



Hubble's Status and Outlook at 36 Years Young

Julia Roman-Duval
Space Telescope Science Institute

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Hubble's 2016 image of the Bubble Nebula is used as a background for the magazine's cover of the December issue featuring actor Timothée Chalamet. Cover Image Credit: Timothée Chalamet in Celine. Urban Jürgensen watch. Image of Emission Nebula, O 6.5 Star is courtesy of NASA, ESA, and the Hubble Telescope Heritage Team. *Fashion Editor: Eric McNeal. Photographed by Annie Leibovitz. Vogue, December 2025.*

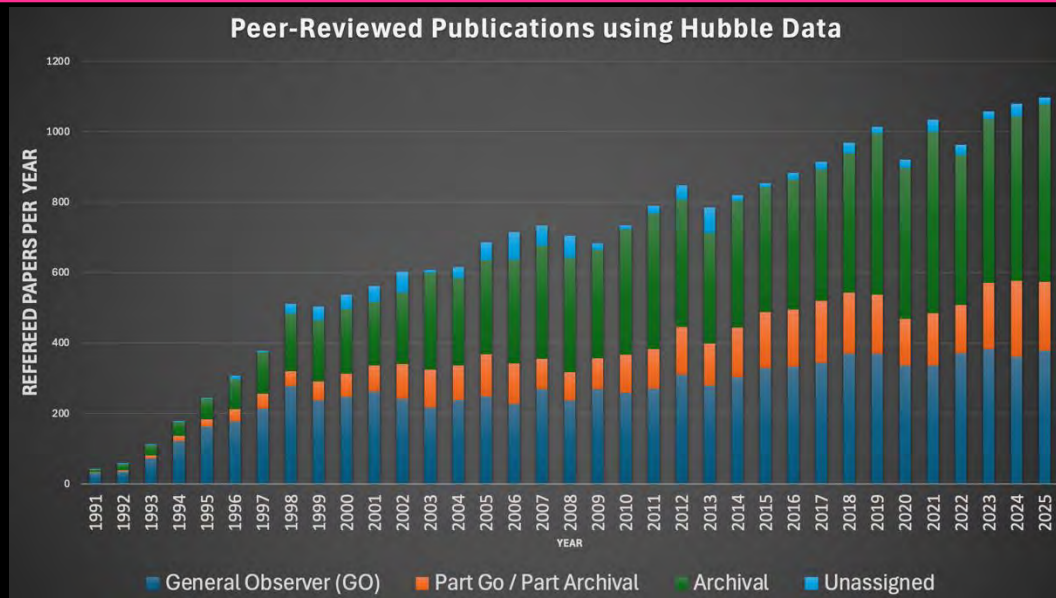
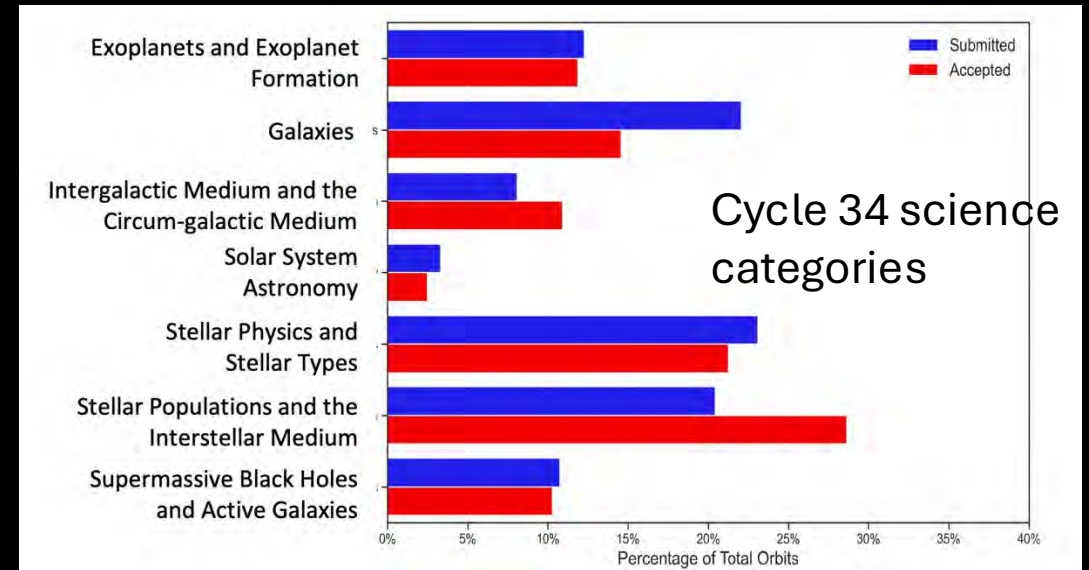
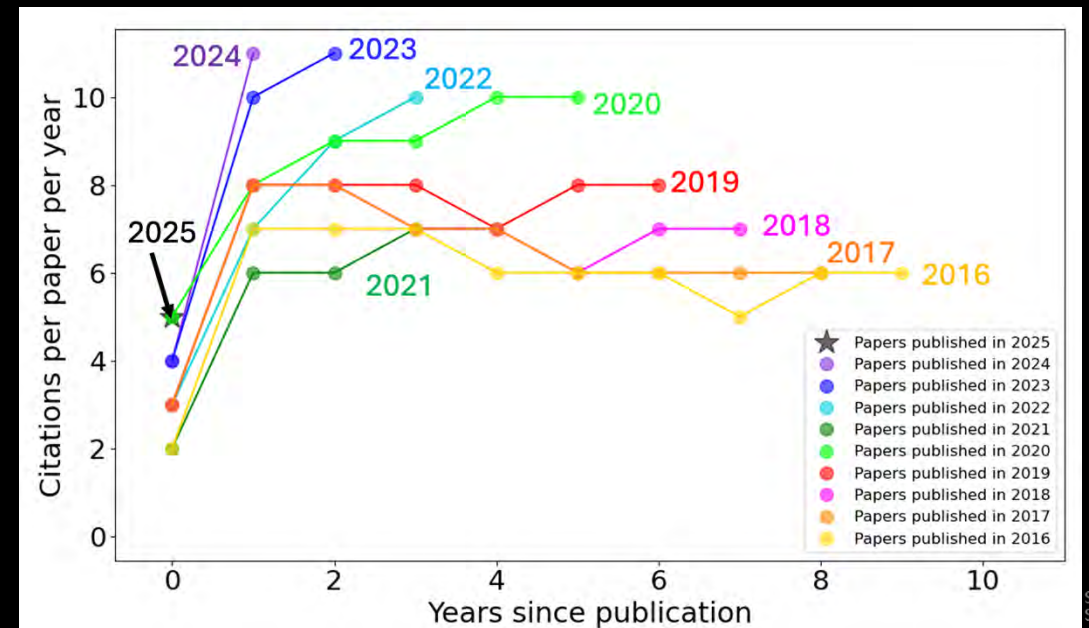




Hubble's Scientific Productivity is at an All-Time High

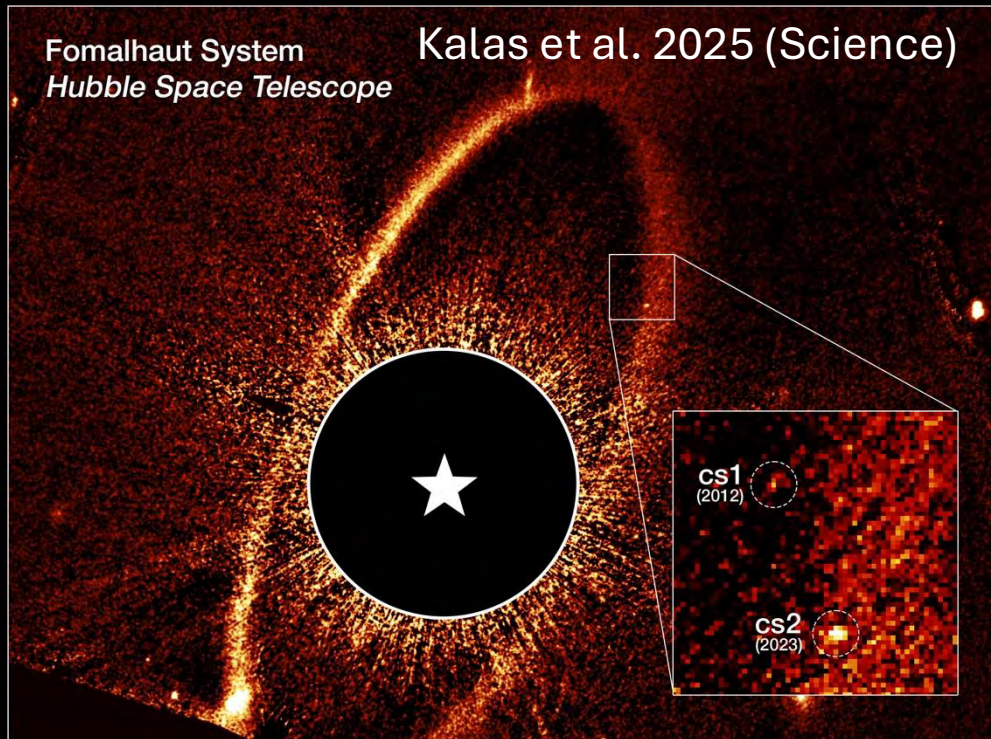
PRODUCTIVITY METRICS

- >1000 refereed papers/year (1097 in 2025)
- >23,000 papers to date
- >1.3M citations to date
- Citation rate doubled over last decade
- >1.7M observations to date
- >4000 orbits scheduled each year





Hubble Supports Planetary and Exoplanetary Science



Hubble captured a debris cloud in the Fomalhaut protoplanetary system, the result of colliding planetesimals. The previously identified candidate planet around Fomalhaut was likely also a debris cloud masquerading as a planet.

Bodewits et al. 2026 (Icarus)



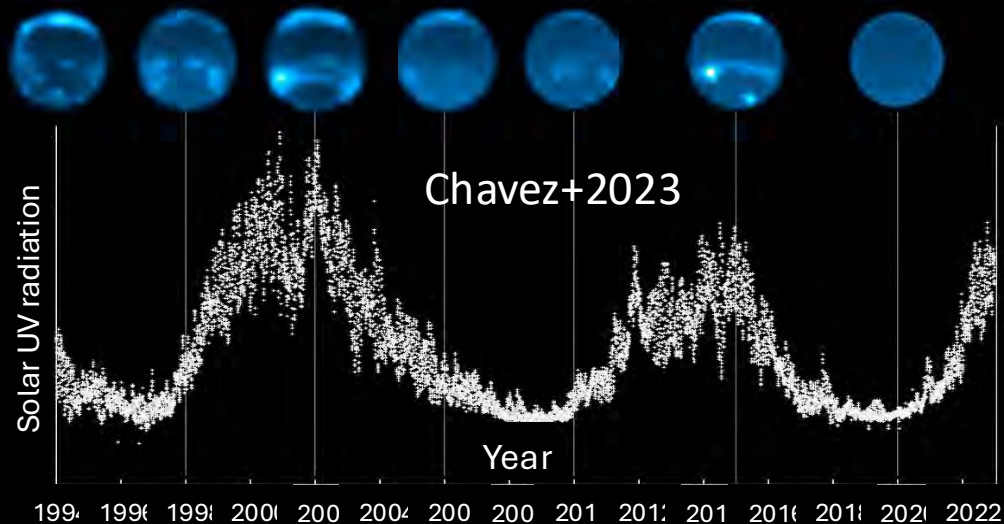
HST images of the fragmenting comet C/2025 K1 (ATLAS) were taken over the course of three consecutive days: Nov. 8, 9, and 10, 2025. This is the first time Hubble has witnessed a comet so early in the process of breaking up. Image: NASA, ESA, Dennis Bodewits (AU); Image Processing: Joseph DePasquale (STScI)



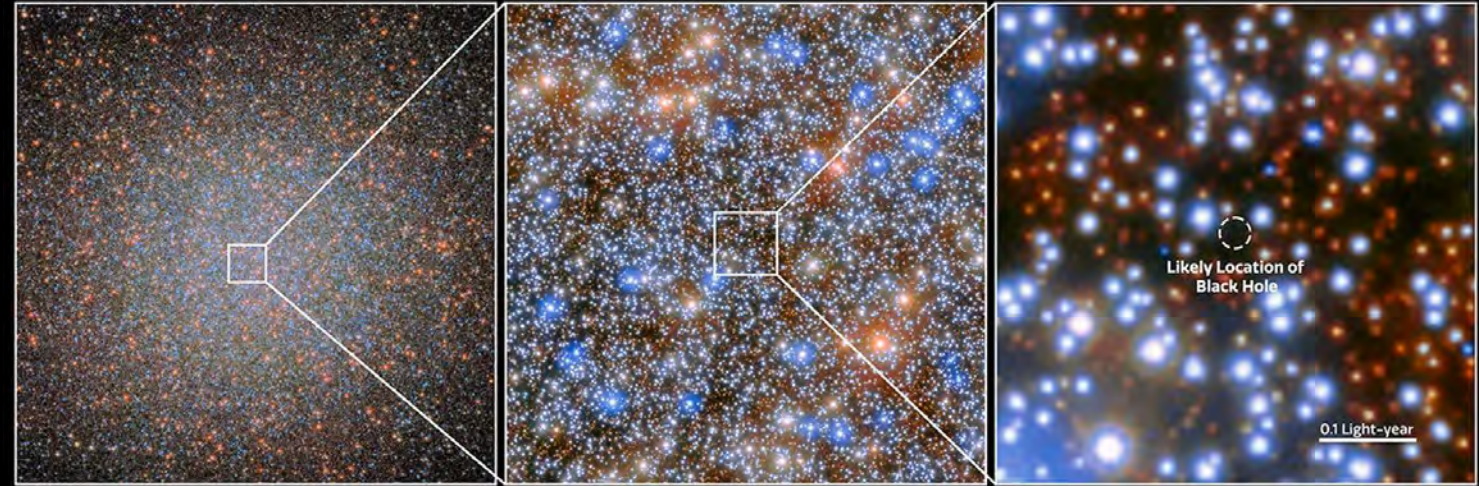
Hubble's Long Baseline of High Precision Observations Enables New Science

Cloud cover on Neptune varies following the 11- year solar cycle, peaking 2 years after solar max due to UV photochemical processes in upper atmosphere

Hubble Space Telescope | Observations of Neptune (1994–2020)
Cloud features plotted against solar UV radiation



Häberle+2024



Discovery of an intermediate mass black hole in ω Centauri from the proper motions of 7 fast moving stars, thanks to 500 HST images taken over 20 years. This measurement is enabled by a median error of 6.6 μ -arcsec/yr (0.17 km/s) and provides insights into black hole formation in the early universe



Hubble's Unique UVO Capabilities Pave the Way for HWO

NGC 346 seen by
HST Ultraviolet



NGC 346 seen by
HST Visible + JWST Infrared

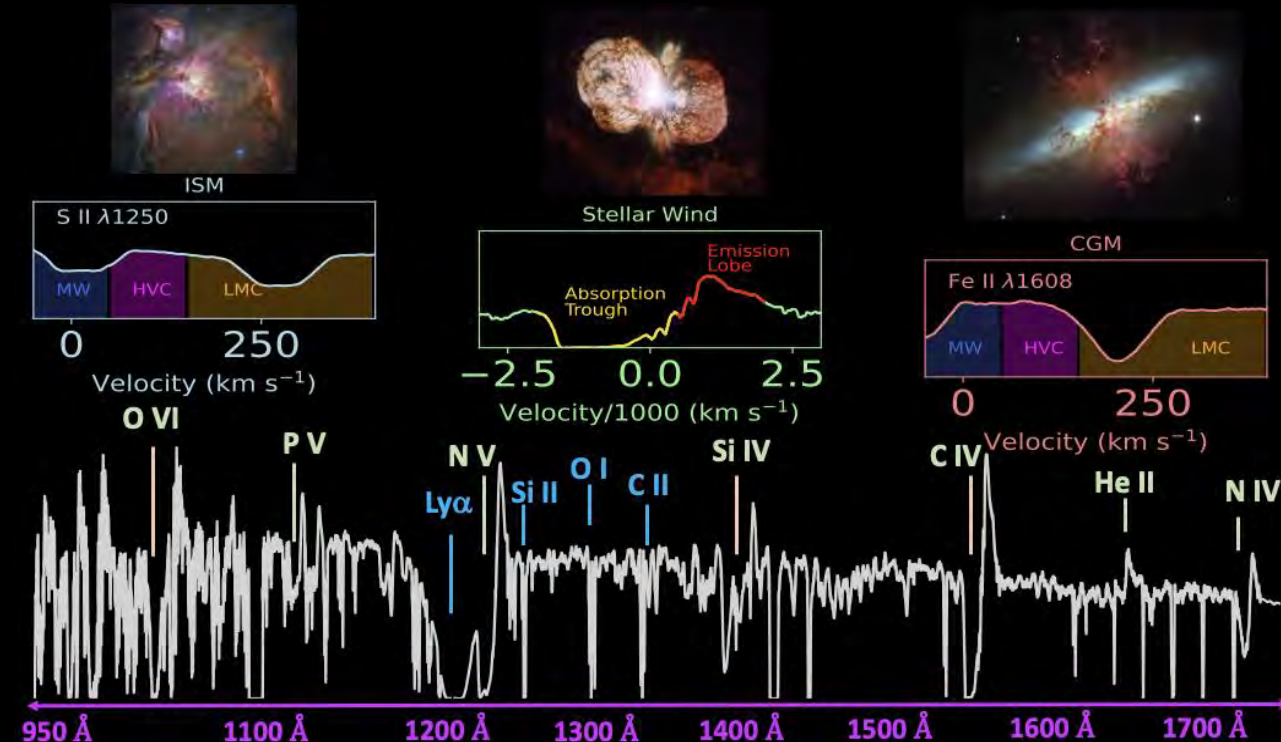


SPECTROGRAPHS

- ❑ **Space Telescope Imaging Spectrograph (STIS, installed 1997)**
 - ❑ Spectroscopy at $R = 1000$ -100,000 & imaging 115-1030 nm
 - ❑ Coronagraphy at 200-1030 nm
- ❑ **Cosmic Origins Spectrograph (COS, installed 2009)**
 - ❑ Spectroscopy 90 – 300 nm at $R = 3000 - 20,000$
 - ❑ Imaging 170 – 300 nm

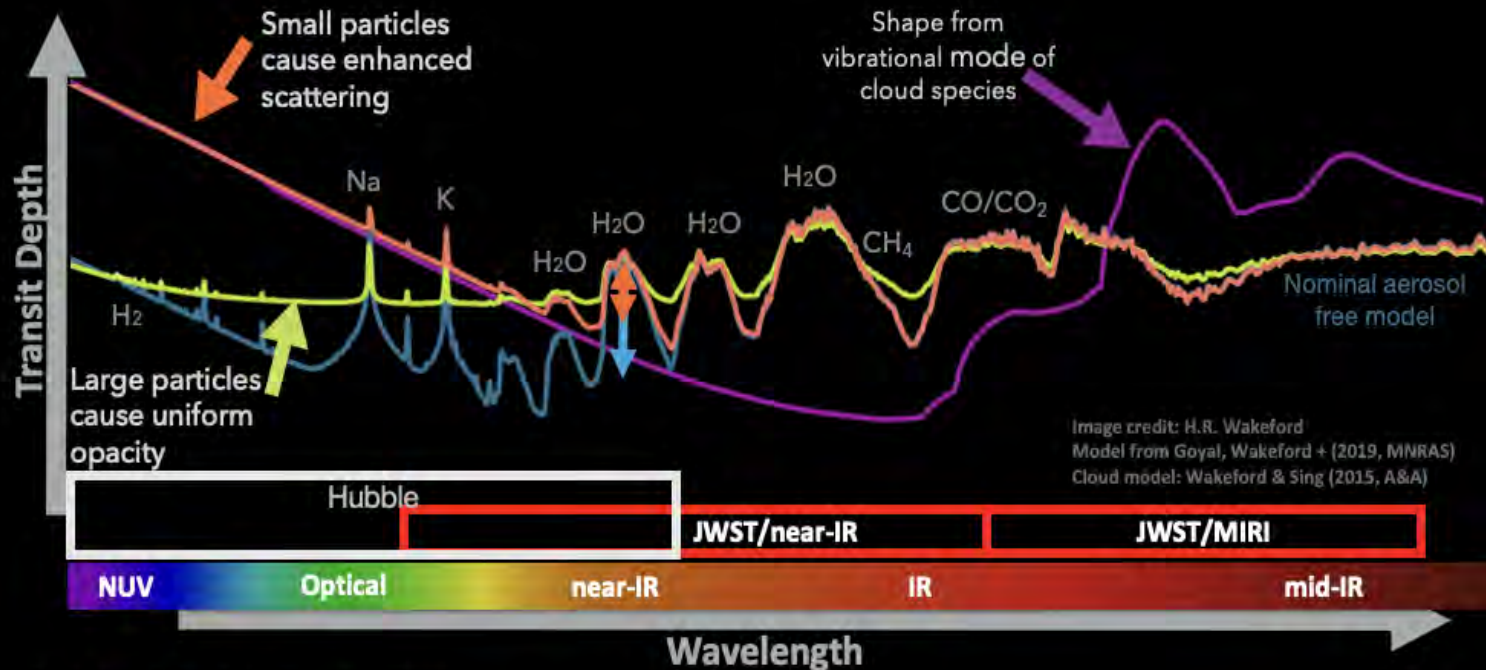
IMAGERS (FWHM=0.07-0.16")

- ❑ **Advanced Camera for Surveys (ACS, installed 2002)**
 - ❑ Imaging, prism spectroscopy 115-1100 nm
 - ❑ Spectro-polarimetry 370-1100 nm
- ❑ **Wide Field Camera 3 (WFC3, installed 2009)**
 - ❑ Imaging and grism spectroscopy 200 – 1700 nm





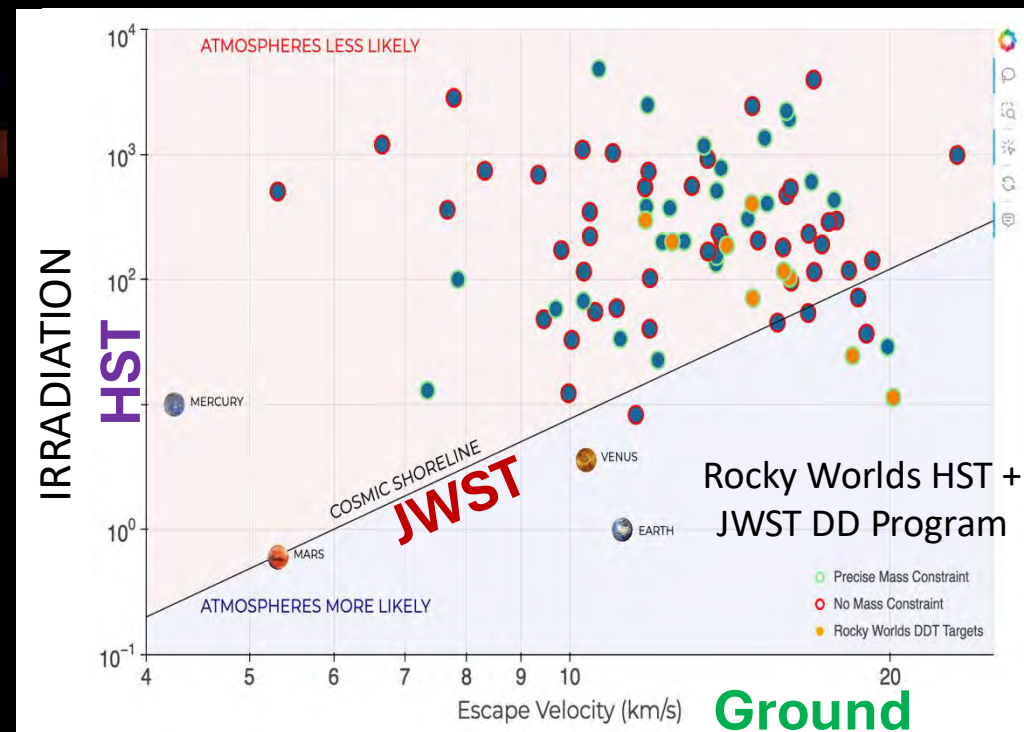
Hubble Key to Exoplanet Research



Credit: Hannah Wakeford - University of Bristol



- First exoplanet detection in 1992 post Hubble launched
- Hubble now leading exoplanet research alongside Webb
- UVO capabilities indispensable to characterize exoplanet atmospheres, in particular clouds and hazes, and exoplanet stellar hosts
- Rocky Worlds program (Hubble + Webb) key to developing exoplanet science case for HWO





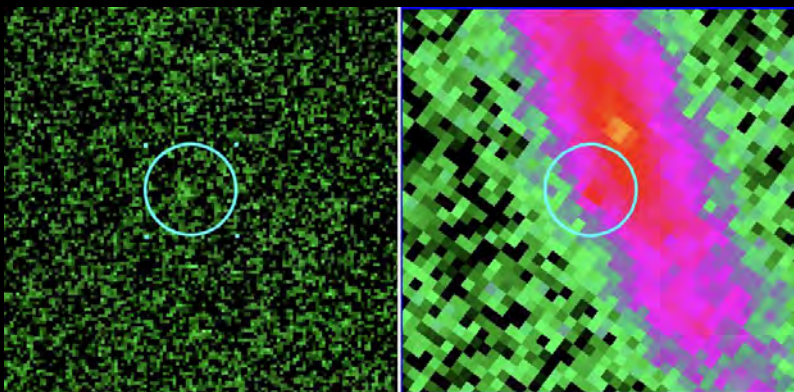
Hubble Supports the Pivot of Astrophysics toward Time Domain and Multi-Messenger Astrophysics

Preparing for increased demand for high-energy transients follow ups from all-sky and multi-messenger surveys (Rubin, Roman, gravitational wave and neutrino facilities...)



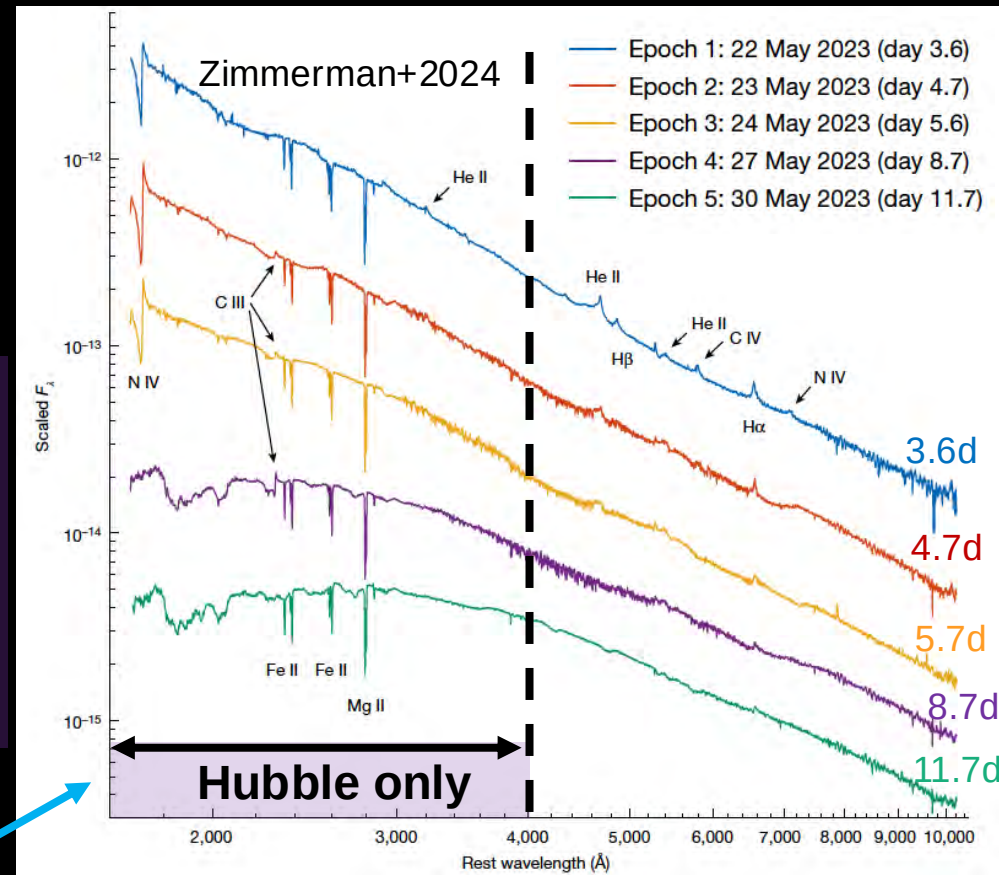
Target-of-opportunity activation opportunities each year:

- Up to 24 Flexible Thursday (~2 day response time)
- 8 disruptive activations (2-21 days)
- 2 ultra-disruptive (<2 days) activations
- Unlimited non-disruptive activations



- August 22, 2025: new Hubble response time record (23.5h) for LIGO kilonova candidate
- HST observations demonstrated source is not a kilonova

Early HST UV spectra of SN 2023ixf in M101, tracing evolving shock-ionized flash lines and the progenitor metallicity of SN 2023ixf

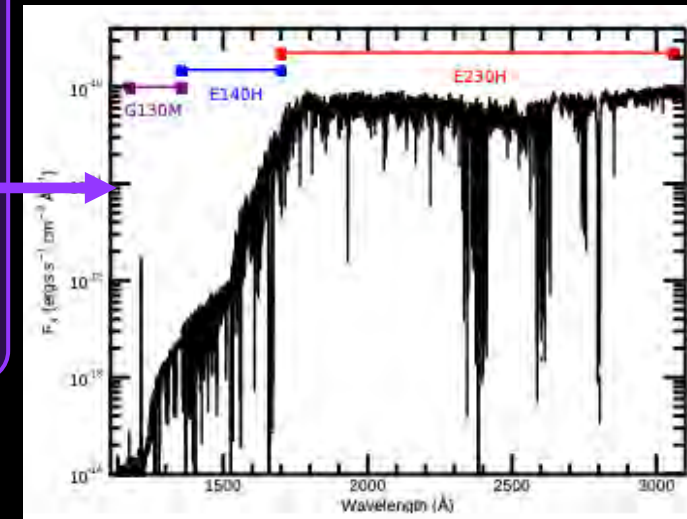




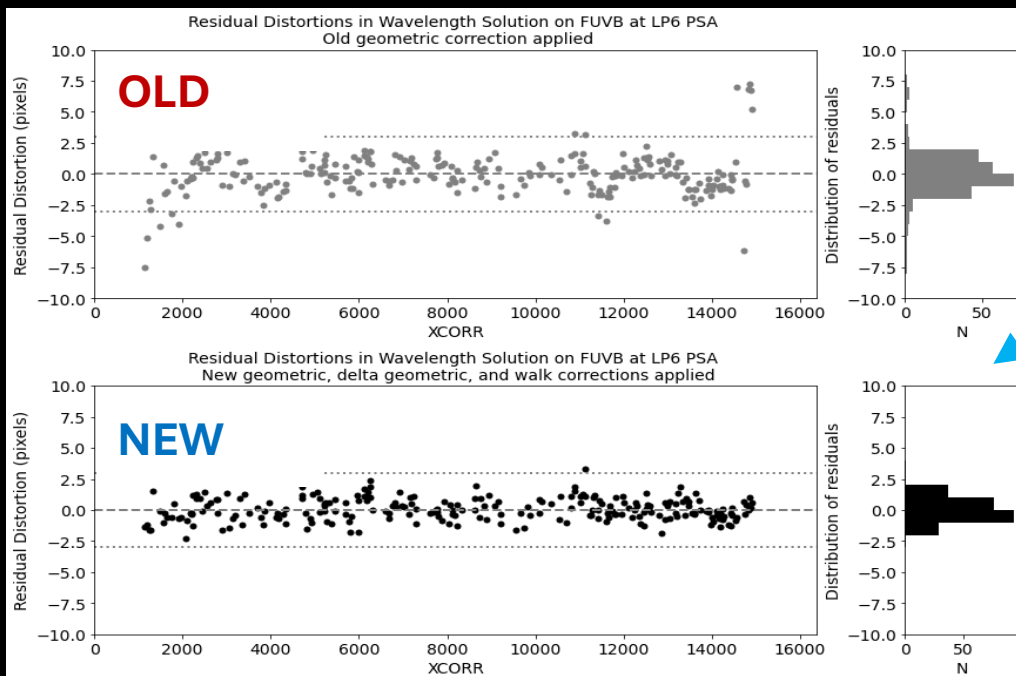
HST Instrument News: COS & STIS



- Hubble Spectroscopic Legacy Archive (HSLA) released on November 17, 2025
- Provides scientifically validated, automatically co-added COS and STIS spectra of individual targets → latest calibration + best possible wavelength coverage and SNR
- Automated target classification, enabling searches based on astrophysical properties
- HSLA products are available on the [MAST portal](#), [HST search form](#), and [astroquery](#)



Full UV SED of β Pictoris HSLA quicklook *aspec* product



- New COS FUV geometric distortion and walk corrections completed in Summer of 2025
- Wavelength calibration accuracy improved from 3 pix to 1.5 pix (locally improvement is even better)

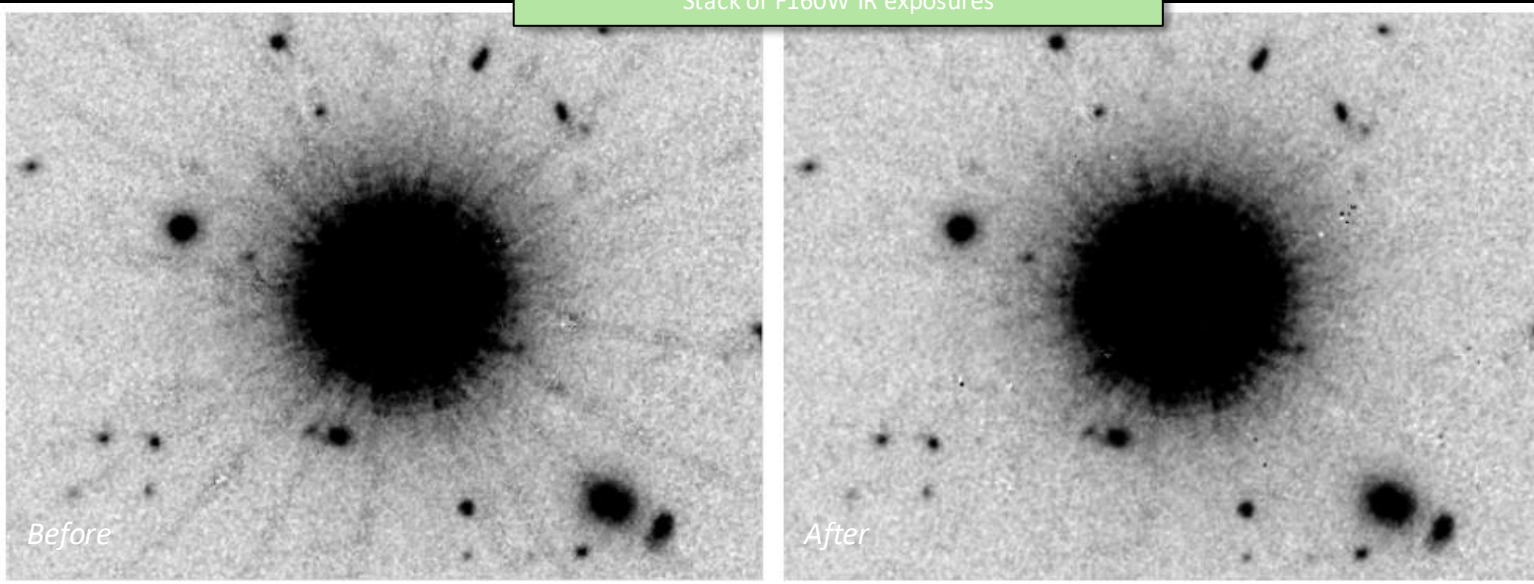
- COS LP7 (G130M) and LP10 (G160M) operational since Cy33; LP11 (G140L) will start for Cy34; LP12 (G130M) enabled for Cy35
- LP moves will ensure capability through 2035
- Other operational strategies to continue COS operations through 2040



HST Instrument News: ACS & WFC3

- **Upgrade to HST notebook repository** → v1.1.0 available on [GitHub](#) and [Zenodo](#) enables users to access high-quality tutorials and cite the use of these notebooks in journal publications.
- **Update to ACS/SBC airglow** in ETC 34.1.1 leading to shorter integration times for background-limited observations
- **HST1pass** (PSF photometry software) now enables users to mask diffraction spikes and SBC PSF photometry
- **Release of slitlessutils** package for slitless spectroscopy simulation and analysis in March 2026; HSTaxe to be retired
- **Release of *Hands on Hubble***, a four part video tutorial series that guides users step-by-step through the fundamentals of using WFC3 data, navigating the HST Jupyter Notebooks Repository, running DrizzlePac, and creating PSF models

Stack of F160W IR exposures



```
DQ_MASK_SPIKE_LVL=1.0      <--- mask anything above this
DQ_MASK_SPIKE_DQ=4         <--- flag to set in DQ array
DQ_MASK_SPIKE_RMIN=25      <--- do not flag within this
DQ_MASK_SPIKE_RMAX=1000    <--- do not flag beyond this
SHOW_MSK+                  ---> jb3701rzq_msk.fits
jb3701rzq_flc.fits         ---> jb3701rzm_flc.fits
```



Hubble's Technical Status



- ❑ Median atmospheric re-entry date: mid-2033
- ❑ 3 Fine Guidance Sensors (needs 2 to operate)
- ❑ 2 gyros (needs 1 to operate)
- ❑ 4 reaction wheels (needs 3 to operate)
- ❑ >90% observing success rate
- ❑ All sub-systems have >82% reliability into the 2030s

Reduced gyro mode since June 2024

- ❑ Gyro-6 in the pointing control loop; gyro-4 is a powered back-up
- ❑ Scheduling efficiency: ~50-55% (max at 60% due to occultations, ~58% in 3GM)
- ❑ No impact on pointing stability and performance
- ❑ **RGM performance is significantly better than anticipated**

Science Instrument Command & Data Handler (SI C&DH)

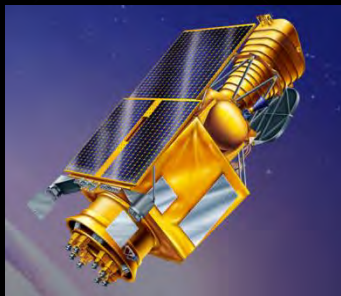
- ❑ Side B of SI C&DH failed in 2021
- ❑ Multi-year effort to implement software repair to hardware failure and restore side B operations
- ❑ B side operations available as of September 2026
- ❑ **Probability of data management assembly in 2030: 85%**

Fine Guidance Sensors

- ❑ FGS3 (1990) and FGS1R (1997) behaving nominally
- ❑ FGS2R2 (2009) failure rate up to 50% in early 2025
- ❑ Mitigations → observing failure rate down to <10%
- ❑ **Executing most ACS/WFC and WFC3 imaging with single guide-star starting in Cy 34 and beyond will increase lifetime of FGSs and facilitate scheduling flexibility**



The Current and Future Astronomical Landscape is Dynamic



ULTRASAT has 200 deg² FOV in NUV, 13" PSF
Launch in 2027



UVEX is a MIDEX, 12 deg² FOV for imaging and 2 deg slit spectroscopy in FUV/NUV; 2" PSF
Launch in 2030

MIRRORS



HUBBLE

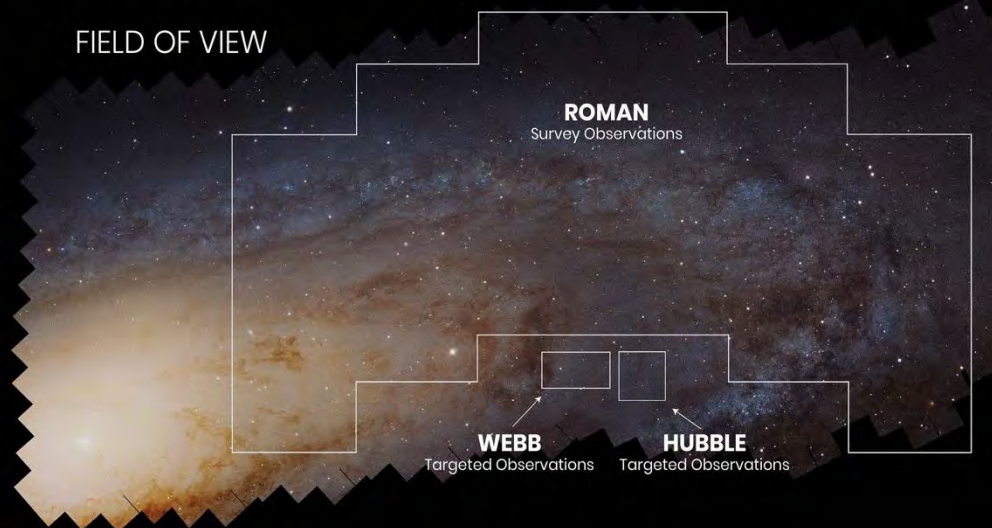


ROMAN

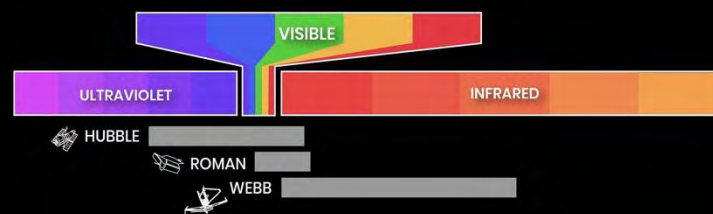


WEBB

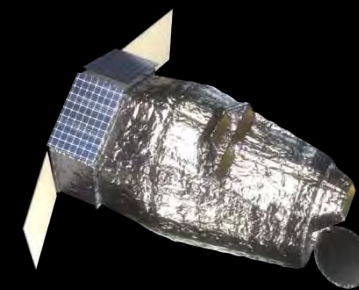
FIELD OF VIEW



WAVELENGTH



Webb and Roman complement Hubble's UV-optical capabilities and extend Hubble's NIR capabilities



Canadian Castor mission — 0.25 deg² FOV for imaging and low resolution slitless spectroscopy in FUV/NUV; 0.15" PSF — Launch early 2030s

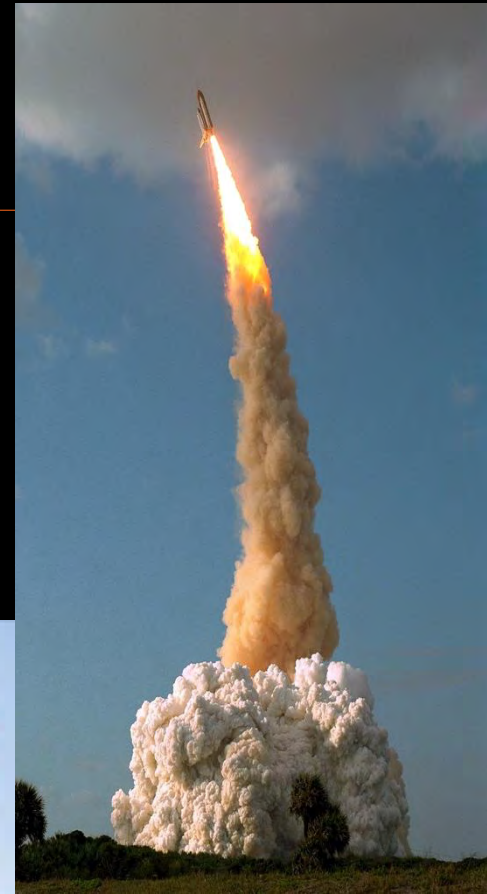


Lazuli Space Observatory aims to “break the cost curve” for optical space telescopes — Imaging, low-resolution spectroscopy, and coronagraphy in optical-NIR, launch 2028-2029



Possibility of a Hubble Boost and Devising a Roadmap for Hubble Science through the 2030s

- Shawn Domagal-Goldman publicly stated a Hubble boost is considered by NASA
- NASA contracted Katalyst to perform a high-risk, low-cost SWIFT boost in mid-2026
 - Attempt was not successful, and this solution may not be scalable to Hubble
- HST boost needs planning and funding in 2027
- STScI issued a call for community white papers and science pitches about key Hubble science and required capabilities in the next 10-15 years → over 90 papers and 39 science pitches received
- Working group of community experts meeting in October to synthesize white papers and inform the roadmap for the programmatic, operational, and scientific future of Hubble through the 2030s
- STScI & NASA GSFC are exploring avenues to streamline, automate, and simplify operations





36th anniversary image
of the Trifid Nebula

Submit your HST science
results for press releases





Thank you!