment awards. Total budget ~\$4M/year.

Notice of intent (NOI) due date May 3, 2024. Proposal due date June 7, 2024.

# NASA Hubble Fellowship Program (NHFP)





The APAC would like an update on the progress toward addressing the challenging recommendations for the NHFP and would also like an update on the demographics of the fellows, including the graduate institution and the fellow host institution.

- The NHFP program is collecting data on many demographic axes and an intern has been hired at NASA HQ to help in this effort over the summer
- We are investigating other similar postdoctoral programs to identify candidate evaluation strategies that would improve the NHFP processes (e.g. holistic evaluation)
- Thanks to the feedback collected last summer the NHFP began brainstorming about the best approach to tackle the most challenging recommendations within the current APD fiscal environment

# APAC Recommendations



# APAC Recommendations from October 2023

Recommendation	Response
<p>On the heels of the 2022 Senior Review and anticipating another imminent and comprehensive Senior Review, the APAC is concerned about the large effort and added expense of the proposed “mini Senior Review” for Chandra and Hubble. The APAC is also not entirely clear on the purpose or consequences of this effort, and indeed there is considerable apprehension in the community and in the APAC that the exercise would result in lifetime-shortening budget cuts or premature cancellation for either mission. Therefore, the APAC recommends that APD reconsider the need for a mini Senior Review, and that the intent of the mini Senior Review be made more transparent, if one is to be held.</p>	



# APAC Recommendations from October 2023

Recommendation	Response
<p>To determine future budget decisions, the APAC recommends that a decision matrix is generated that accounts for near- and long-term impacts to astrophysics and the astrophysics community for models that prioritize preserving irreplaceable scientific capabilities versus those that impose a flat cut for each mission. Examples of these capabilities include UV imaging and spectroscopy offered by Hubble and high angular resolution in X-ray offered by Chandra.</p>	<p>While APD understands the intent of the recommendation, a matrix can only serve as a guideline. In addressing budget guidance, APD tries to follow its' principles for budget reductions, and of course Decadal direction. However, a number of other considerations present challenges that preclude the application of a matrix approach.</p> <ul style="list-style-type: none"> <li>• Earmarked budget items.</li> <li>• Decadal Survey Priorities</li> <li>• Congressionally cost-capped programs e.g. Roman</li> <li>• Mission funding profiles</li> <li>• Flat cuts to missions in development lead to significant cost overruns, breached cost-caps, and the potential loss of key personnel at critical points in the mission.</li> </ul> <p>These considerations tend to generate an environment in which the fraction of available budget to make reductions, when required, is significantly below the annual APD operating budget, severely limiting options.</p>

# APAC Recommendations from October 2023

Recommendation	Response
<p>The APAC further recommends that this decision matrix be informed by community input, perhaps by a Request for Information (RFI), as we note that the Decadal did not weigh in on the relative prioritization of protecting the current program of record versus investing in future programs.</p>	

# APAC Recommendations from October 2023

Recommendation	Response
<p>Given the relatively high costs associated with maintaining and building on existing communications infrastructure (primarily related to TDRSS and DSN), and the recent successes of the Deep Space Optical Comm (DSOC) demo on the Psyche mission and with the Integrated Laser Communications Relay Demonstration Low Earth Orbit User Modem and Amplifier Terminal (ILLUMINA-T) with Laser Communications Relay Demonstration (LCRD) on ISS, the APAC recommends that APD explore the benefits, feasibility, and possible future implementation of optical communications on astrophysics missions. Further, we recommend a Request for Information to better understand the space communication needs and concerns of the astrophysics community, as well as to explore the applicability and timescale of optical services to APD missions.</p>	<p>Dr. Fox has discussed SMD's strategy for space communications. TDRSS will continue to exist in some form for the foreseeable future. The ability to address upcoming or existing mission on-demand communication needs will be addressed on a mission by mission basis.</p> <p>If the APAC would like a deeper discussion on optical communications, capabilities and options for the future, APD can plan a presentation from SCaN at a future meeting.</p>



# APAC Recommendations from October 2023

Recommendation	Response
<p>The APAC is pleased to learn that APD is considering pursuing its own graduate fellowship program to either replace or augment FINNEST. We recommend that APD explore the feasibility of a graduate fellowship opportunity that has flexibility to address the unique needs and priorities of the APD community.</p>	<p>The APD FINESST working group has concluded its analysis in February and discussion is ongoing within APD as well as with SMD on a possible stand-alone pilot program to be rolled out no earlier than ROSES-25.</p>

# APAC Recommendations from October 2023

Recommendation	Response
<p>Although it's clear that a new large Gamma-ray mission is not possible in the current budgetary climate, the APAC nonetheless endorses several of the other recommendations from the GTN SAG report that represent low-risk, relatively low-cost, yet high-reward changes to current mission operations. For example, the report made a convincing case that TDAMM science would be better enabled by increasing the Swift downlink cadence. The APAC recommends APD conduct a trade study on the recommendations from this report that concern existing mission capabilities (starting at page 42). Further, we recommend that the division explore cross-divisional partnerships to sustain and amplify the impact of the Interplanetary Network.</p> <p>The APAC also recommends that future SAG reports include an executive summary to spell out the findings and recommendations for APAC consideration.</p>	<p>APD is very interested in the findings of the GTN SAG on the value of sustaining and revamping the InterPlanetary Network. Cross-divisional partnerships are of keen interest to SMD leadership and we will follow up with discussions regarding those partnerships. Operating missions past prime phase submit proposals for continued operations (including enhanced capabilities) as part of the Senior Review process and these proposals are evaluated for science return in the context of the whole NASA fleet and available funding.</p> <p>We appreciate the suggestion regarding the executive summary and will so instruct our SAGs in the future should their findings come to the APAC for consideration and advice.</p>

# APAC Recommendations from October 2023

Recommendation	Response
<p>The APAC approves the terms of reference for the Future Innovations in Gamma-ray Science Study Analysis Group (FIGSAG) within PhysCOS.</p>	<p>APD thanks the APAC for their input on the ToR for FIGSAG which has seen a successful kick-off and will host a community workshop at Michigan Tech at the end of June. Their activities are detailed here: <a href="https://pcos.gsfc.nasa.gov/sags/figsag.php">https://pcos.gsfc.nasa.gov/sags/figsag.php</a></p>
<p>The APAC would like the Roman team to consider mechanisms to increase community participation from researchers at less resourced institutions. It may be useful to consult the Rubin Observatory on its Discovery Alliance program for a potential framework.</p>	<p>See Roman update on March 21</p>
<p>Inspired by the GTN SAG report, the APAC recommends that APD analyze the current astrophysics portfolio to identify potential low-cost high-impact upgrades to mission operation, including joint data analysis, and/or cross-agency cooperation, to better facilitate TDAMM science. This may be an excellent charge to the TDAMM SIG and TDAMMCOM SAG.</p>	<p>APD agrees that making full use of the NASA fleet to facilitate TDAMM science is a worthy endeavor and in 2022 tasked the Physics of the Cosmos Program Office to study how best to pursue it. In this meeting you will hear from Jamie Kennea of the ACROSS team about the pilot cross-mission support center which emerged from Year 1 of the PhysCOS PO study. The next phase of the study will examine cross-agency coordination with or participation in ACROSS.</p>



# APAC Recommendations from October 2023

Recommendation	Response
<p>Relatedly, the APAC recommends that the Roman team expand the approach used to adapt the mission to better enable time domain astrophysics to optimize multi-messenger astrophysics as well.</p>	<p>1. Roman has added a Project Infrastructure Team to do:</p> <ul style="list-style-type: none"> <li>a) Rapid image-differencing of every new Roman image</li> <li>b) Prompt public alert stream of all transient and variable candidates</li> <li>c) Source match-files recording photometry for every Roman source</li> <li>d) Forced-photometry service for non-Roman sources</li> </ul> <p>2. Roman pipeline being developed for near-real-time: much of raw data available within ~10 min. of acquisition!</p>
<p>The APAC looks forward to receiving the Terms of Reference for Student Science Interest Group.</p>	
<p>The APAC encourages the NHFP to continue to explore ways to expand the range of institutions that host Hubble Fellows, for example by encouraging applicants to consider a range of possible institutions, providing incentives or resources for smaller or less-resourced institutions to serve as hosts.</p>	<p>The NHFP has gathered community input on possible resources that, if provided to the Fellows, may result in the consideration of a wider pool of possible hosts. Discussion is ongoing regarding what resources are needed and the possible mechanisms to offer them in an equitable and inclusive way to all Fellows.</p>

# APAC Recommendations from October 2023

Recommendation	Response
<p>The APAC recommends that APD consider the legal, financial, logistical and scientific ramifications of after-launch international partnerships.</p>	<p>APD coordinates all international partnerships with the Office of International and Interagency Relations, consistent with USG priorities for international cooperation. The terms, including the financial, logistical, and scientific responsibilities, are captured in legally binding space act agreements. APAC's recommendation will be considered during the development of such documents.</p>
<p>The APAC was impressed by the plans to decrease the burden on PIs and Institutions by simplifying the ROSES solicitation and associated proposal requirements and considering requesting a simplified budget for R&amp;A proposals. While APD is planning on a pilot program in ROSES-25 for an investigation that is non-technology based, the APAC recommends APD develop a plan to test this out on a technology-based program such as APRA or SAT and, if feasible, implement a similar pilot also in ROSES-25.</p>	<p>For FY24, the Division will run a pilot program with a non-technology solicitation, the Astrophysics Data Analysis Program (ADAP) to require only a single page budget justification instead of a detailed budget. ROSES-2024 ADAP solicitation currently states: <i>"No NSPIRES-based budget is required, nor any Total Budget file uploaded. Proposals must instead identify the planned duration and cost cap under which the proposal is submitted as either small, medium, or large."</i> Based on this pilot program, the Division will assess the outcome, and if successful, it will extend this simplification to technology-based solicitations like APRA and SAT and to other solicitations within the Division portfolio.</p>



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 orange nebula on the left, a purple and blue galaxy on the right, and a white and blue nebula at the top. The word "QUESTIONS?" is written in white, bold, sans-serif capital letters across the center of the circular inset.

**QUESTIONS?**





**THANK YOU!**