STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

STScI Town Hall

Nancy Levenson, Stacey Bright, Claire Murray

AAS June 2024

Space Telescope Science Institute

- Founded to connect astronomers to missions and to enable science
- Perform science and mission operations of NASA astrophysics flagships
- Conduct research in astronomy and related technology

Overview

Agenda:

- General STScI updates including HST (Nancy Levenson)
- JWST (Stacey Bright)
- Roman Science Platform (Claire Murray)
- Q&A

Reminder: Slack channel #317-stsci-town-hall for questions

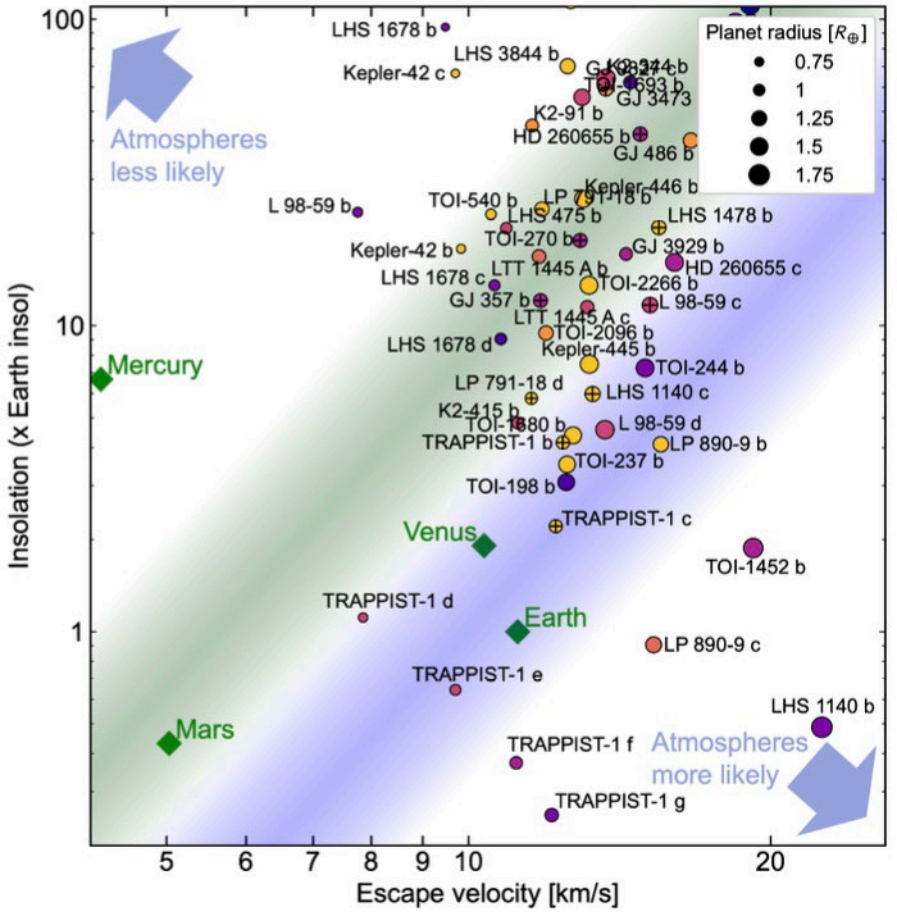
Visit the STScI booth throughout for details about all these topics, work with your data, find job opportunities, and more!

Community input on strategic programs

Exoplanets arxiv.org/2404.02932

Recommendations include

- Survey rocky worlds around M-dwarfs
  - locate the “cosmic shoreline”
  - JWST: dayside temperature in secondary eclipse
  - HST: FUV and NUV for stellar characterization
- Support community 10^4 Hour Survey
  - information about observations
  - systematic approaches
- Programmatic considerations
  - timelines, exclusive access, modelling and preparation



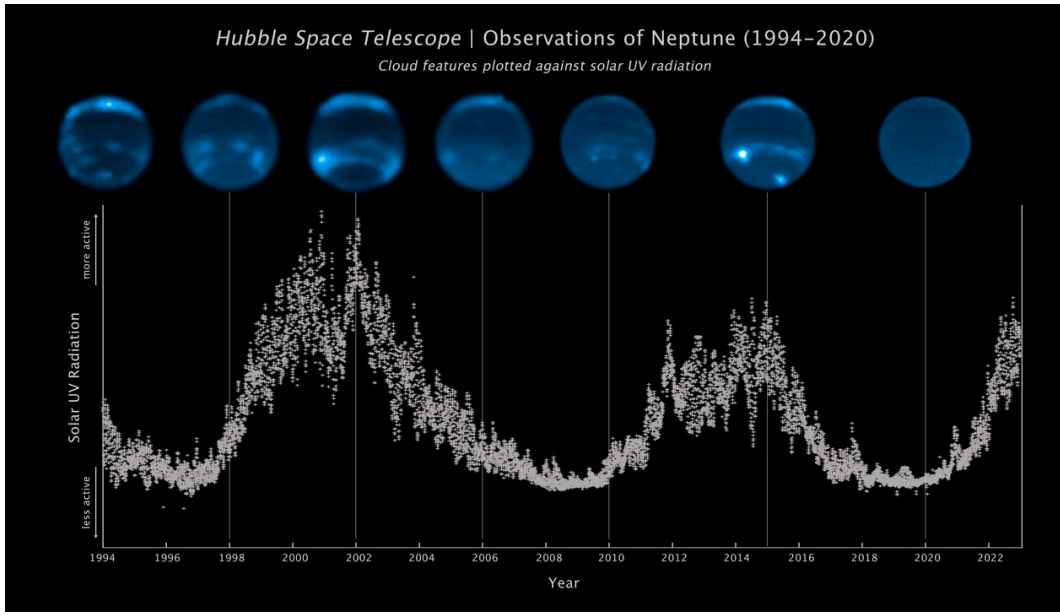
STScI Director is evaluating the recommendations

Community input on strategic programs

Long-term monitoring and variability arxiv.org/2405.12297

Recommendations include

- Enable **long-term** programs
- Dedicated TAC panel
  - high-energy transients panel in HST Cycle 32
- Review process to check progress
- Community input on JWST baseline field
- High-redshift transients—requested specific input
  - NIRCam imaging CVZ to 28 mag
  - also re-observation of COSMOS-Web
  - time available for follow-up



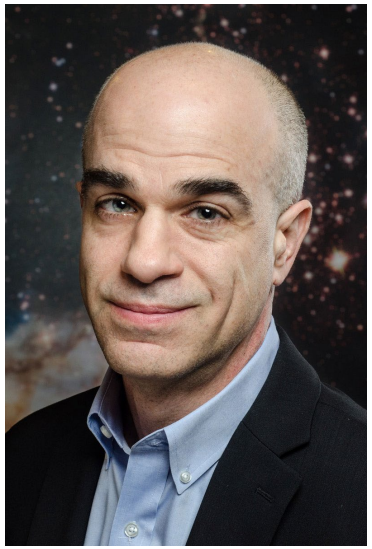
STScI Director is evaluating the recommendations

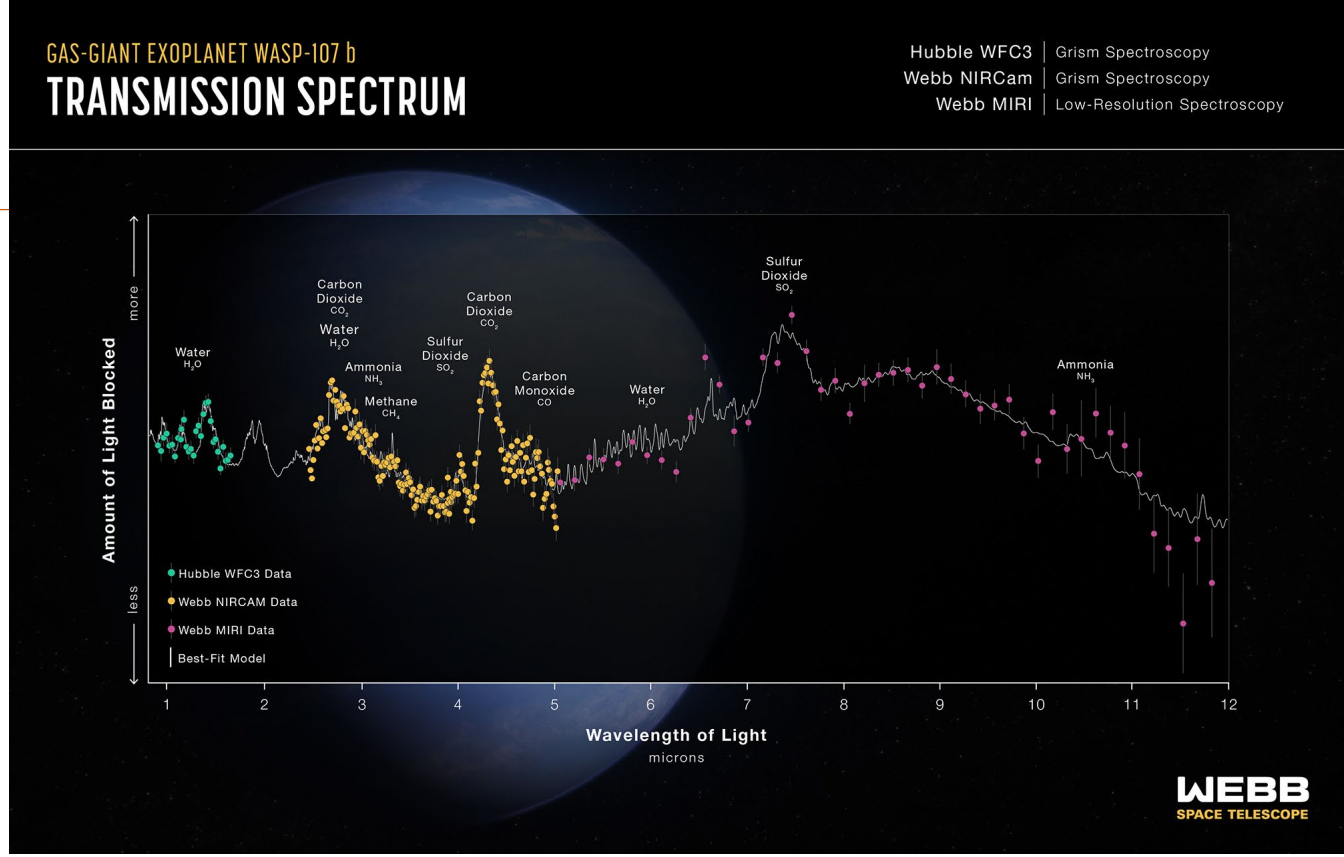
JWST updates

Fantastic science continues!

- Changes for Cycle 4:
  - shorter proposals
  - science categories revamped
- Improvements to data pipeline and analysis tools
- Communication opportunities
- More from Stacey Bright

- New JWST Mission Head Tom Brown

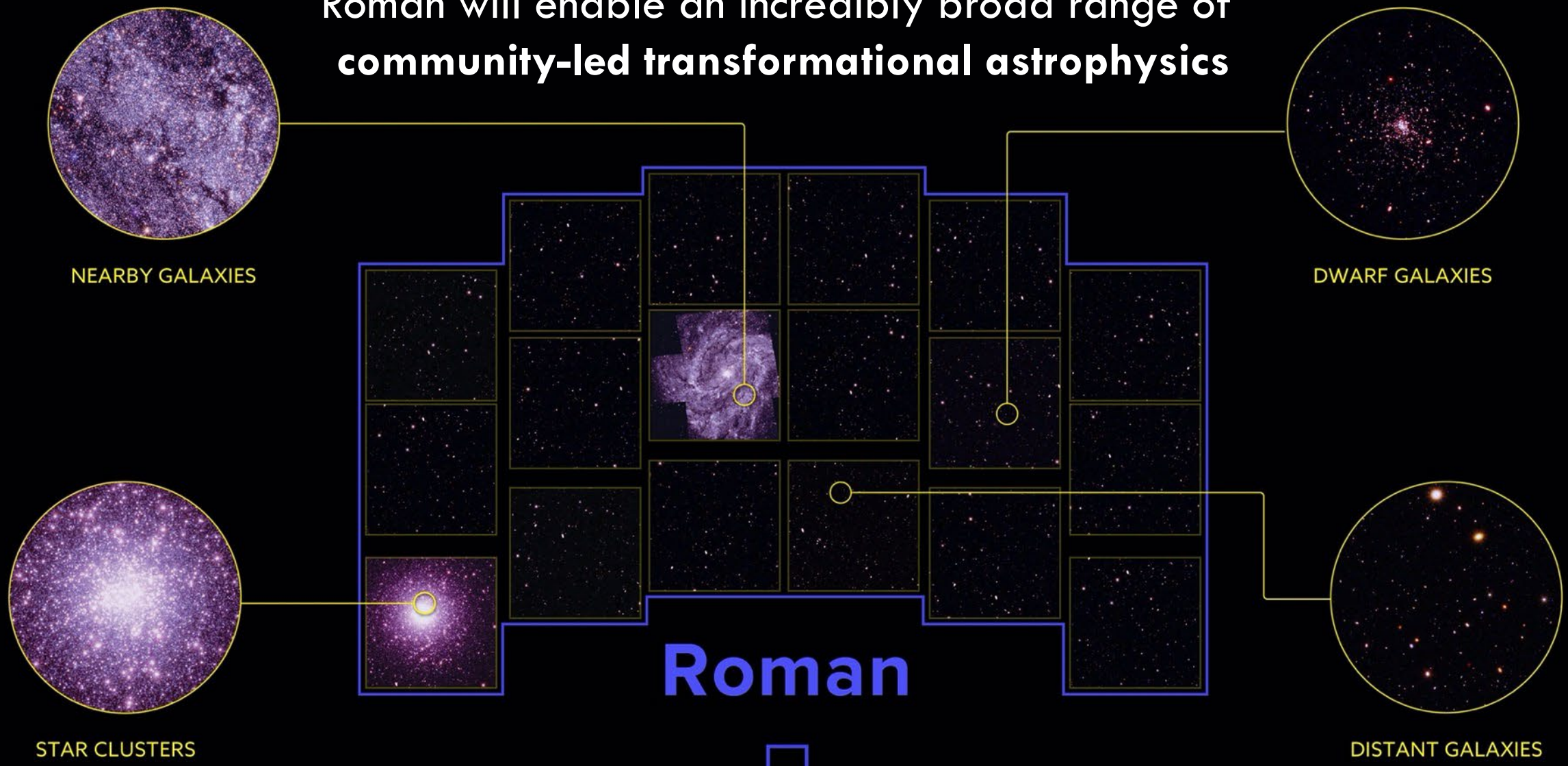




- metal-rich atmosphere
- high internal T → “tidal inflation”
- high core mass

Welbanks+, Sing+ 2024

Roman will enable an incredibly broad range of
community-led transformational astrophysics



All data immediately public

What's Happening with Roman?

Planned Launch Date: Oct 2026
Commitment Date: May 2027

- PI-led Programs & Archival Funding: *First Call for Proposals October 2025*
- Get involved at the Roman Science Forum
  - *Now*: Hear about mission updates & join working groups
  - *Coming soon*: training opportunities for the Roman APT, preview the Roman Science Platform
- Roman Data access via the Roman Science Platform with cloud compute (more from Claire Murray)
- Roman Survey definitions pre-launch:
  - Three Core Community Surveys are currently being defined by community committees
    - High Latitude Wide Area Survey, High Latitude Time Domain Survey, and Galactic Bulge Time Domain Survey.
  - Galactic Plane General Astrophysics Survey definition committee being formed
  - Roman Time Allocation Committee will provide final recommendations on survey definition options; self-nominations accepted soon
  - Implementation plans for surveys available mid-2025
- Learn about Roman & Roman tools: Rdox

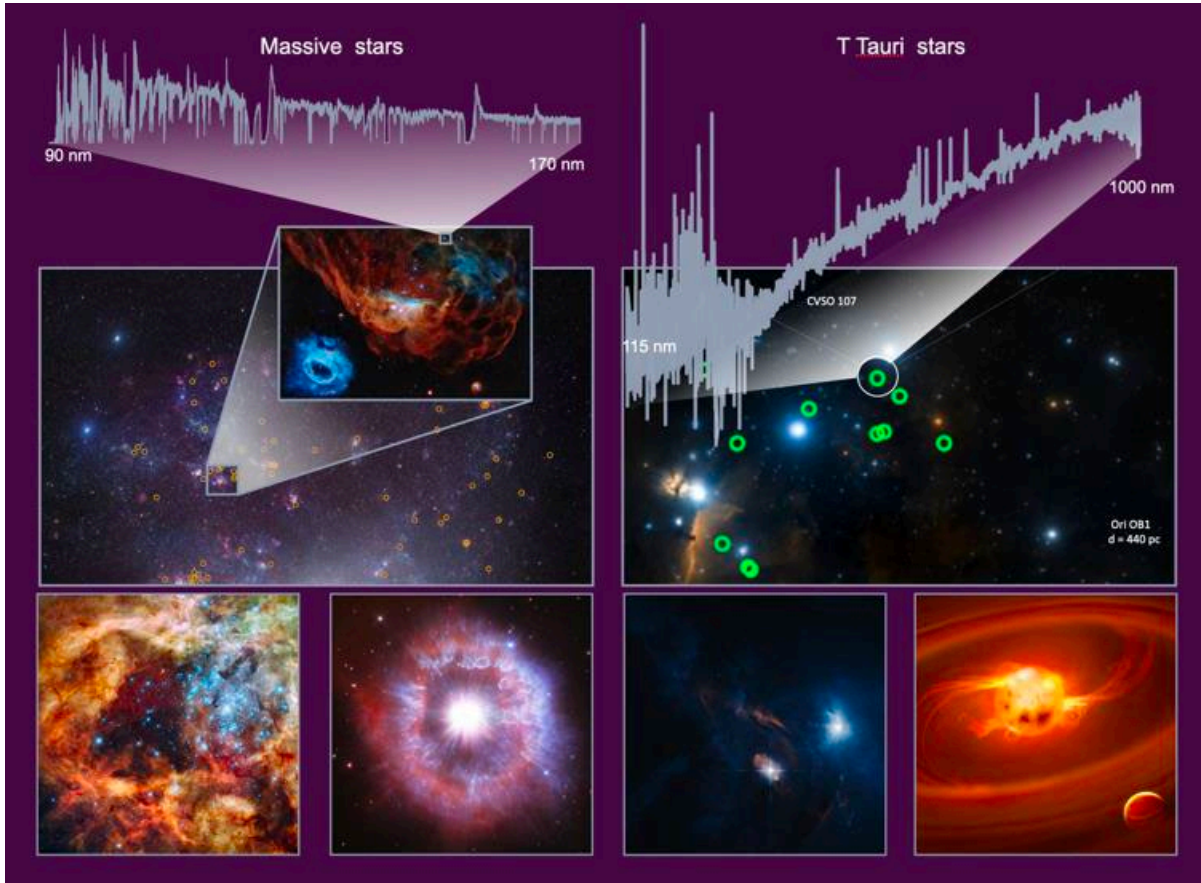
Join the Science Forum!

Latest Roman News!

Hubble updates

Fantastic science continues!

- Unique capabilities vital to NASA's flagship suite
- Scientific productivity at an all-time high
  - 1056 papers in 2023
  - overall 21,000+ papers cited 1.M+ times
- Cycle 32
  - ~6:1 oversubscription
  - Multi-cycle treasury programs
  - New high-energy transients panel
  - Flexible Thursdays
  - Results coming ~early July



ULLYSES survey complete

Hubble reduced gyro mode

Same great science data quality; longevity into 2030s

- Hubble pointing and control depends on gyroscopes
  - Previously: 3 for slewing, 1 during science
  - Now: to use 1 in all cases
    - Hubble has 2 good gyros with expected long life
- Consequences:
  - Smaller field of regard; similar sky fraction to JWST's
  - Slower tracking (no objects closer than Mars)
  - Less flexibility in orientation, scheduling, and associated science
  - Some loss of efficiency (less scheduling flexibility, slower slewing)
- Used fewer than 3 gyros 2005–2009

- Expect to begin ramping up science observations by June 17 or earlier

Gyro operations

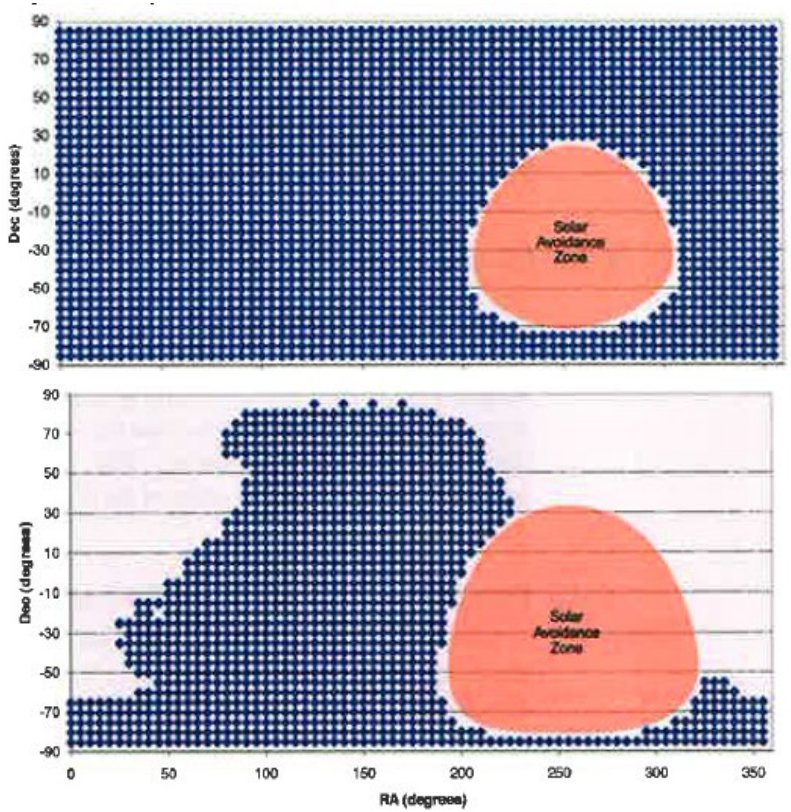
Installed 2009: 3 standard + **3 enhanced gyros**

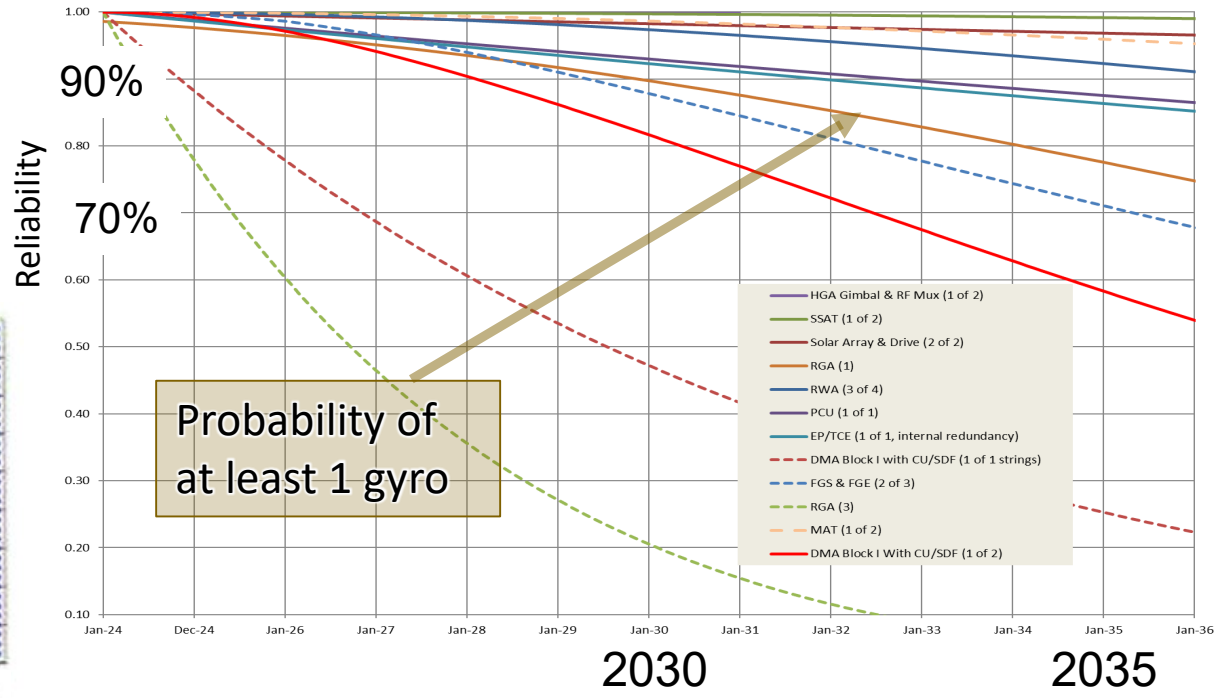
Enhanced gyros all operational – Gyro 3 has had transient stability issues

Probability > 90% at least 1 gyro through 2030

Broad instantaneous field-of-regard in3-gyro mode (full-sky excluding solar exclusion zone)

Reduced gyro mode covers fraction of sky similar to JWST, but with no loss in science performance





Scientific performance with either 1 or 2 gyros is the same as that with 3, *and since 2021, we have only used 1 gyro for science exposures*.

NASA Operations Paradigm Change Review (OPCR)

May 8 review of both Hubble and Chandra operations

> *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 useful scientific productivity and operating efficiency of the HST and CXO missions under the current and future budget realities.*

OPCR is based on NASA's need to rebalance its portfolio in the face of top-line pressures to NASA Science Budget, not Hubble science or operational performance

Hubble science productivity remain very strong, with record 2023 publications (1056) and strong Cycle 32 response (932 proposals). HST science + operations support by STScI, Goddard were top ranked in 2022 Senior Review.

Hubble principles for this review

- Maintain required mission operations
- Keep unique capabilities in UV/optical
- Support HST community through GO grants
- Support a diverse user community
  - Don’t introduce disparity in future operations

Current HST Budget Scope

Grants

- New grants and continuing multi-cycle to US investigators
- Typically supporting ~80 grad students, ~65 postdocs per year at wide range of US institutions

NASA Hubble-Einstein-Sagan Fellowship Program

- Hubble, Einstein, Sagan Fellows together
- 24 new fellows/year; ~65–70 fellows at a time

Mission operations at Goddard and Science Operations at STScI

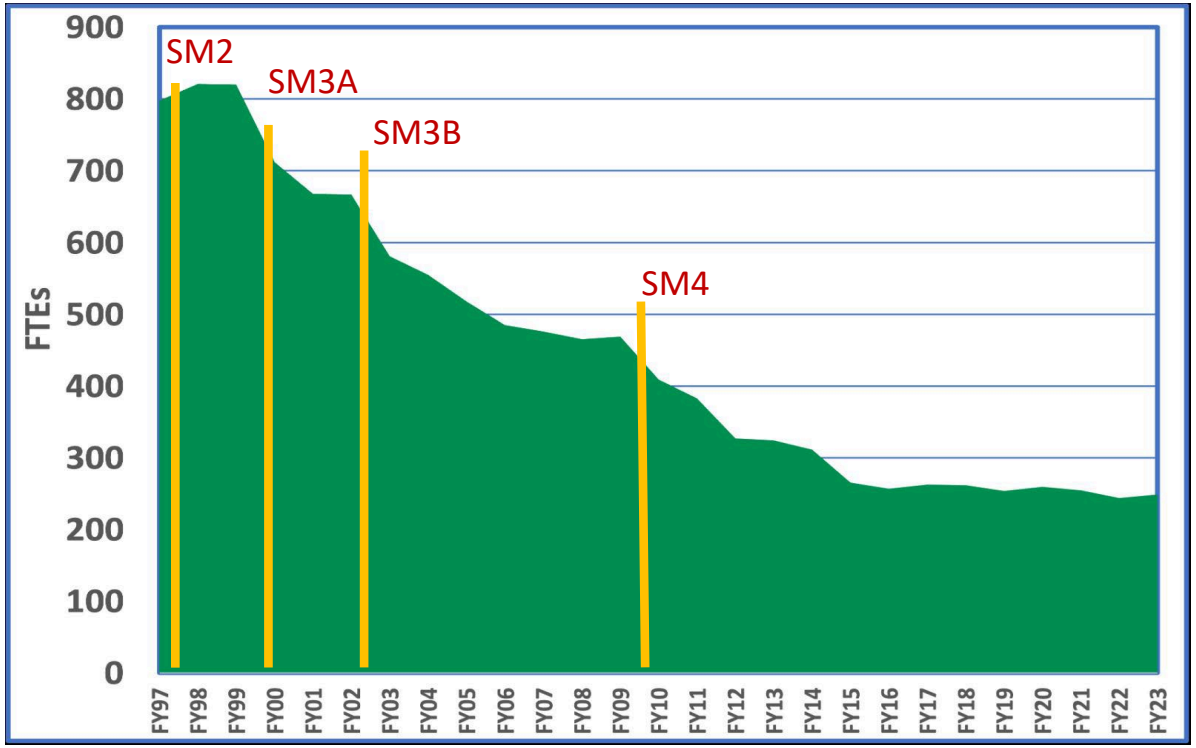
- mission operations; flight software; anomaly response
- telescope and instrument operations; commanding; health & safety
- user support; planning; scheduling
- instrument calibrations; data pipeline; archives; tools; high-level science products
- TAC; grants administration
- public outreach and engagement

Hubble budget

Fiscal Year President's Budget Request (M$)					
2024*	2025	2026	2027	2028	2029
98.3	88.9	87.5	87.8	83.0	64.7

*FY24 = Congressional budget appropriation

- 10% cut from current to FY25 request
  - plus ongoing grant commitments set with past higher budgets
- Hubble staffing has decreased by >70% since SM2
- Majority of current staff (~70%) cover basic observatory operations → incompressible
- Savings (while continuing to operate) can only be achieved by eliminating science instrument modes



Total FTEs: civil servants, GSFC contractors, STScI AURA, STScI ESA

Mikulski Archive Videos, Tutorials and Cloud Data

Subscribe to the MAST YouTube Channel

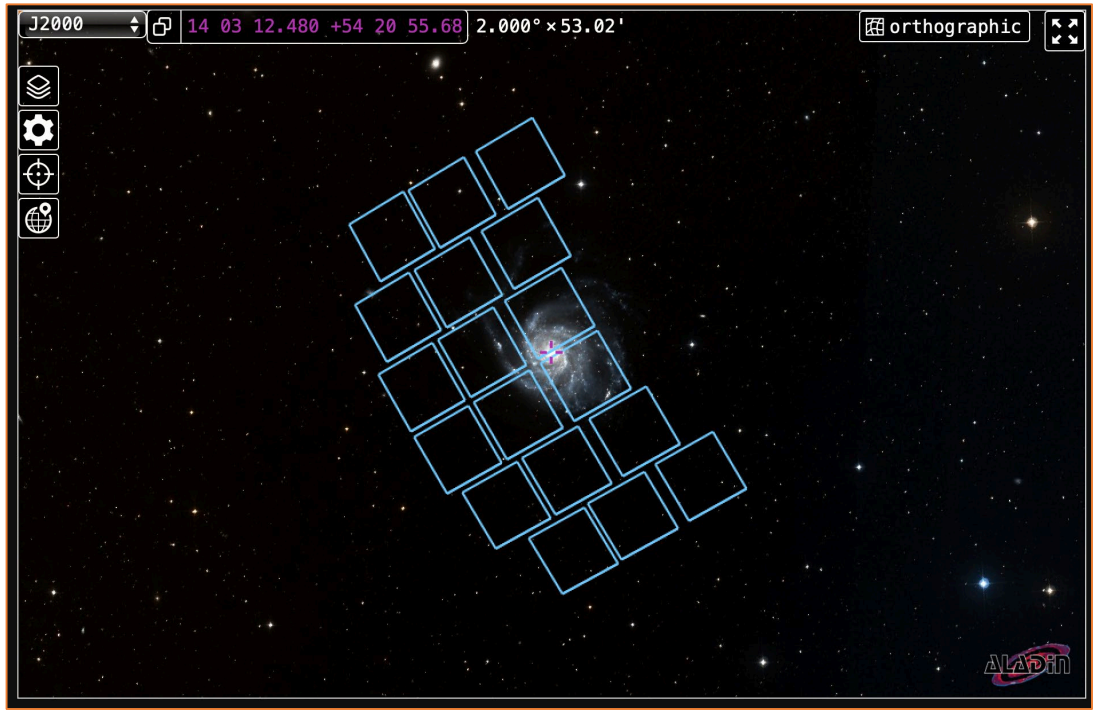
- MAST Summer Webinar videos on doing research in the cloud using the **TIKE Science Platform**
- Jdaviz demo videos showing how to visualize data
- YouTube: @STScIMAST

View Observation Footprints in a Notebook

- Quick look Notebook tutorial to view observation footprints for HST, JWST and Roman.

Directly work with MAST data in the AWS cloud

- HST, Kepler, TESS, GALEX and PanSTARRS are available in the AWS Open Data Repository.
- **TIKE science platform** will get you started.



The Roman Space Telescope's field of view (blue squares), overplotted on the spiral galaxy M101.

Habitable Worlds Observatory (HWO)

HWO, the top space-based recommendation from the Astro2020 Decadal

- large, UV/optical/near-IR telescope; high contrast (10^{-10})
- seeking biosignatures in atmospheres of Earth-like planets
- transformative astrophysics
- NASA Project Office being established

Community input on science cases

- What science goals drive technical requirements?
- Ongoing effort through open working groups involving hundreds of astronomers

If you want to do UVOIR astronomy in the 2030s, you have a stake!

To get involved, visit STScI's website:

www.habitableworldsobservatory.org

deep fields mapped 8x faster than Hubble and 4x JWST

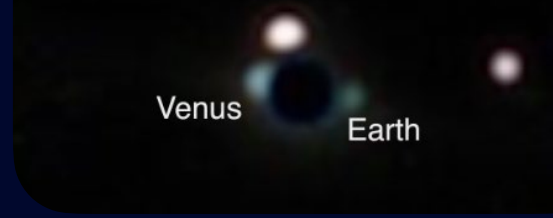
1.4 million individual shutters for intensive UV spectroscopy

precise proper motions from sub-microarcsecond astrometry

mapping the baryon cycle in emission and absorption

reliable photometry in fields 50x denser than Hubble

searching 100 star systems for “Earths”



seeking biosignatures

resolving the outer solar system as well as in-situ spacecraft

seeing all the building blocks of galaxies

29th magnitude point sources in an hour

Your idea here!

servicing to achieve leaps in instrument capabilities

www.habitableworldsobservatory.org

Backup

HST technical performance

HST continues to perform well. Its unique instruments are in high demand, and are expected to continue to deliver high quality science through the 2030s.

- 1056 science papers in 2023
- Consistent 6:1 over-subscription for new observing programs

The limiting factor for HST's lifetime is orbital decay, not telescope performance.

- Anomalies are more frequent, but in 2023, Hubble was executing the mission schedule >93% of the time.
- Even since August 2023 (onset of erratic Gyro-3), through April 2024, HST has been up >85% of the time.

The plans for 1 gyro mode are well developed and tested, with 1-gyro field of regard giving sky coverage similar to JWST's. Science quality and scope will be minimally impacted - we already operate in 1-gyro mode during science exposures.

Instrument Usage in recent cycles

Prime	C29	C30	C31	*C32**
WFC3/IR	10.4%	18.6%	4.8%	9.4%
WFC3/UVIS	22.4%	35.9%	42.8%	36.4%
STIS/FUV	13.0%	5.7%	6.4%	6.0%
STIS/NUV	7.4%	4.7%	7.5%	7.3%
STIS/CCD	5.0%	3.7%	9.4%	6.0%
COS/FUV	30.2%	16.0%	14.4%	15.8%
COS/NUV	0.5%	3.0%	4.1%	3.2%
ACS/SBC	2.3%	3.4%	0.0%	4.3%
ACS/WFC	8.8%	9.2%	10.4%	11.5%

- Prime usage statistics
  - Accepted proposals from Cycles 29, 30 & 31
  - Submitted proposals from Cycle 32
- Decrease in WFC3/IR usage post-JWST in-orbit operations (Cy 31)
- Cycle 31 aggregate statistics:
  - ~47% WFC3
  - ~23% STIS
  - ~18% COS
  - ~10% ACS

*Requested

Efficiencies from Multi-Mission Science Operations Center

- The **science operations center (STScI)** is organized as a **multi-mission institution** to **enable efficiencies** in many aspects of **science program support** (e.g., program solicitation, planning & scheduling, data archiving & distribution, grants administration) and **infrastructure** (e.g., information technology, human resources, business resources, facilities, science research & associated infrastructure).
- **Software developed for science programs** is also multi-mission (e.g., time allocation committee management, grants management, astronomer's proposal tool).
- **Diversity, equity, inclusion, & accessibility are driven across the organization by Diversity Officer**, employee resource groups, training programs, codes of conduct, and community connections. **Internships develop the STEM pipeline** through regional and international pools of students, with attention to underrepresented communities.
- While most staff are efficiently organized along tasks (e.g., planning & scheduling), **instrument support teams are aligned to specific instruments on individual missions given expertise required** (e.g., instrument calibration, instrument documentation, contact scientists, health & safety, anomaly response, instrument operations, lifetime extension).
- Even within the context of shared resources, **mission-specific work must be paid for by the mission in question**; neither JWST nor Roman cannot pay for HST instrument support, and vice versa. This is a legal contractual requirement.
- **The science operations effort in the JWST contract assumes 20% cost saving by operating alongside HST.**