



National Aeronautics and
Space Administration

NASA Astrophysics Update

Committee on Astronomy and Astrophysics | March 18, 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), Pamela King-Williams (C)

DIVISION LIAISONS

Resource Management

Elijah Owuor (Lead)
 Jenna Robinson (Detail)
 Jennifer Holt

Communications

Alise Fisher

Policy

Jason Callahan

OIR

Peyton Blackstock

Program Support Specialist

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 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)
 Megan Ansdell
 Dominic Benford
 Valerie Connaughton
 Antonino Cucchiara (C)
 Doris Daou
 Michael Garcia (D)
 Thomas Hams (C)
 Hashima Hasan
 Stefan Immeler

Hannah Jang-Condell
 Patricia Knezek
 David Morris
 Roopesh Ojha
 Joshua Pepper (IPA)
 Mario Perez
 Linda Sparke
 Sanaz Vahidinia
 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 2023 → 2024



Doug Hudgins
(PS)
→ DAR



Sangeeta Malhotra (PS)
→ GSFC



Bill Latter
(PS)
→ Retired



Shawn Domagal-Goldman(PS)
→ GSFC



Kartik Sheth
(PS)
→ OCS



Stefan Immler
(R&A lead)
→ OMB Detail



Manuel Bautista
(PS)
→ DOE

APD →



Alessandra Aloisi
(Data Lead)



David Morris
(PS)



John Wisniewski
(PS)



Megan Ansdell
(PS)



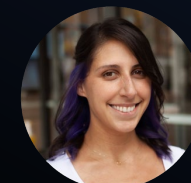
Tahani Amer
Associate Director
Flight Projects
(Acting)



Rosa Avalos-Warren
(PE)



Rhiannon Roberts
(XO)



Julie Stoltz
(Engagement)

→ APD

Astrophysics by the NUMBERS

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

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

TECHNOLOGY DEVELOPMENT

~**\$160M** Invested Annually

REFEREED PUBLICATIONS

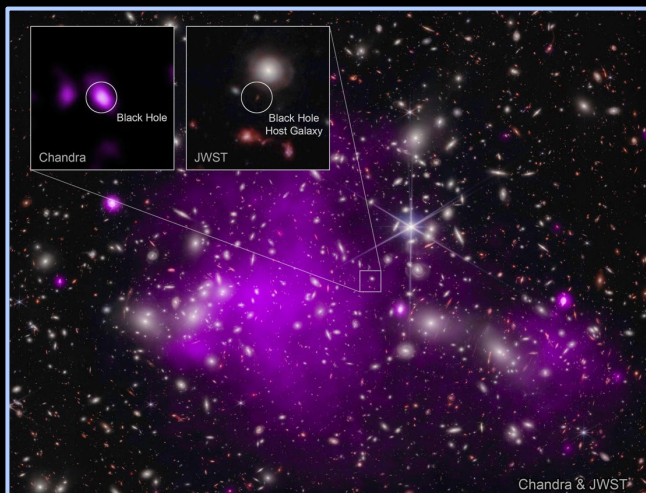
>**23,432** Total Publications
(2019-Current)
>**21,249** Hubble Publications
(1991-Current)
>**542** Webb Publications
(July 2022-Current)

MISSION SUMMARY

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

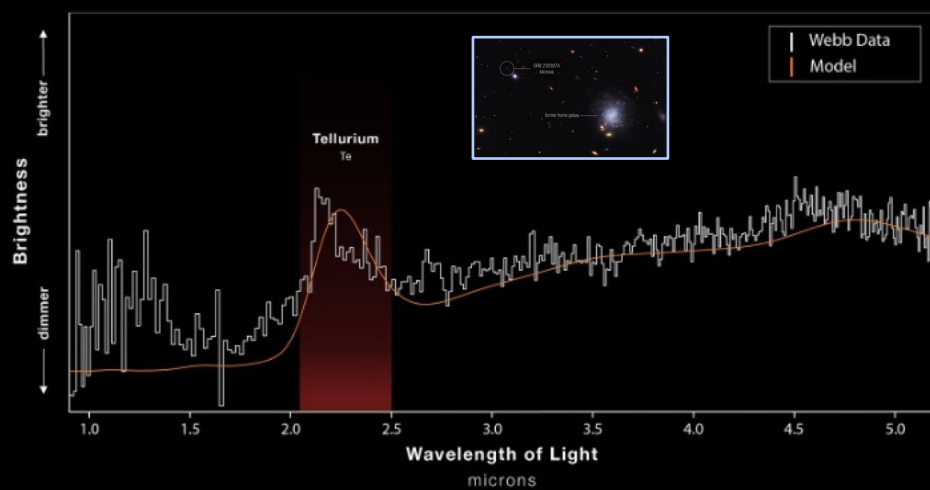
Science Highlights

James Webb Space Telescope



**JWST & Chandra
Discover Most Distant
Black Hole**

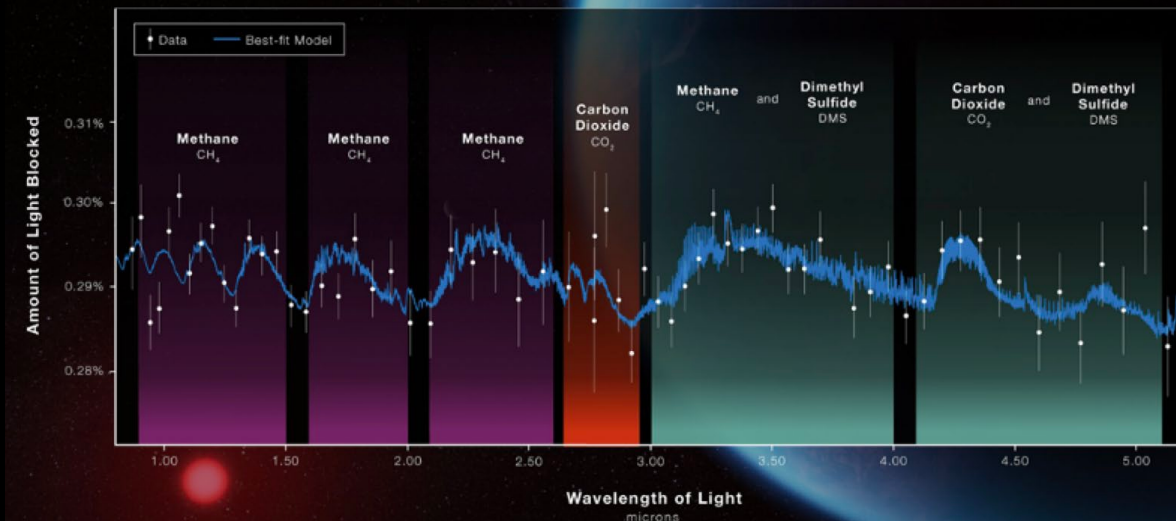
GRB 230307a Kilonova Explosion: Te detection



JWST confirms Hubble Tension

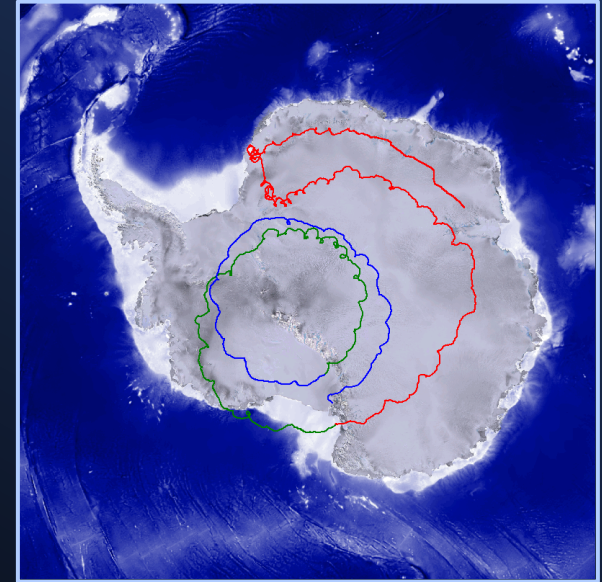


Discovery of CH₄, CO₂ in Atmosphere of K2-18 b

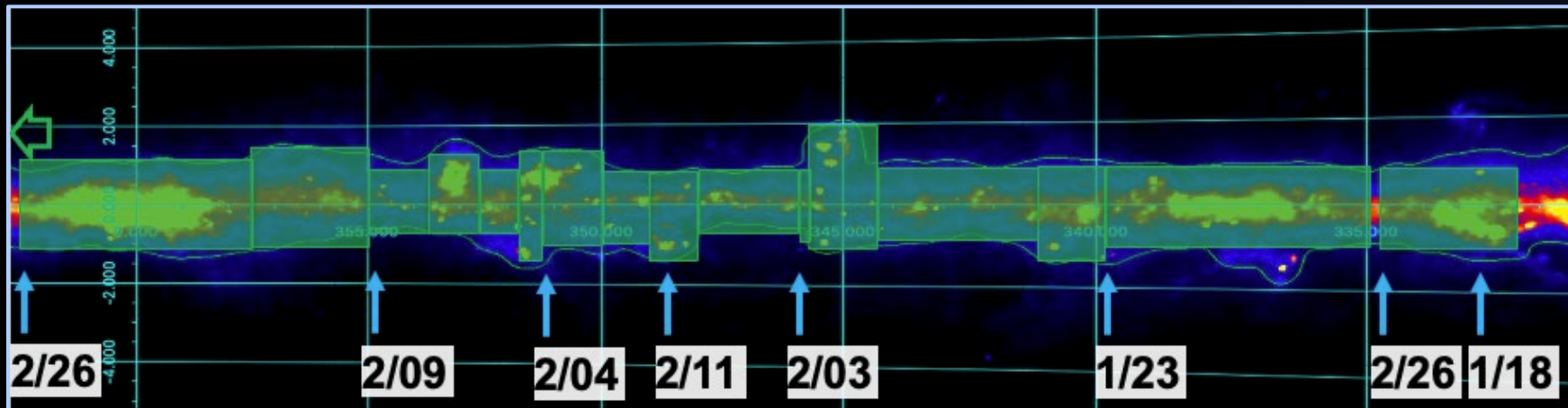


GUSTO

- The GUSTO mission had a very successful flight, launched on a zero pressure balloon from McMurdo late in the Antarctica season Dec. 30, 2023.
- The balloon flight 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^2 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.

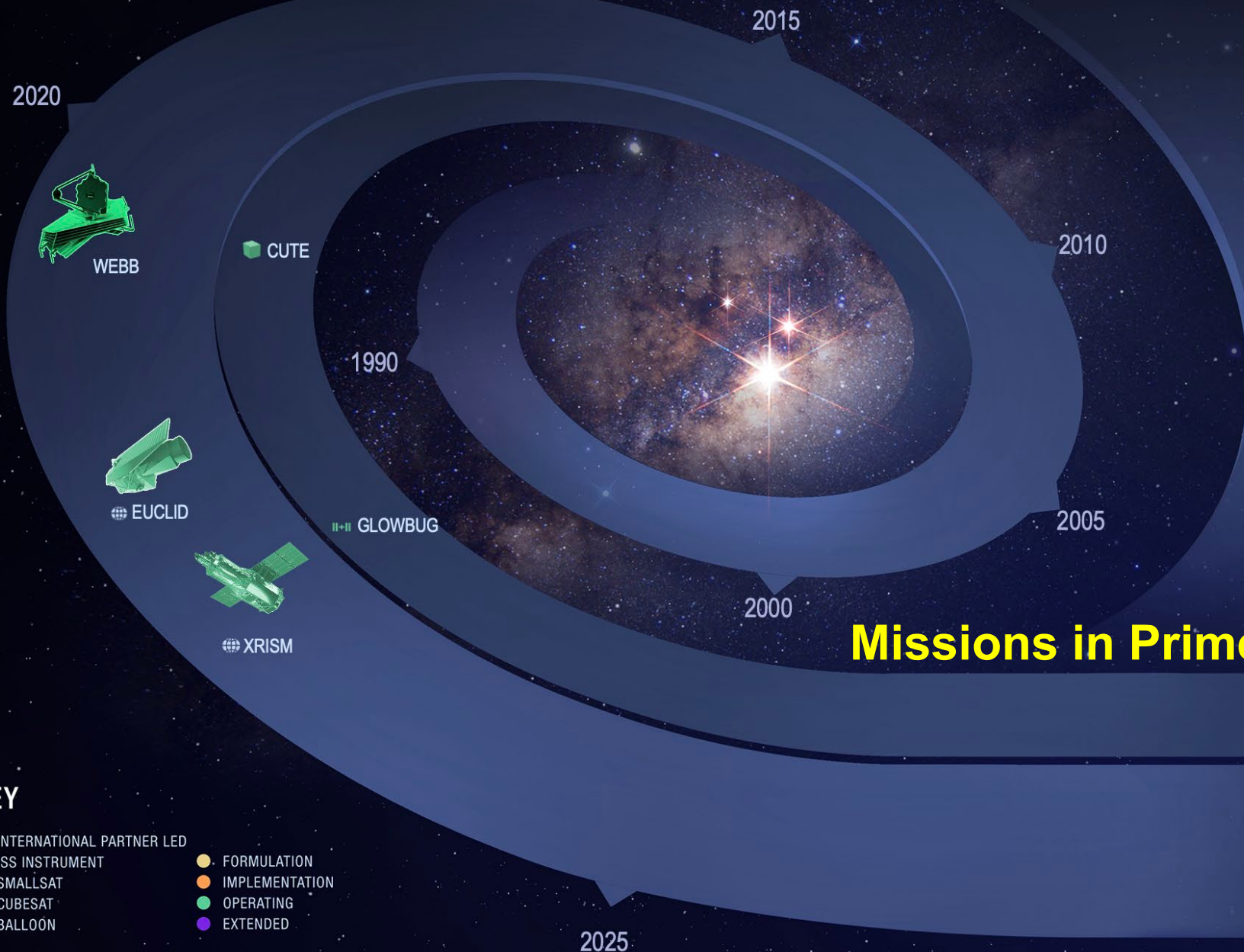
Senate Report Language - Habitable Worlds Observatory

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



KEY

- INTERNATIONAL PARTNER LED
- ISS INSTRUMENT
- SMALLSAT
- CUBESAT
- BALLOON

- FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED

National Aeronautics and
Space Administration



ASTROPHYSICS FLEET

PRE-FORMULATION

PROBE ~2030
ATHENA EARLY 2030s

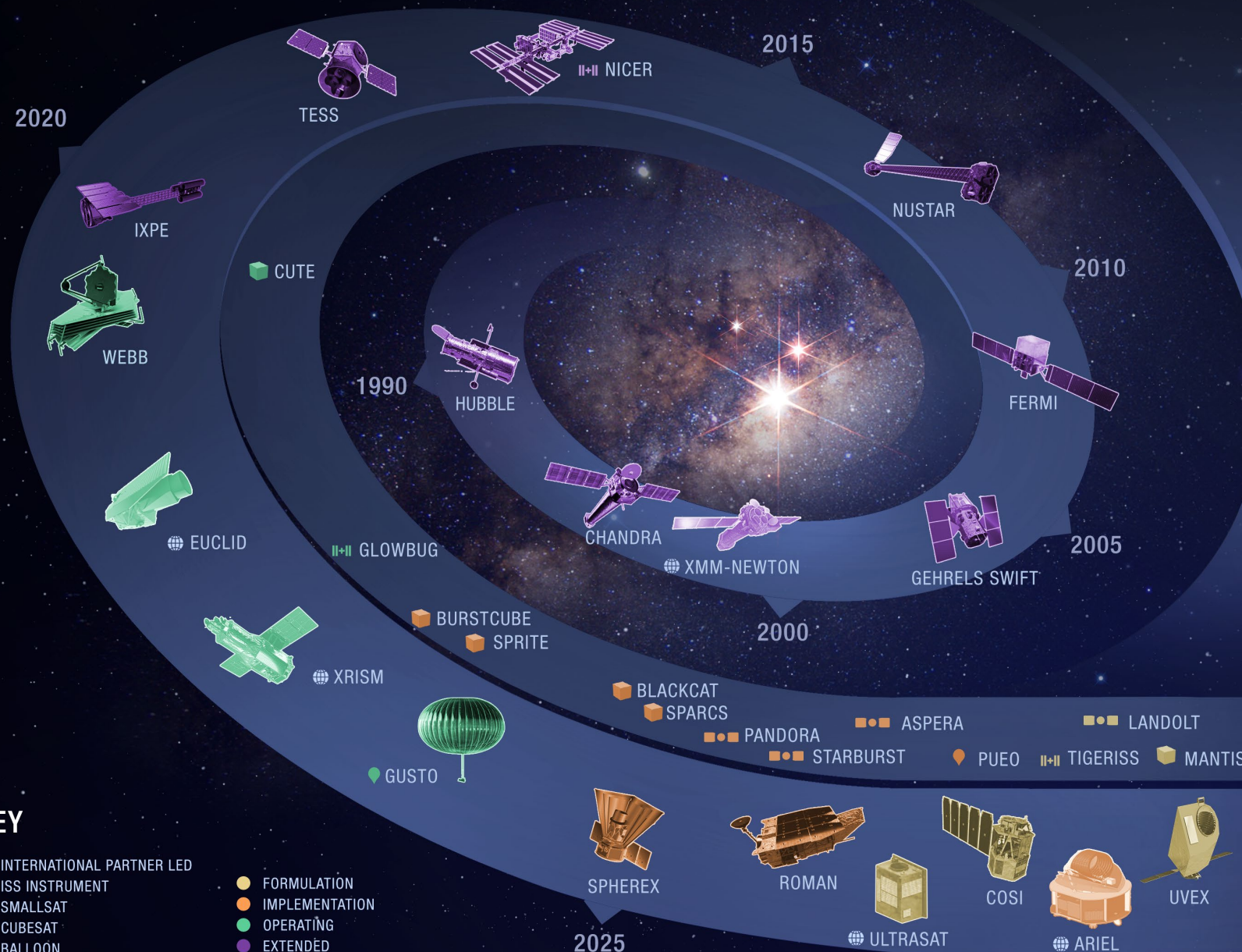
VERY SMALL MISSIONS

TRADITIONAL MISSIONS

KEY

- INTERNATIONAL PARTNER LED
- ISS INSTRUMENT
- SMALLSAT
- CUBESAT
- BALLOON

- FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED



FY25 President's Budget

	Actual 2023	CR 2024	Request 2025	2026	Out-Years 2027	2028	2029
Astrophysics	\$1,510.0		\$1,578.1	\$1,587.0	\$1,613.6	\$1,647.1	\$1,673.4
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

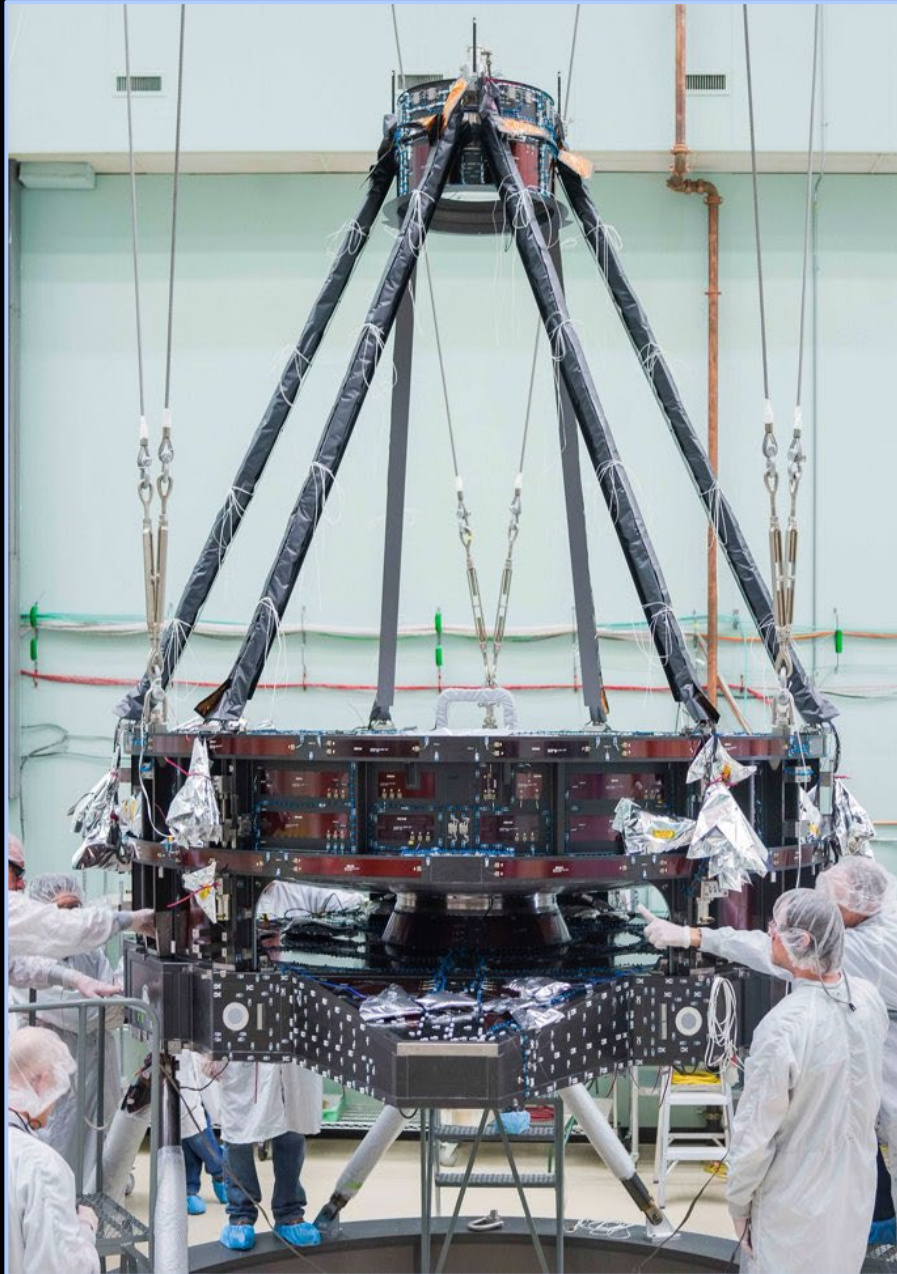
Explore/Innovate/Partner/Inspire

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 Mini-Senior Review of the Chandra and HST missions in 2024. The Review 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 Chandra missions under the current and future budget realities. NASA will use the findings to:

- Define an implementation approach consistent with astrophysics strategic objectives,
- Prioritize the operating mode(s),
- Provide programmatic direction to the missions and projects concerned for FY25, FY26 and FY27; and
- Issue initial funding guidelines for FY28 and FY29 (possibly to be revisited in the 2025 Senior Review).

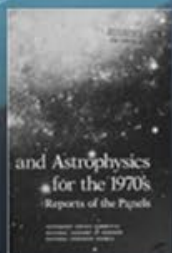
NASA actions resulting from the review could include authorizing a mission to; maintain the status quo; restructure the project; or terminate an ongoing science mission.

Mission Progress

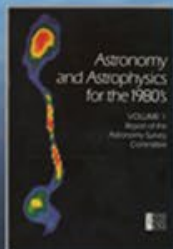


Astrophysics

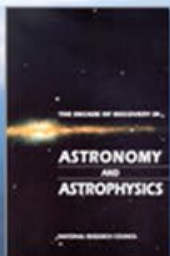
Decadal Survey Missions



1972
Decadal Survey
Hubble



1982
Decadal Survey
Chandra



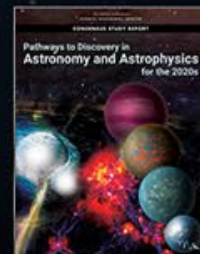
1991
Decadal Survey
Spitzer



2001
Decadal Survey
Webb



2010
Decadal Survey
Roman



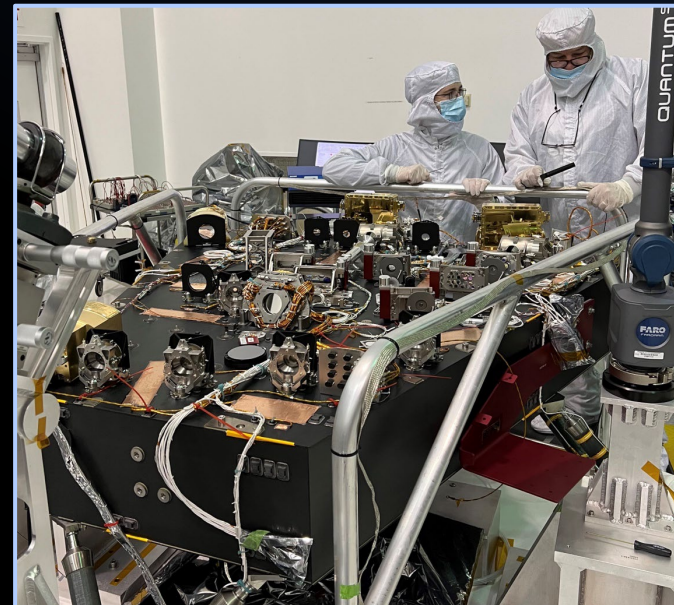
2021
Decadal Survey

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

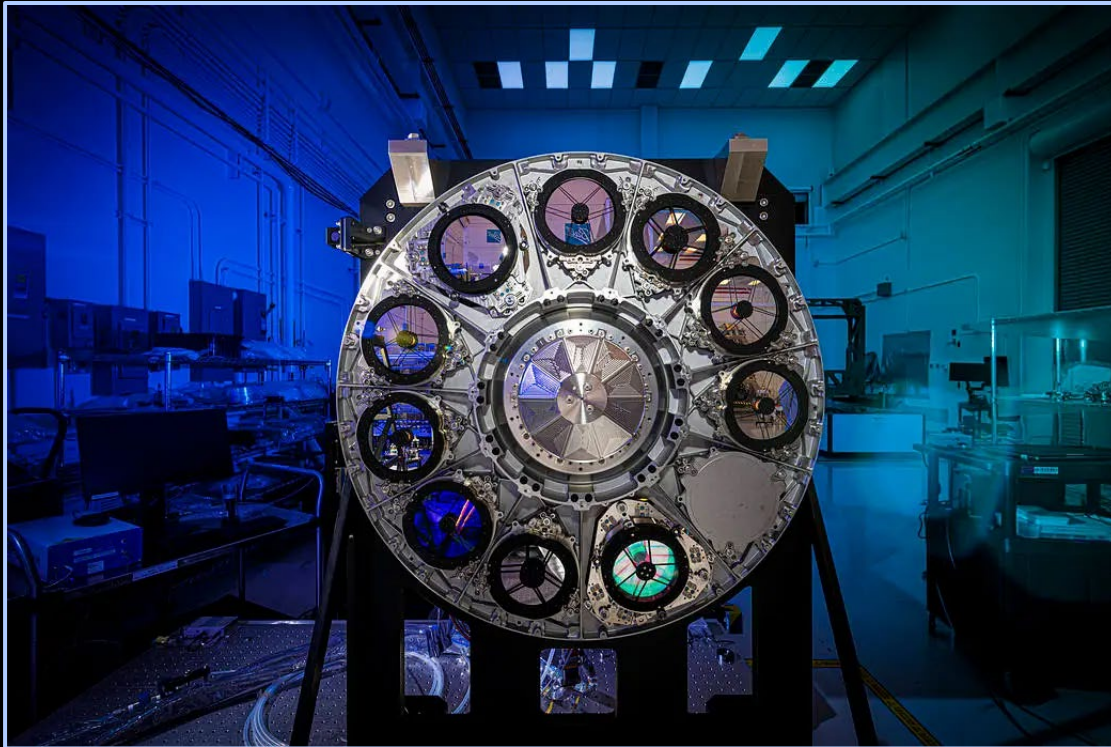
CGI is now in thermal vacuum testing



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)

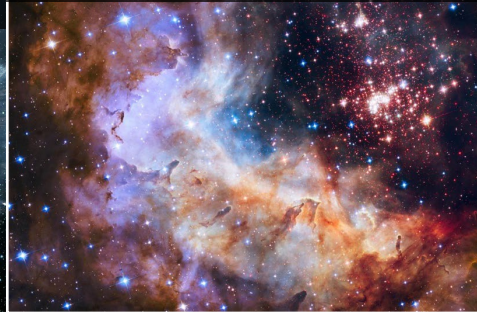
Nancy Grace Roman Space Telescope: Science Areas

22

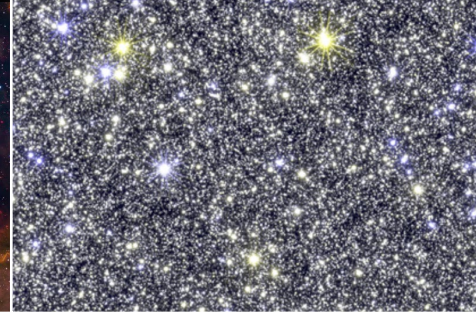
Gravitational Wave Counterparts



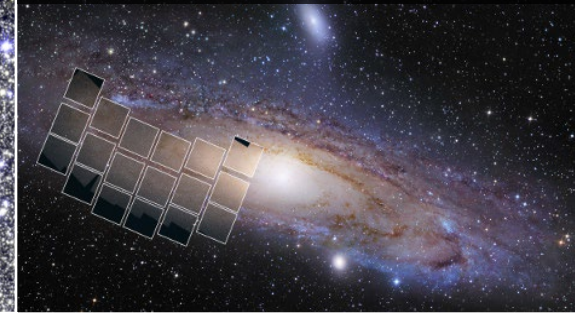
Stellar Nurseries



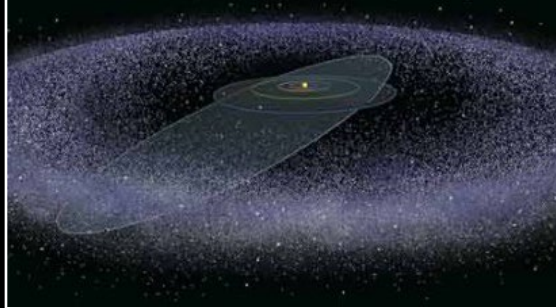
Asteroseismology



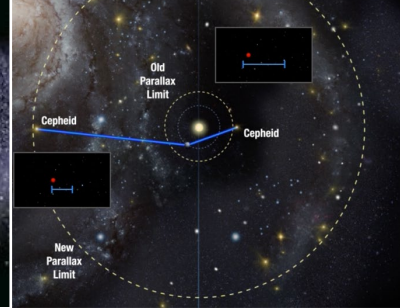
Resolved stellar populations



Mapping the Kuiper Belt



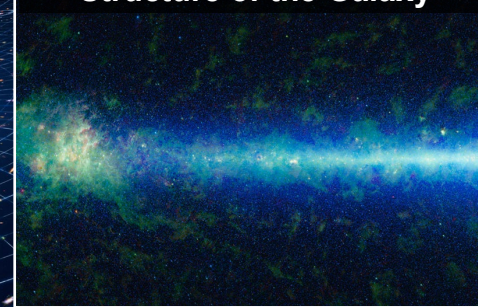
Precision Astrometry



Evolution of the Universe



Structure of the Galaxy



Universe of galaxies



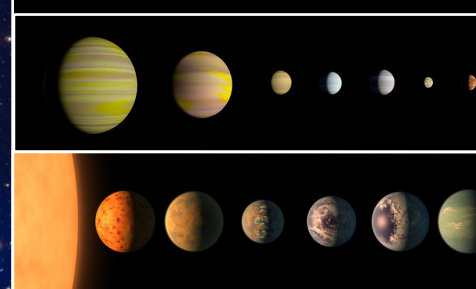
How galaxies assemble



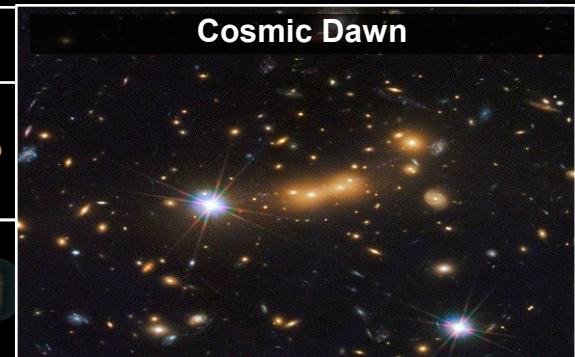
Mapping dark matter



Planetary system diversity



Cosmic Dawn

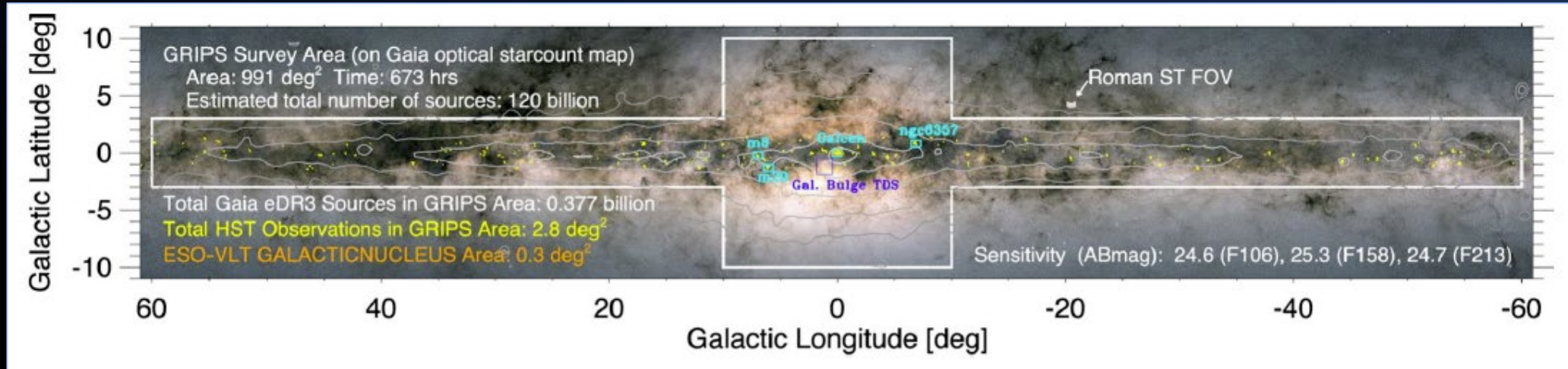


Roman Observing Program

- **Core Community Surveys:** Revolutionary surveys of unprecedented scale to address Astro2010 objectives
 - Three Large Surveys: Community owned and community defined
 - Survey definition committees formed to work with community to maximize overall science return
 - **High Latitude Wide Area Survey** (Chairs: Risa Weschler, Ryan Hickox)
 - **High Latitude Time Domain Survey** (Chairs: Masao Sako, Brad Cenko)
 - **Galactic Bulge Time Domain Survey** (Chairs: Jessie Christiansen, Dan Huber)
- **General Astrophysics Surveys:** Significant fraction of observing time set aside for other infrared surveys
 - Defined via competitive GI program and/or additional community processes
 - Completed community process to evaluate the science value of defining a GA Survey
- **Coronagraph Instrument:** 3 month observing allocation within the first 18 months of the mission
 - Top priority is to verify technical requirements (TTR5); expect to need 2-4 weeks (15-30% of allocation)
 - Remaining allocation available for expanded technology demonstration and scientific targets
 - CPP (Community Participation Program team) will facilitate community engagement

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

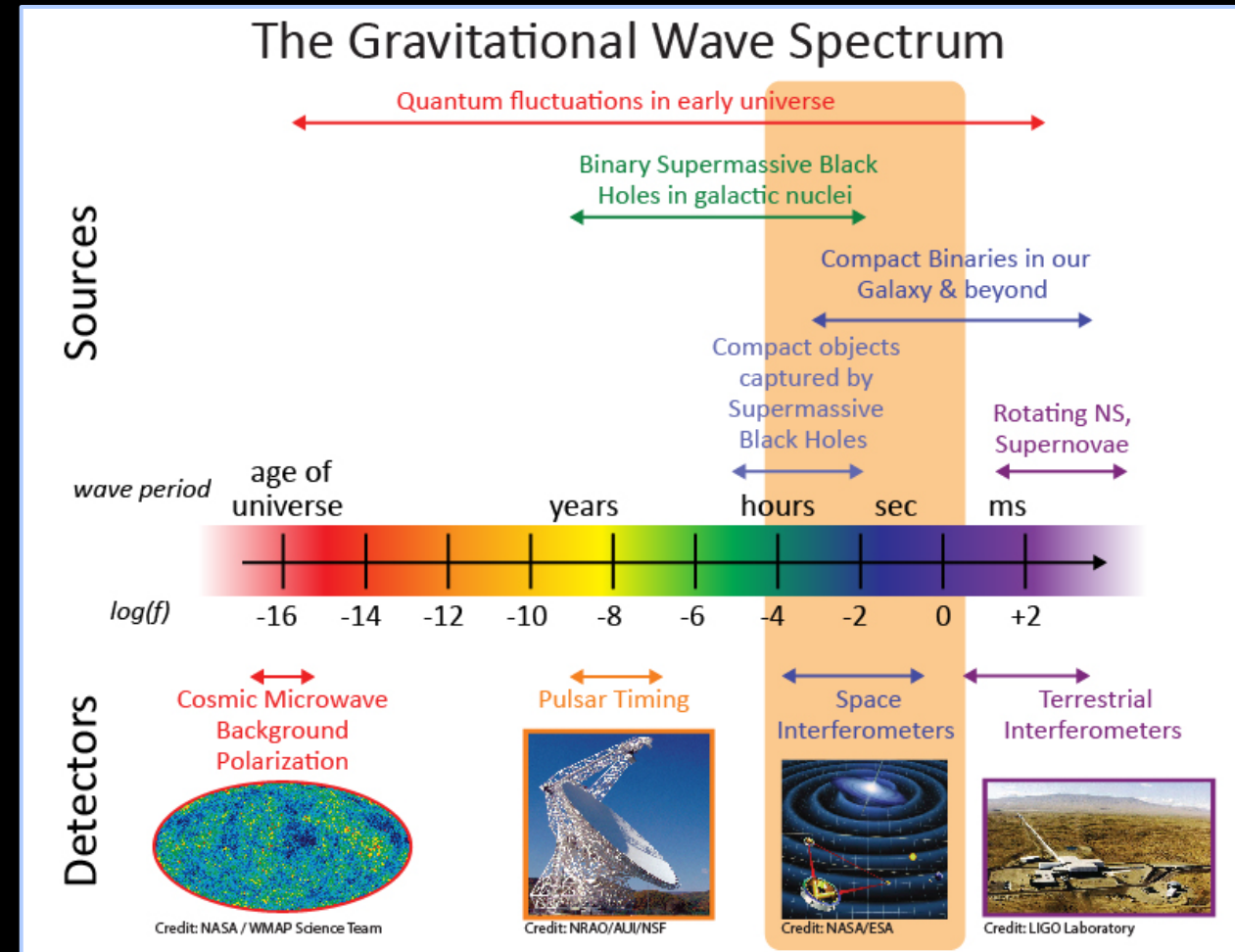
LISA

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

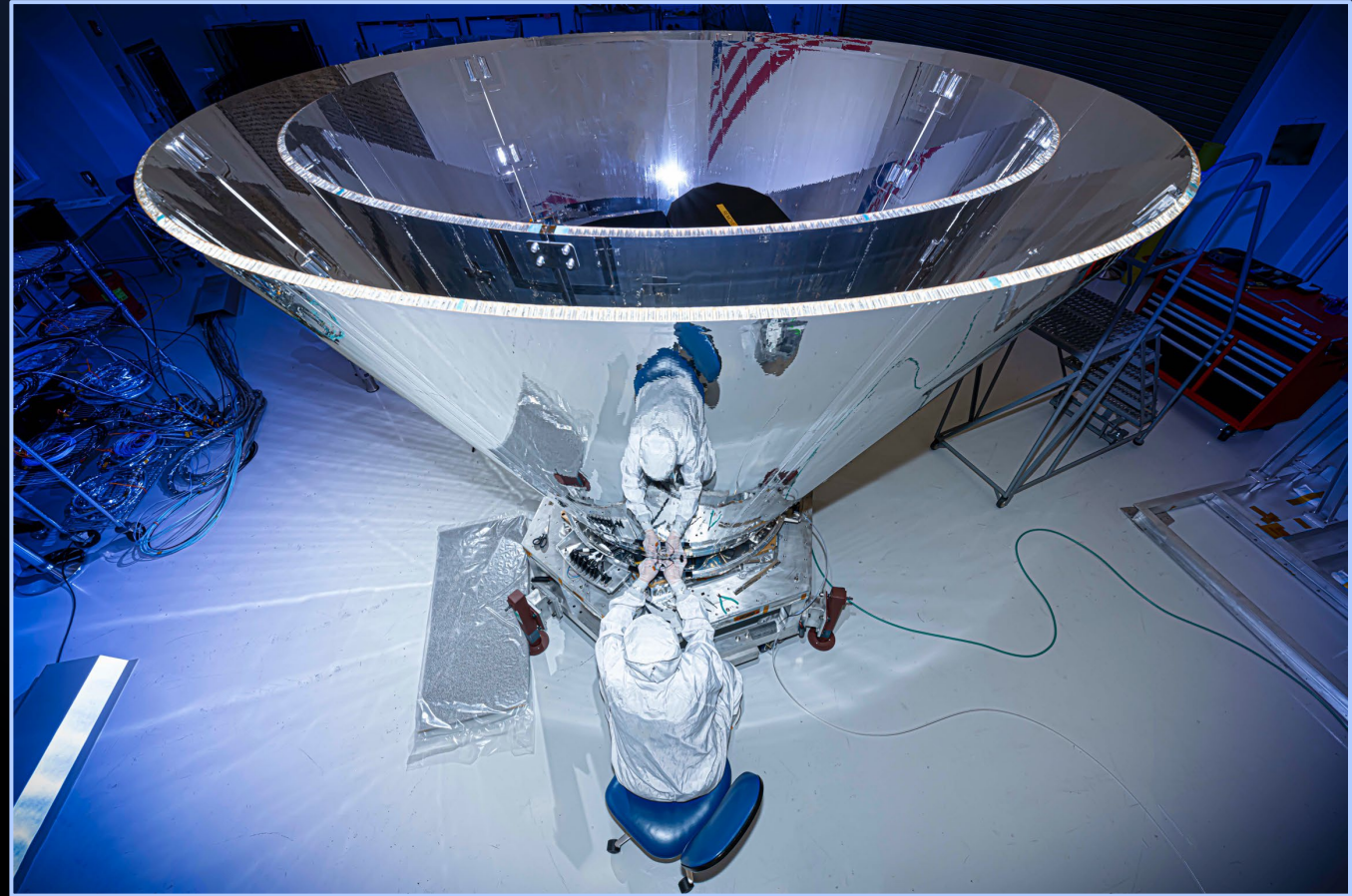
SPHEREx

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

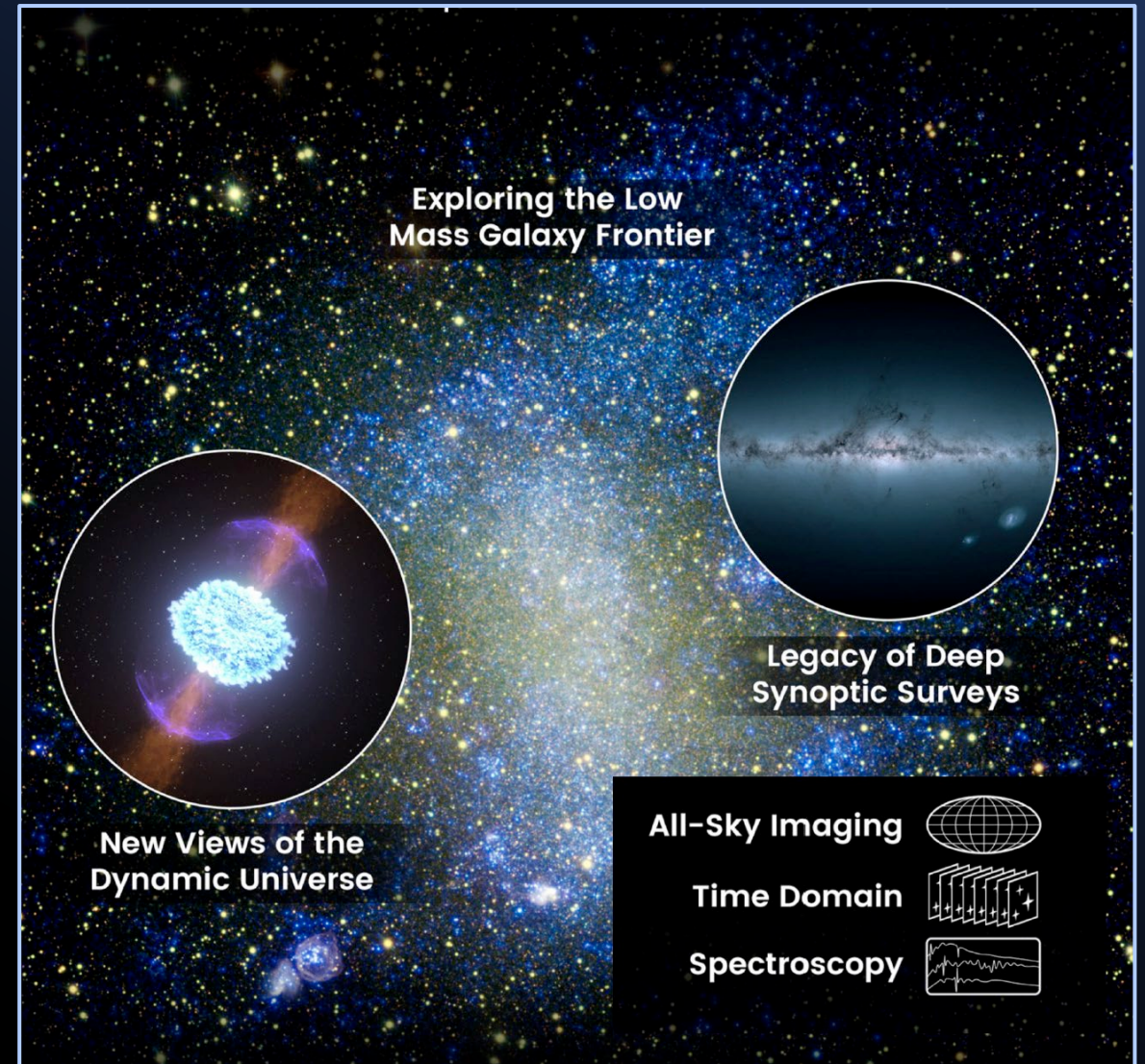
- MA LRD remains February 2025. Agency LRD remains April 2025.
- ORR is scheduled for September 15, 2024.



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)

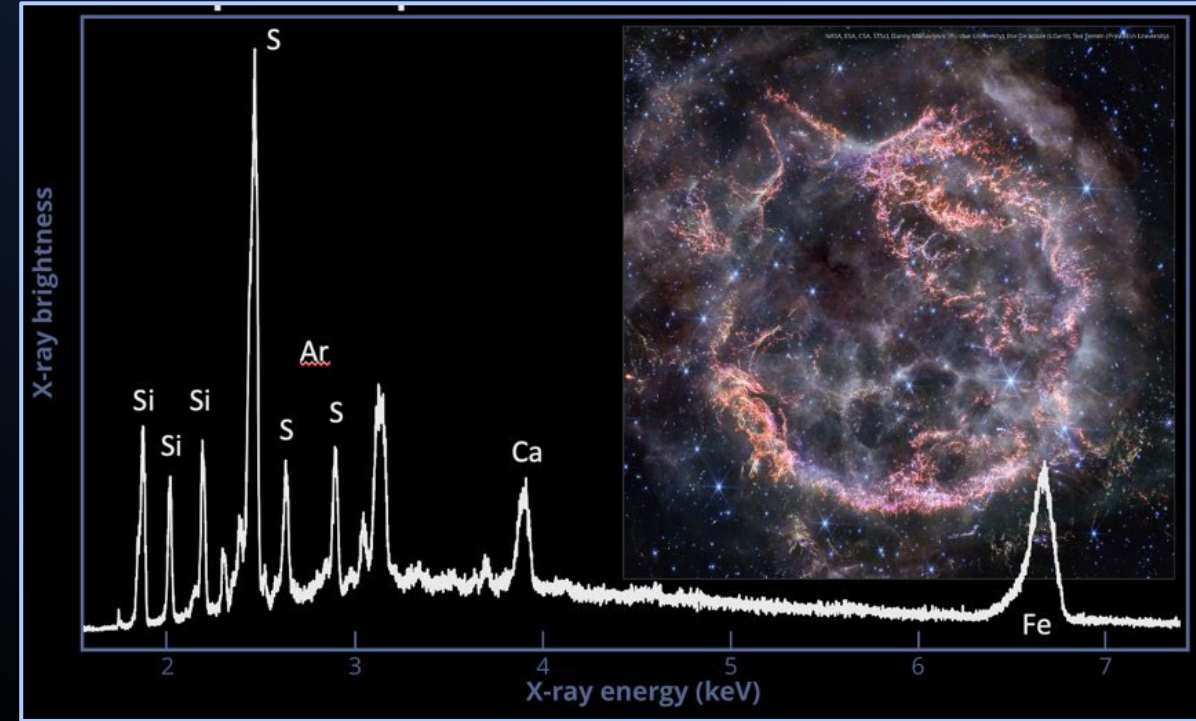
MIDEX Selection: UVEX

- 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



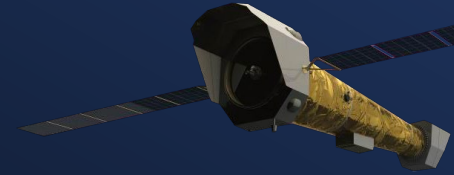
*Image by Jim Willis, courtesy of Northrop Grumman Corporation
½ Space Systems; background image courtesy of European
Southern Observatory*

Pioneers

- Aspera: IGM Inflow/outflow from galaxies via OVI 10^5K emission line imaging. PI Carlos Vargas
 - Launch date: October 2025
- Pandora: Multiwavelength Characterization of Exoplanets and their Host Stars
 - Launch date: March 2025
- StarBurst: Gamma-ray ASM, Simultaneous detection of NS/NS mergers with LIGO
 - Launch date: July 2025
 - CDR scheduled for April, 2-3, 2024
- PUEO: A Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies
 - Launch date: December 2025 in Antarctica
- TIGERISS: Measuring ultra-heavy (r-process) cosmic rays on ISS
 - Launch date: September 2026
 - Delta SRR/MDR completed on February 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 remains 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.

Probes

Astrophysics Probe Announcement of Opportunity (AO)

- Astro2020 specified X-Ray or Far-IR imaging/spectroscopic science program for this first Probe mission

Key proposal 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

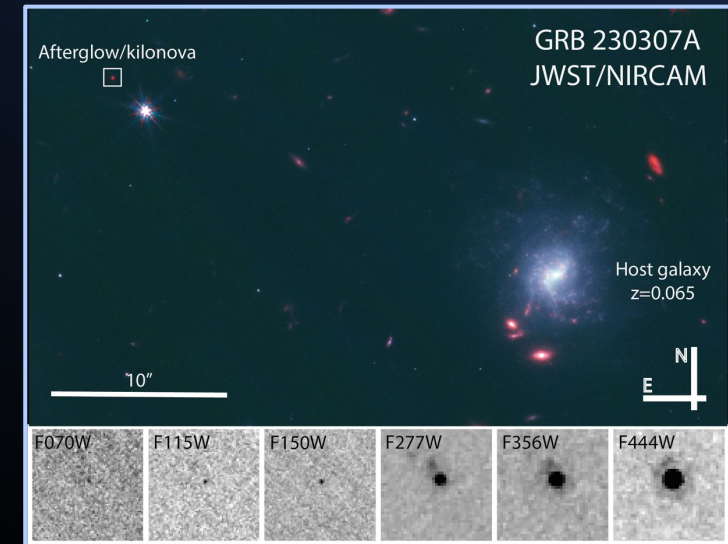
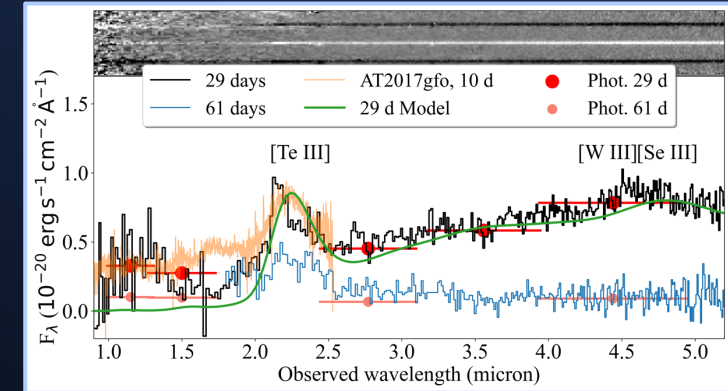
Time Domain and Multimessenger Astronomy

- **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; 2nd 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

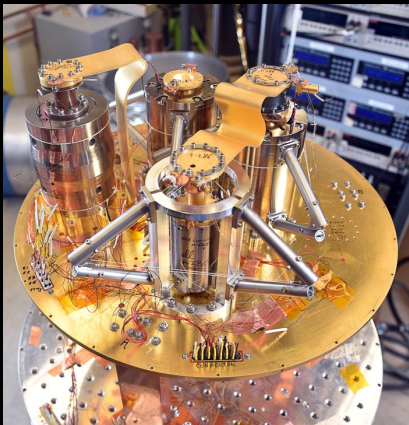
JWST observations of GRB 230307A reveal a kilonova associated with a long GRB and significant r-process nucleosynthesis

- **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 –survey / transient capabilities
 - **UVEX:** See previously discussed
- **LVK O4 Run:** Began May 2023; *Swift* “zero latency ToO” follow-up capability tested, for use with early-warning GW candidate alerts



Technology Development and Maturation

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...

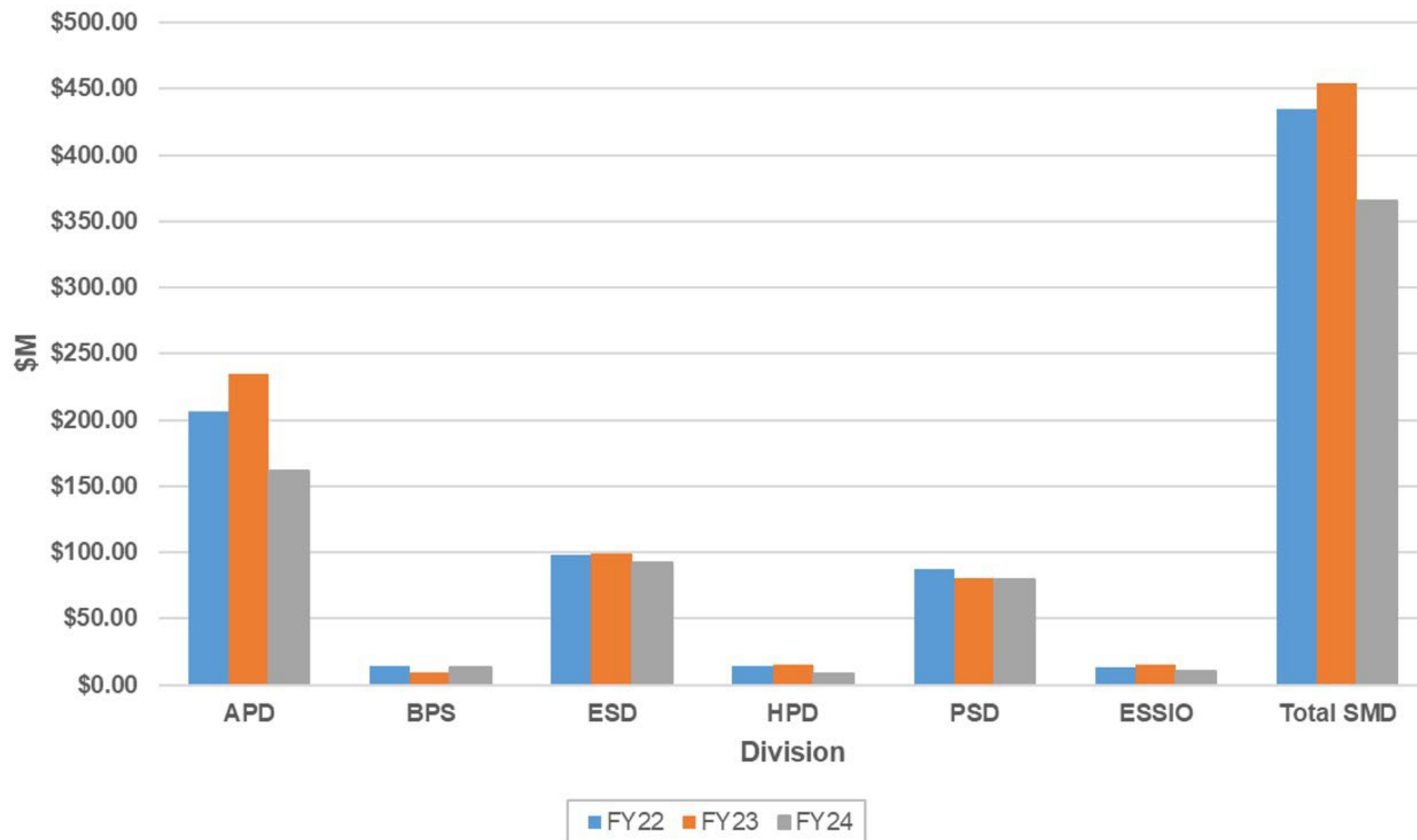


Workforce: Three new Roman
Technology Fellows in 2023

**Upcoming
Deadlines**

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

SMD Technology Development Funding (by Division)

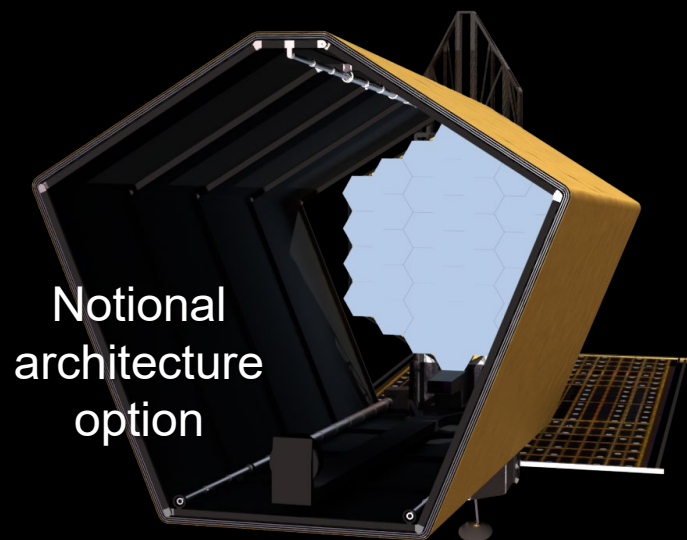
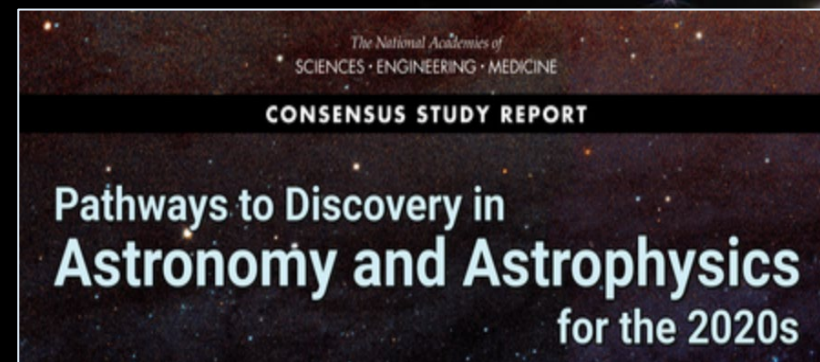


GOMAP / HWO Update



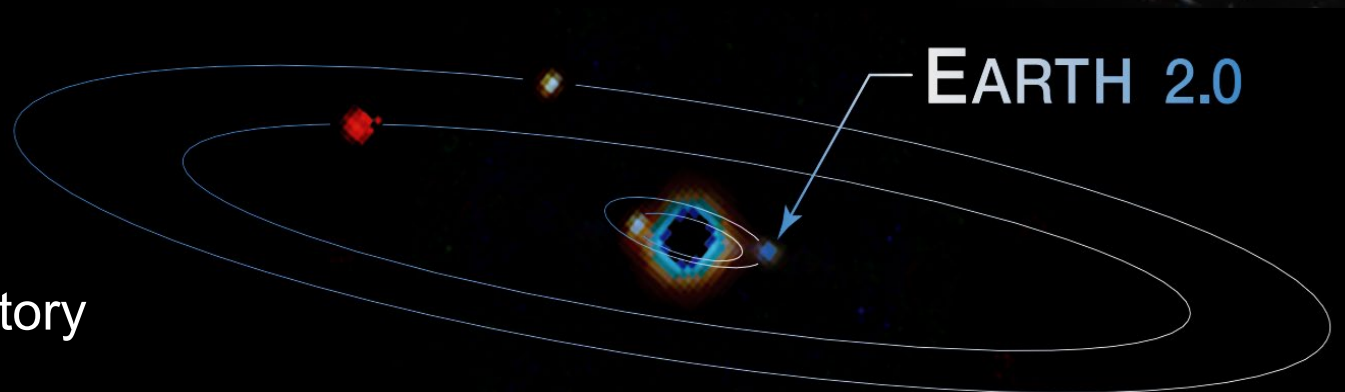
What Is Habitable Worlds Observatory (HWO)?

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



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

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



Implementing HWO's GOMAP Phase

41

MILESTONES

GOMAP
Established

START & TAG
Formed

Initial Working
Groups
Formed

HWO START, TAG,
& Working Groups

Concept
Maturity
Level 3

Status
Review

DEFINE MISSION-DRIVING
TRADE SPACES &
HOW TO EXPLORE THEM

WE
ARE
HERE

ACTIVITIES

Begin Decadal Survey implementation

Solicit & select initial START & TAG members

Develop precursor science & technology calls

Communicate GOMAP approach with HWO

Investigate potential science cases & identify mission drivers

Develop analytic science & engineering codes & models

Assess technology gaps & aerospace landscape

Develop technology maturation roadmaps

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

The image features a vibrant cosmic background with various celestial elements. In the upper right, there's a dark, wispy nebula with bright pink and red stars. The lower right shows a dense, colorful galaxy with blue, purple, and orange hues. The lower left has a blue and orange nebula. A large, white-outlined circle is centered in the image, containing a swirling, multi-colored nebula. The word "QUESTIONS?" is written in white, bold, sans-serif capital letters across the center of this circle.

QUESTIONS?



THANK YOU!