



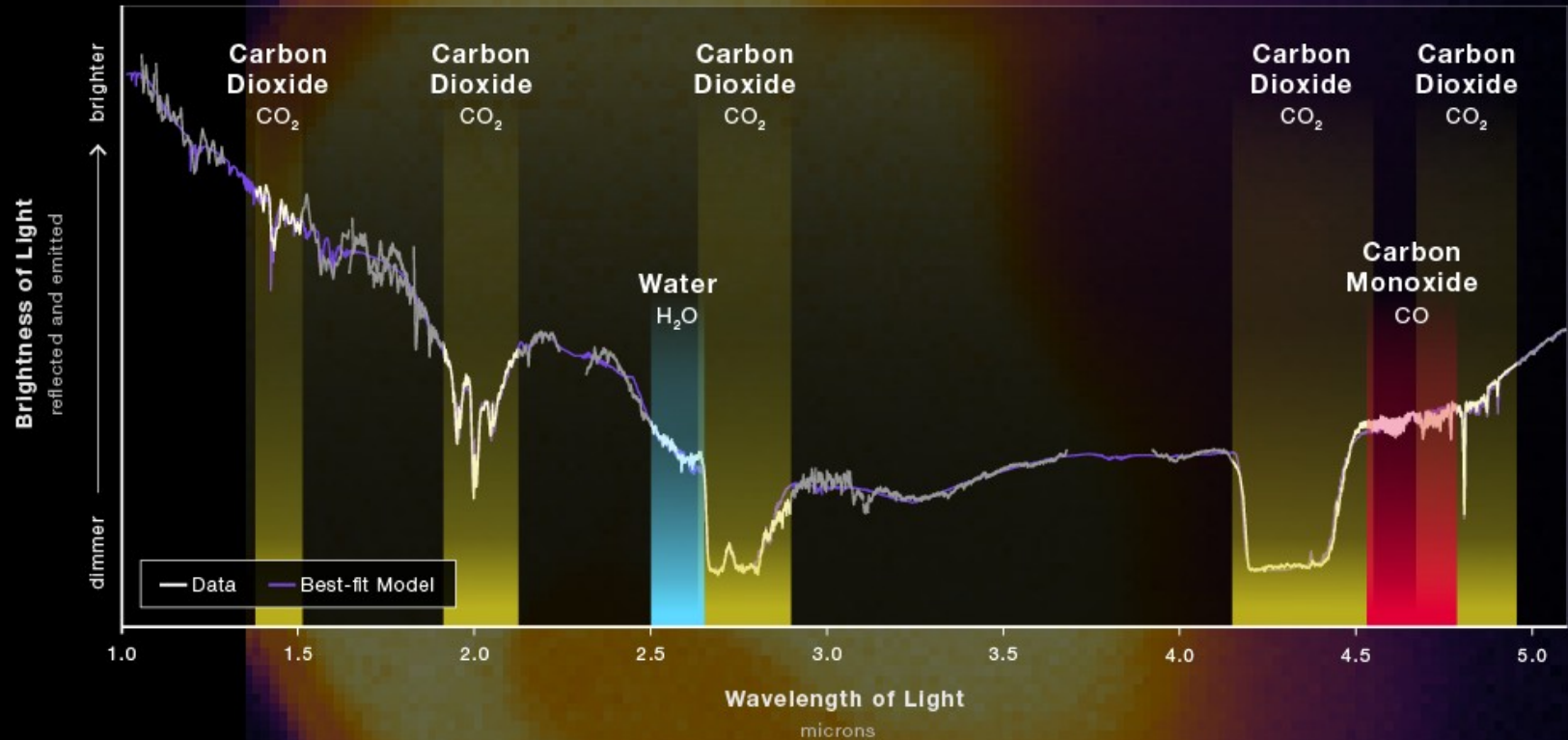
# Latest results from HST and JWST

The talk will present the last years results from the Hubble Space Telescope and the James Webb Space Telescope. Included will be images and spectra of a wide variety of objects, including planets, exoplanets, stars, galaxies, and quasars.

MARS

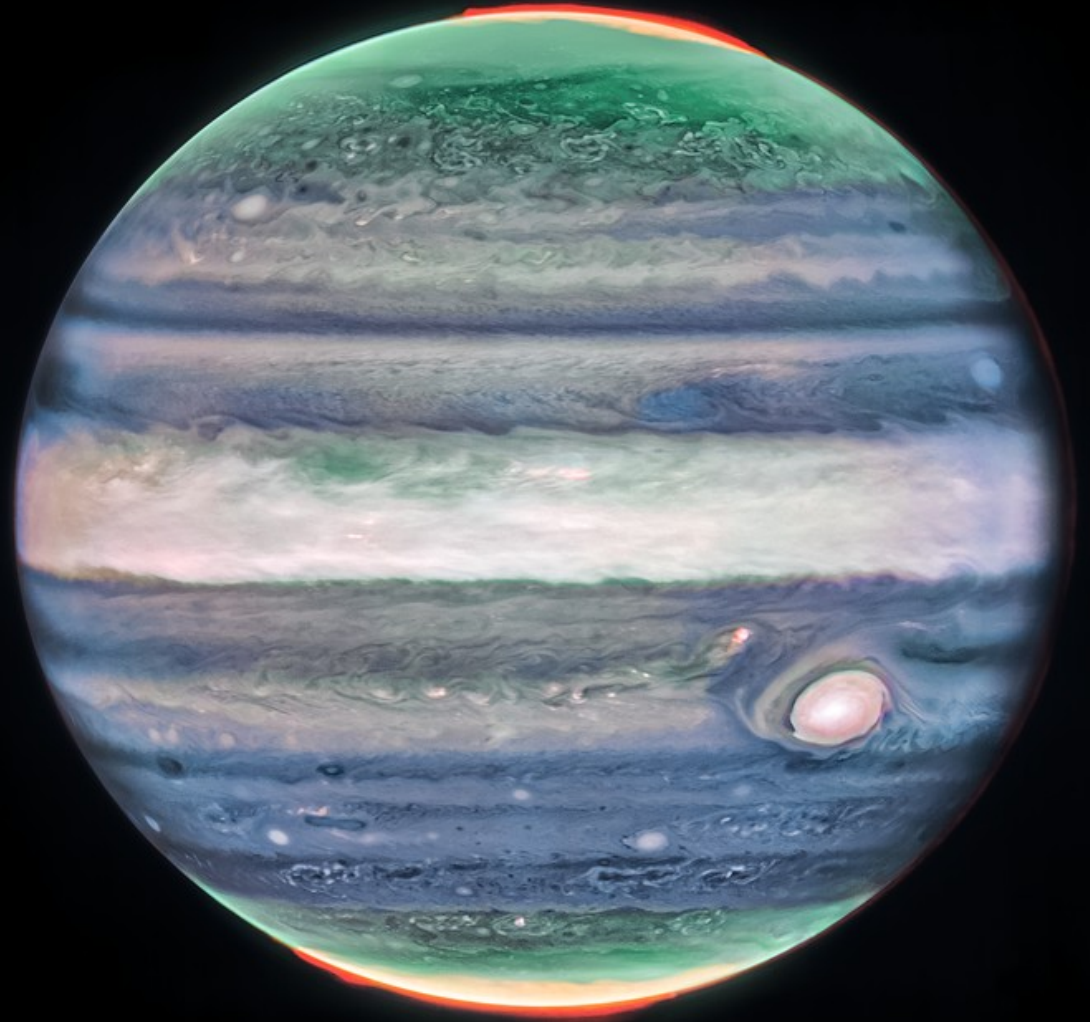
# ATMOSPHERE COMPOSITION

NIRSpec | Fixed Slit Spectroscopy



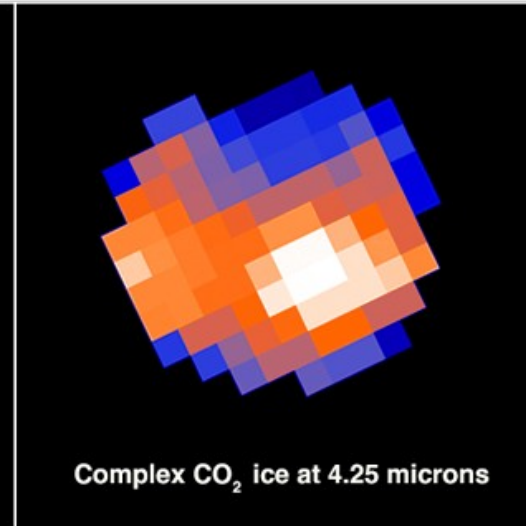
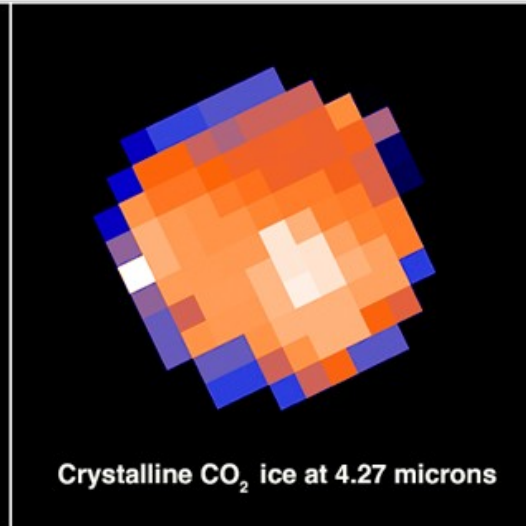
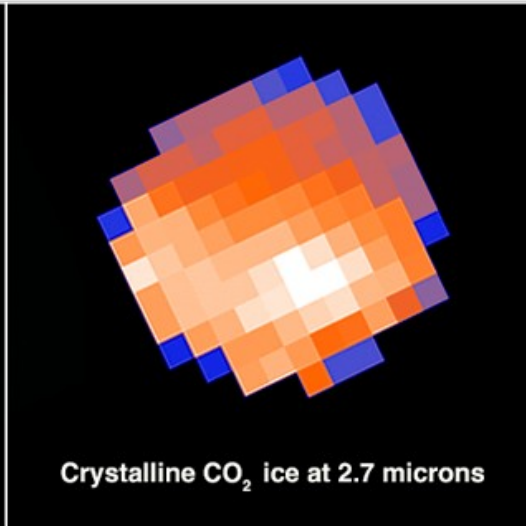
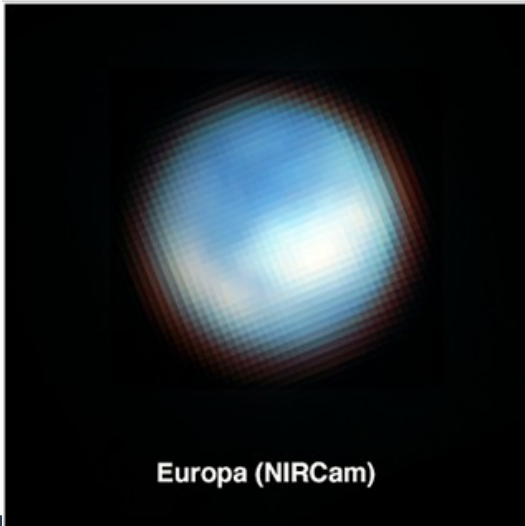
# JWST - NIRCAM

- In this image, brightness indicates high altitude. The numerous bright white "spots" and "streaks" are likely very high-altitude cloud tops



# Europa NIRCams and NIRSpec/IFU

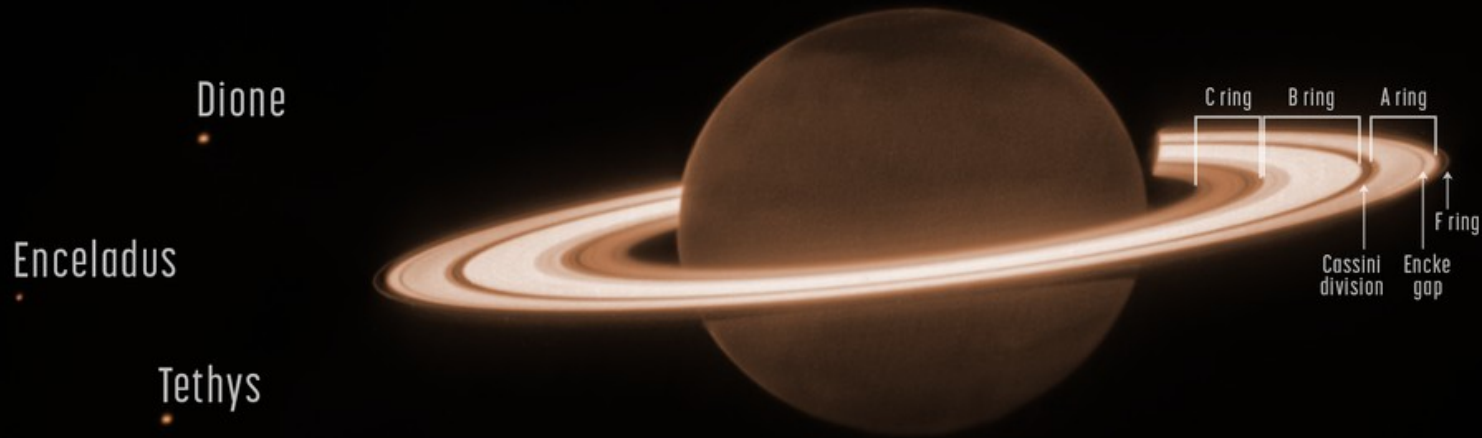
- Surface ices have been disrupted, and there likely has been a relatively recent exchange of material between the subsurface ocean and the icy surface.



# HST image of Saturn exploring start of spoke season



Saturn  
JWST NIRCам F323N  
June 25, 2023



# Uranus and its moons

JAMES WEBB SPACE TELESCOPE

URANUS | FEBRUARY 6, 2023

- JWST NIRCams image of Uranus and its moons, the rings are prominent in this NIR image because of their composition.



NIRCams Filters | F140M F300M

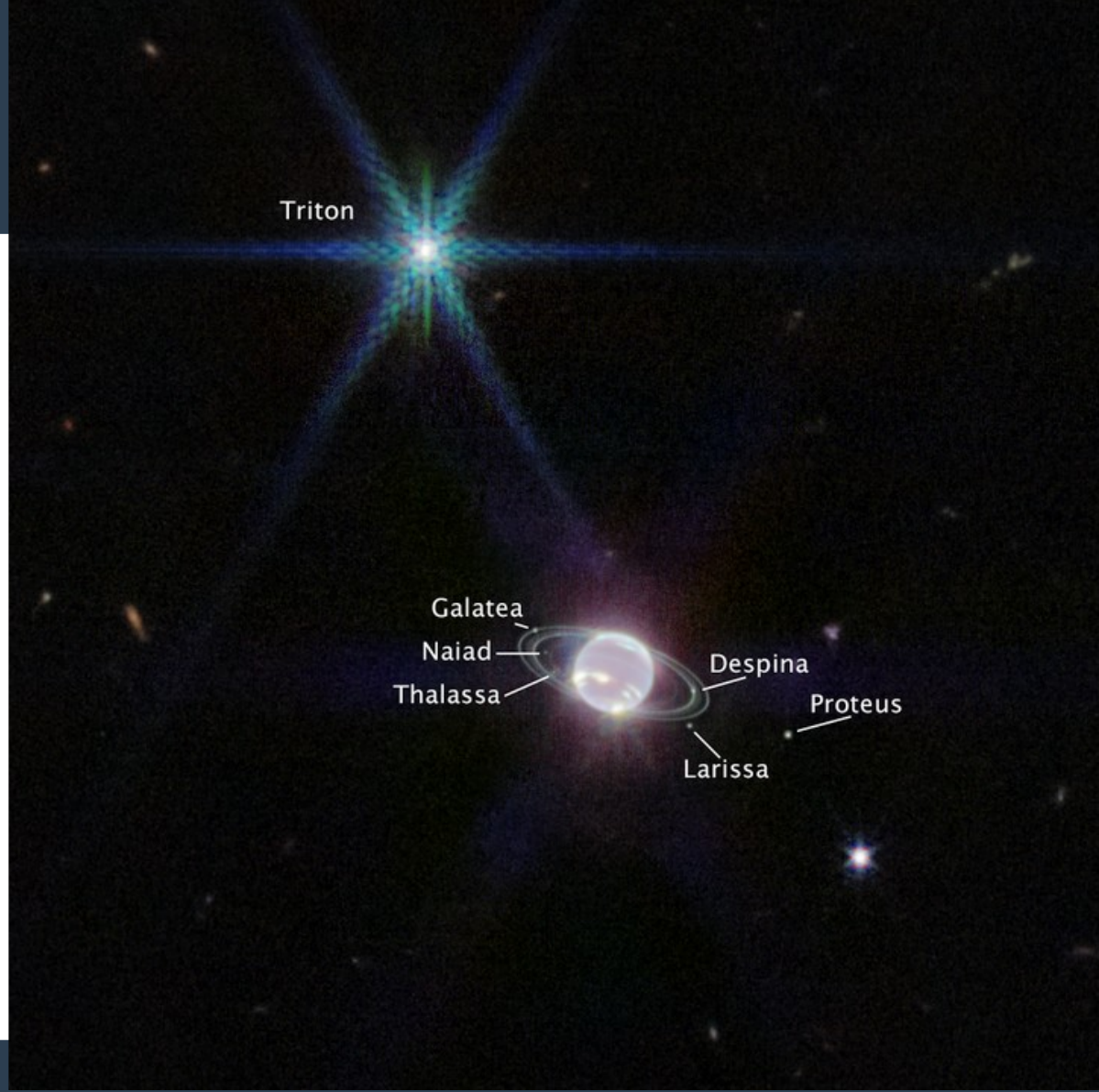
# Neptune NIRCam





# Neptune and moons

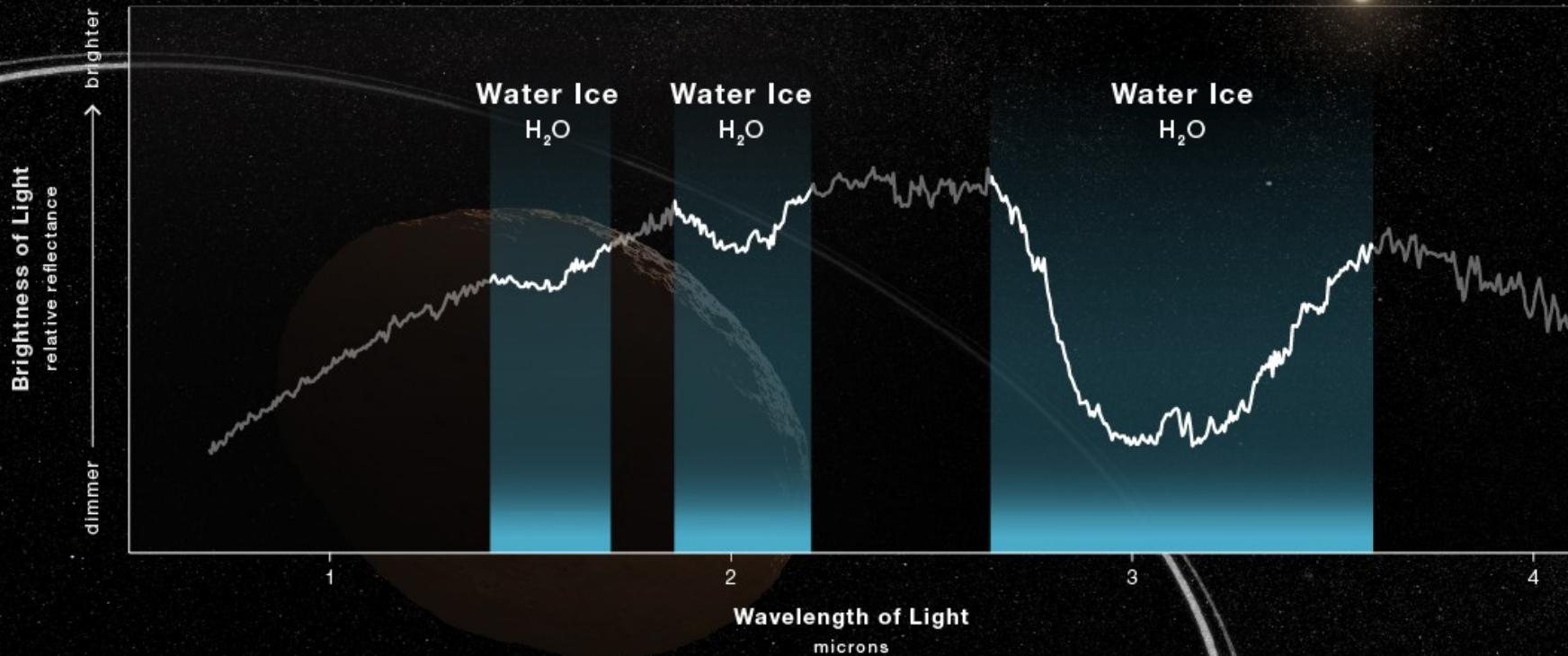
- Neptune and moons from NIRCam. The bright point to the lower right is a star. The other fuzzy points are distant galaxies.



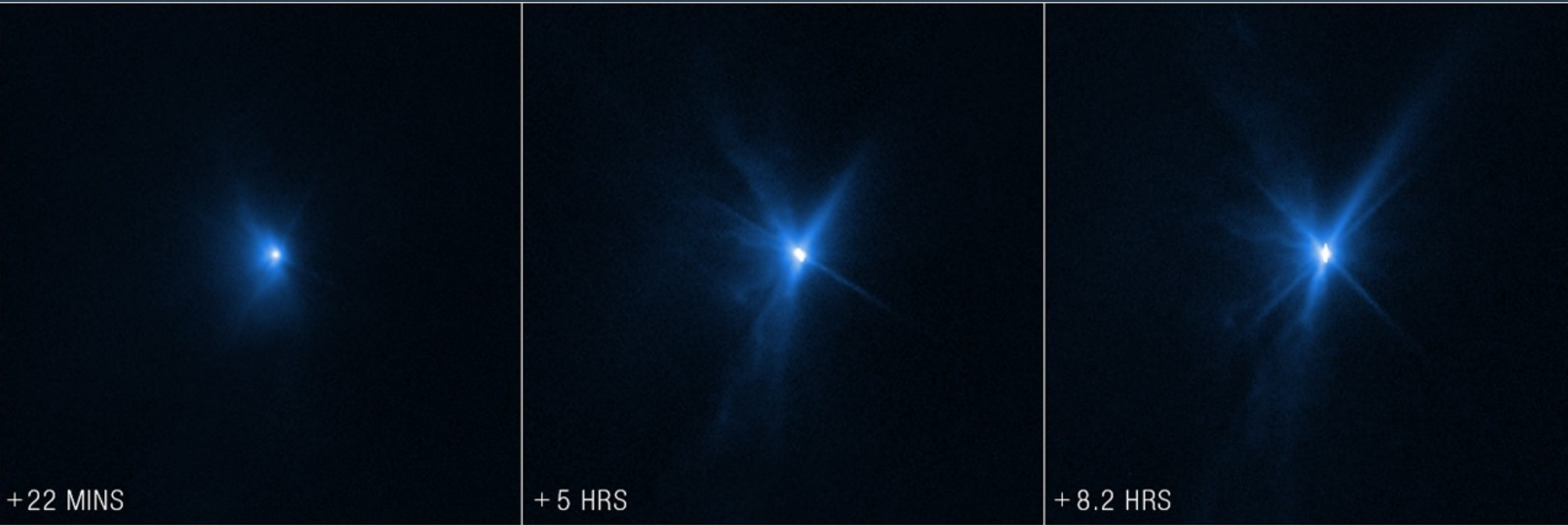
CENTAUR 10199 CHARIKLO

# SURFACE COMPOSITION

NIRSpec | PRISM

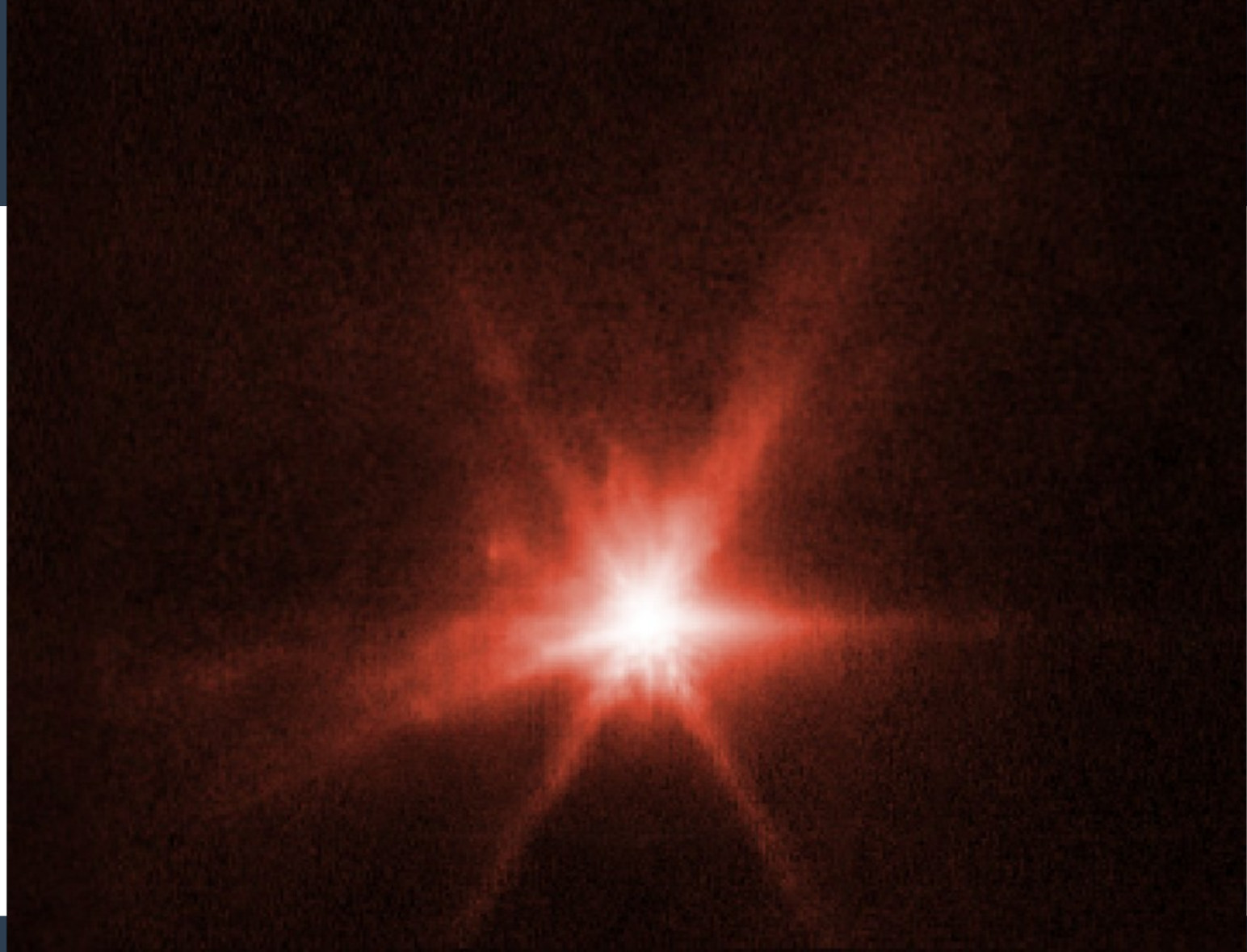


# Hubble view of Dimorphos impact



# Webb view of Dimorphos ejecta

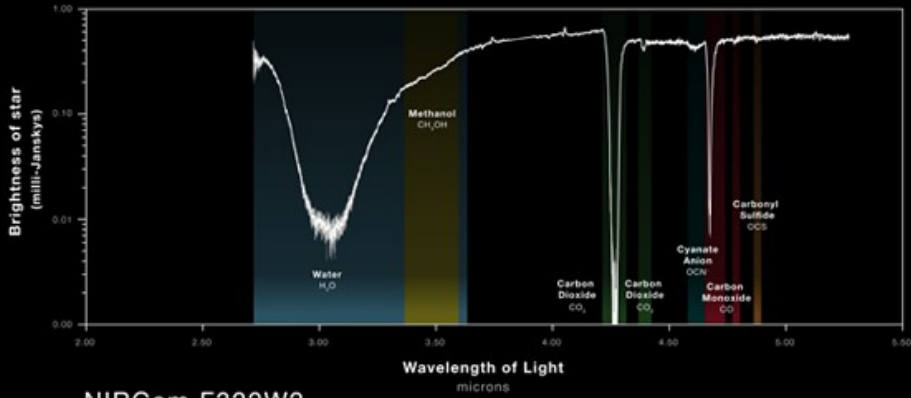
- **Complicated by the Webb diffraction spikes, the ejecta can be seen to the left and top**



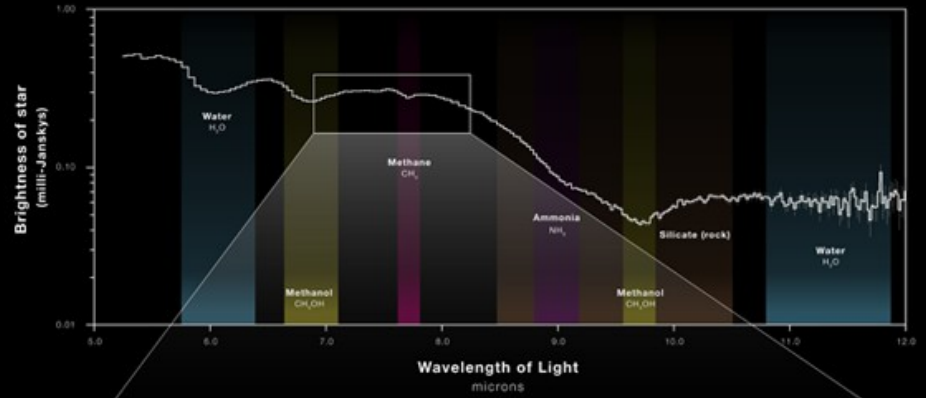
# CHAMAELEON I DARK CLOUD BACKGROUND STAR NIR38

## ICE CHEMICAL COMPOSITION

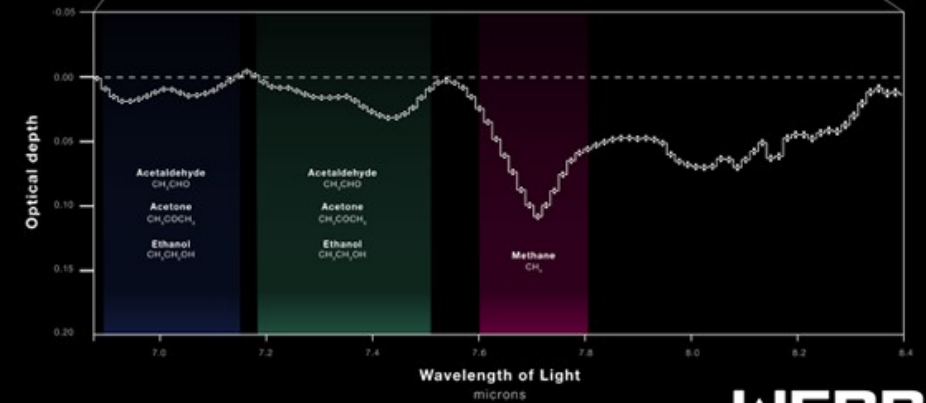
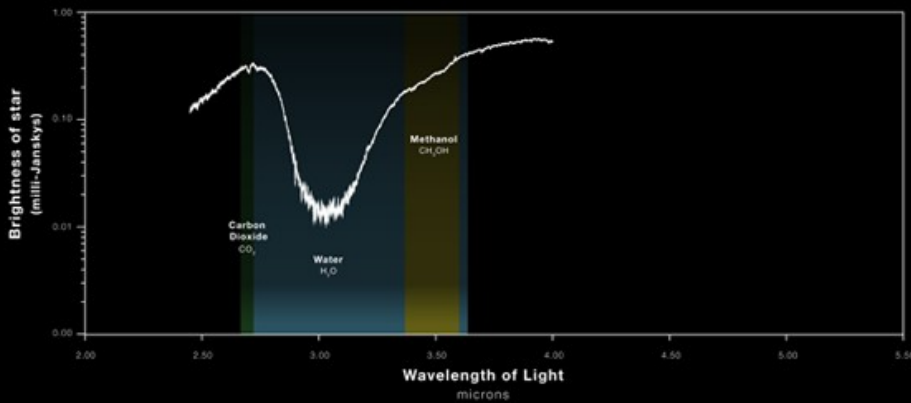
NIRSpec G395H



MIRI LRS P750L

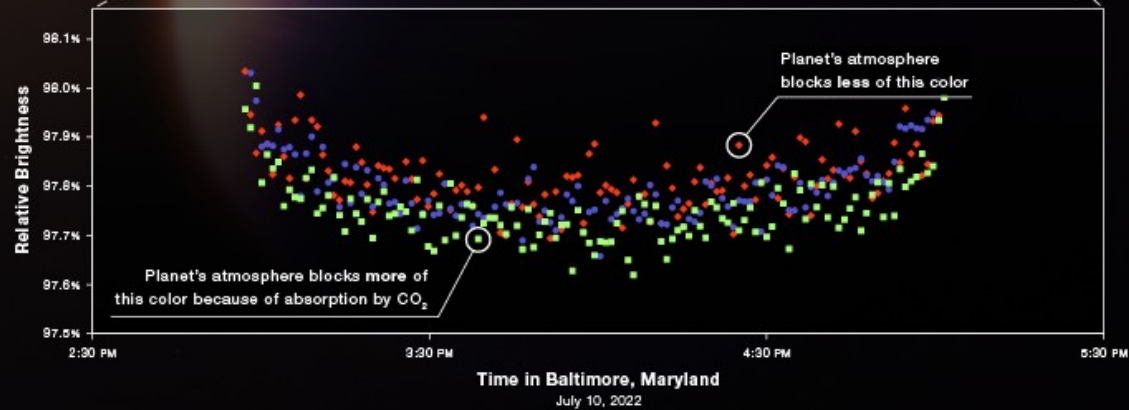
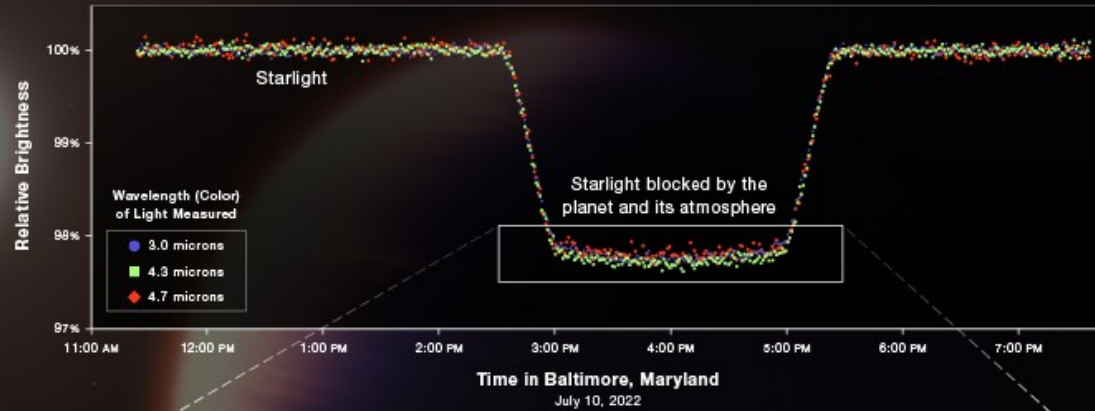


NIRCam F322W2



# HOT GAS GIANT EXOPLANET WASP-39 b TRANSIT LIGHT CURVE

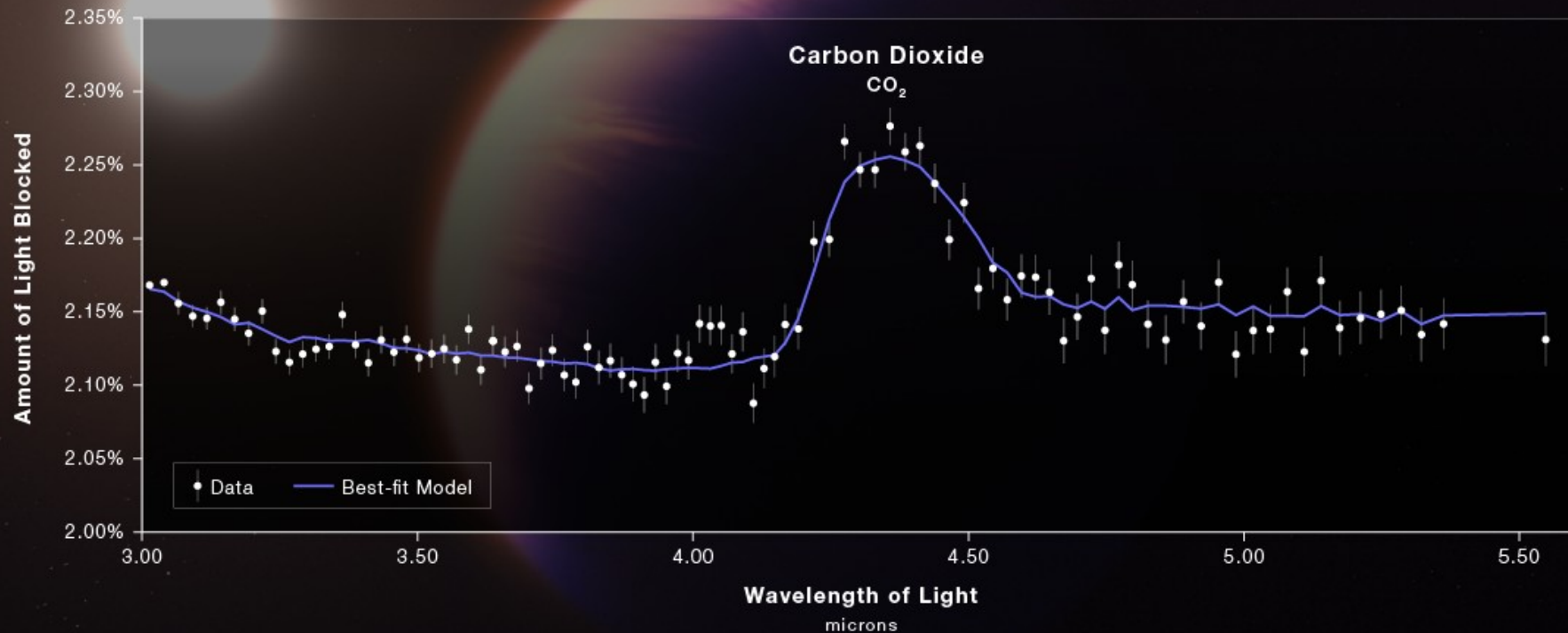
NIRSpec | Bright Object Time-Series Spectroscopy



HOT GAS GIANT EXOPLANET WASP-39 b

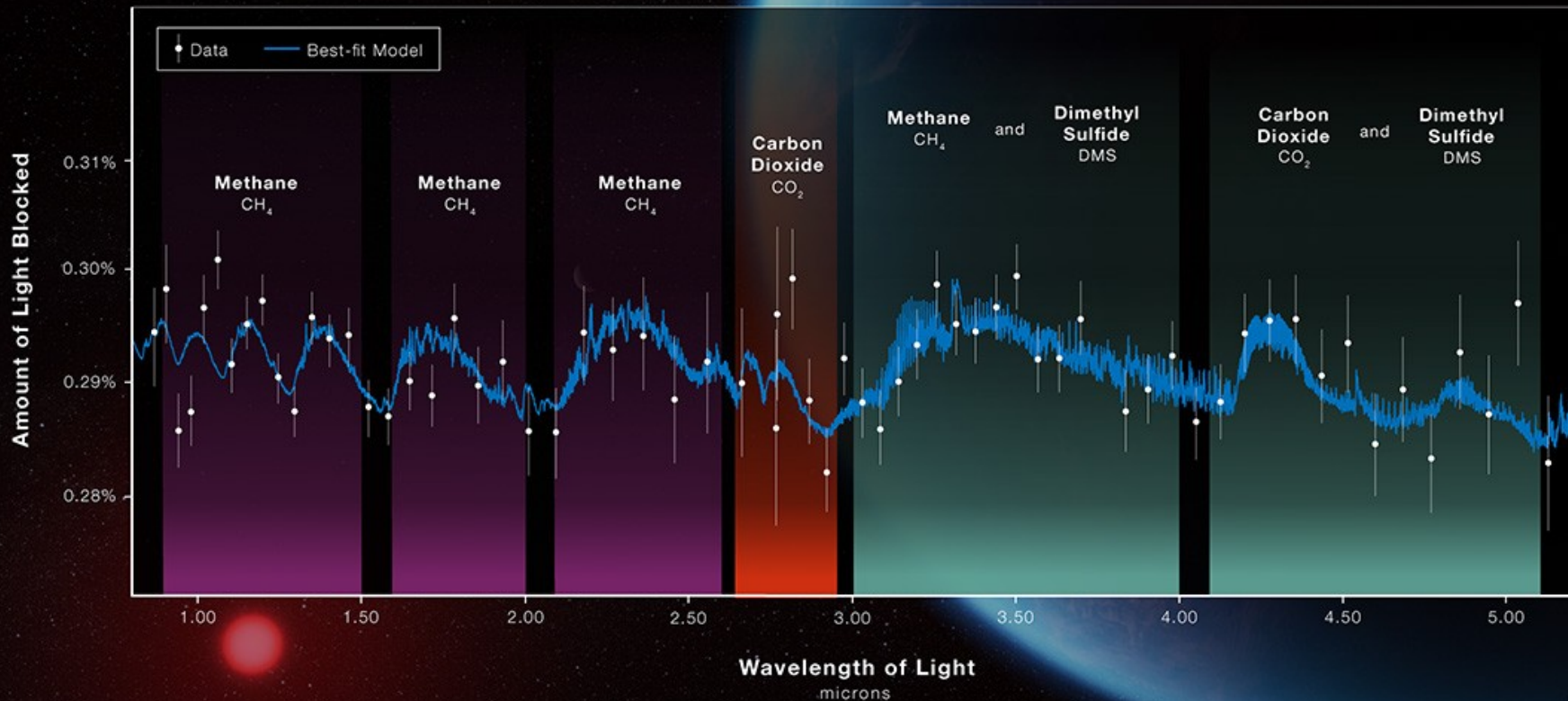
# ATMOSPHERE COMPOSITION

NIRSpec | Bright Object Time-Series Spectroscopy



## ATMOSPHERE COMPOSITION

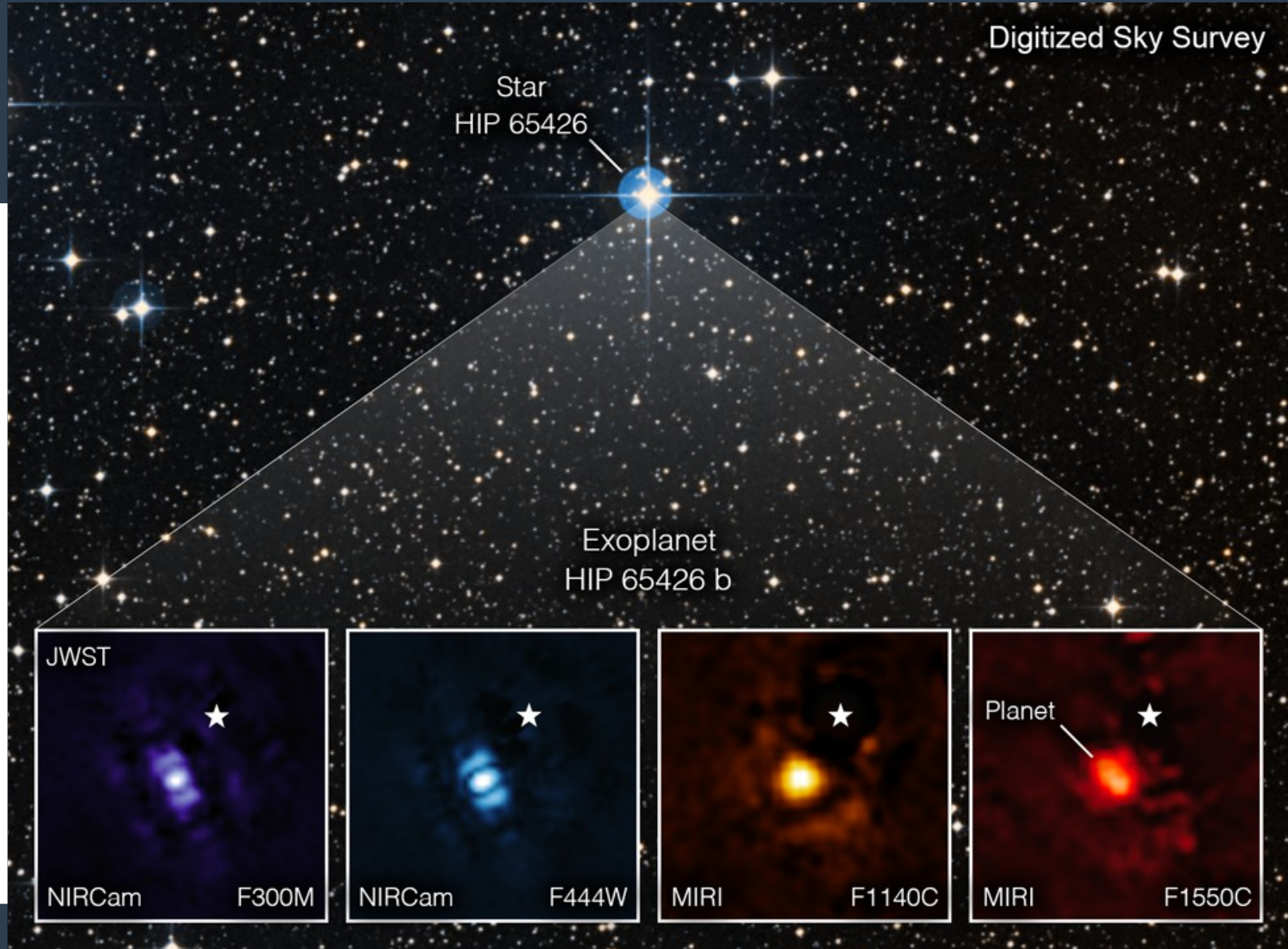
NIRISS and NIRSpec (G395H)





# HIP 65426b

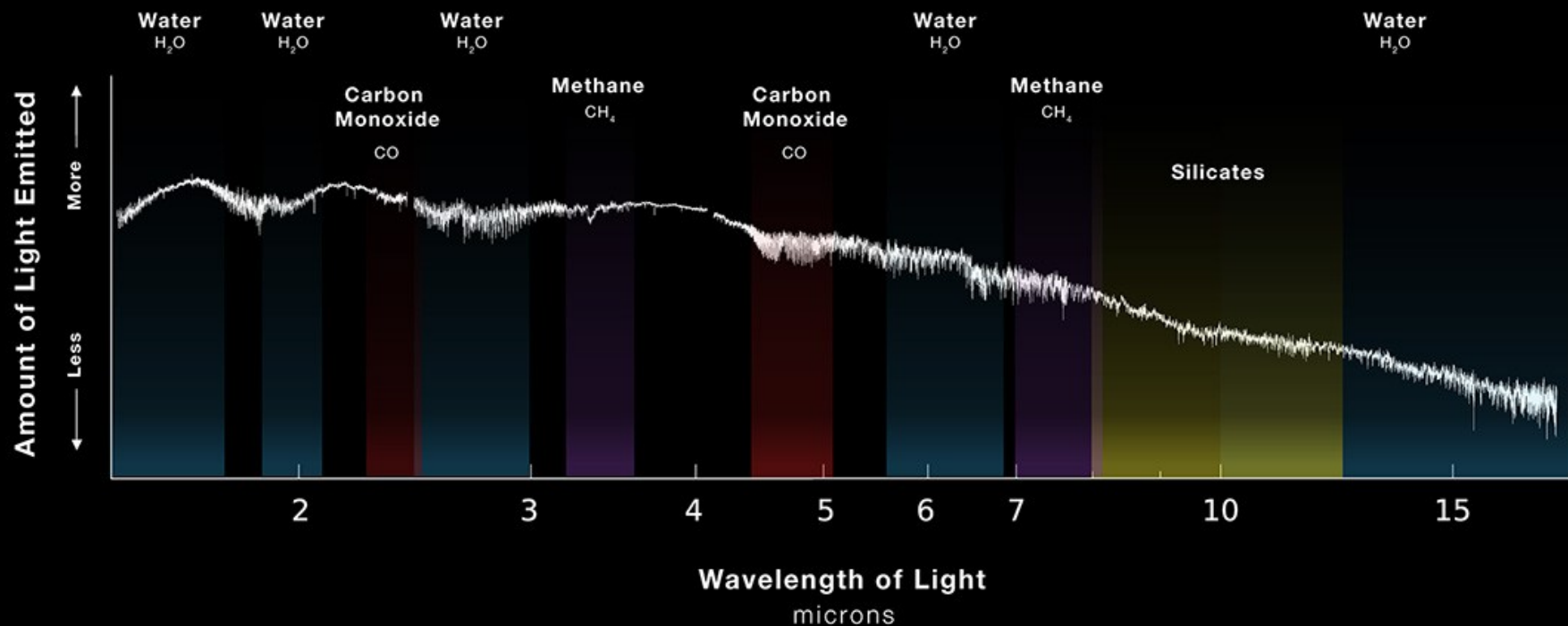
- **Coronagraph images of the Exoplanet HIP 65426b from NIRCcam and MIRI**



EXOPLANET VHS 1256 b

# EMISSION SPECTRUM

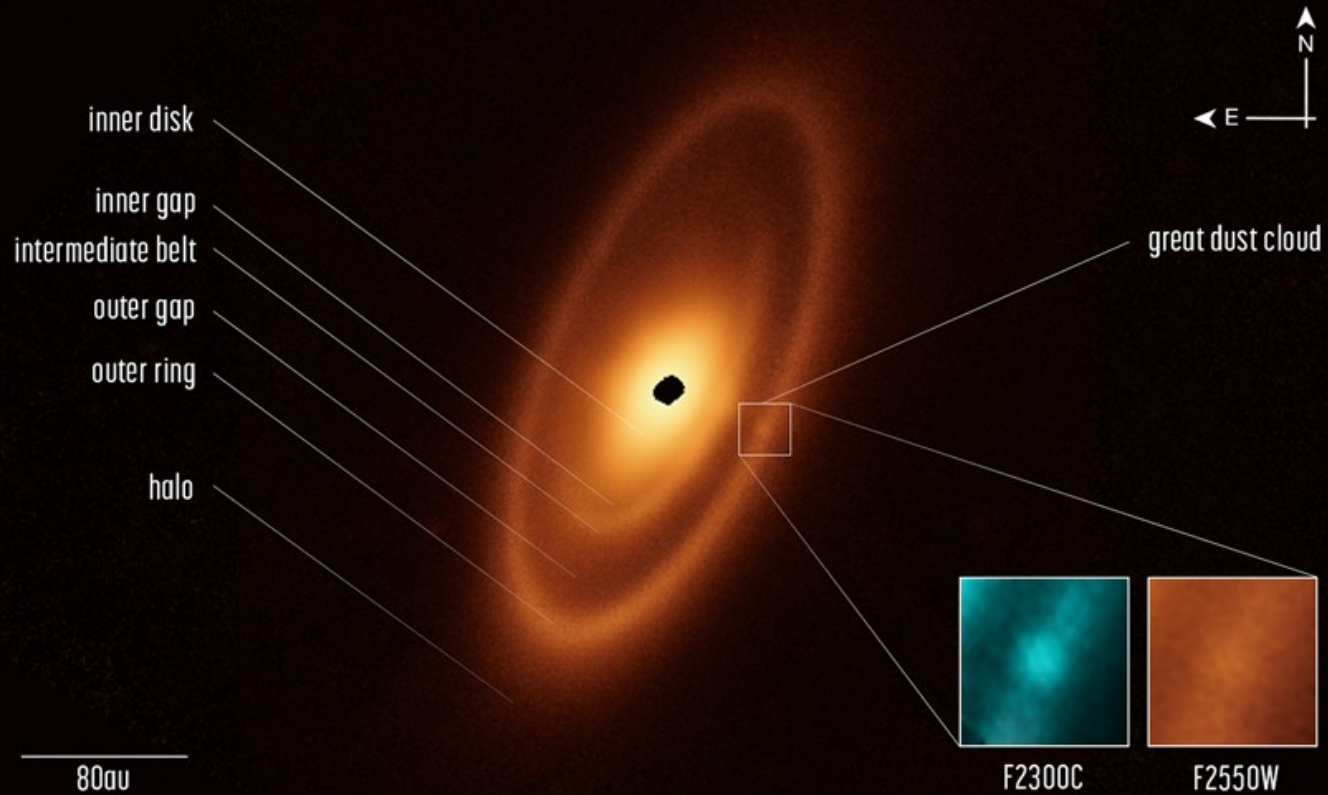
NIRSpec and MIRI | IFU Medium-Resolution Spectroscopy



# Fomalhaut - MIRI

- **Fomalhaut Dusty Debris Disk, shows the great dust cloud which was mistaken for a planet.**

JAMES WEBB SPACE TELESCOPE  
**FOMALHAUT**



# CW Leonis

- **CW Leonis is a red giant star losing its outer envelope rich in carbon to the interstellar medium**



# Protostar L1527 IRS

- Jets of material from a protostar interacting with the interstellar medium

JAMES WEBB SPACE TELESCOPE

L1527 IRS | IRAS 04368+2557



NIRCam Filters | F090W F335M F445W F470N

# Hubble observes Herbig-Haro 1 and 2

- Herbig-Haro 1 and 2 are stellar outflows from a newly born star hidden behind dust in the middle of this frame. They form when jets of gas thrown outwards from these young stars collide with surrounding gas and dust at incredibly high speeds.

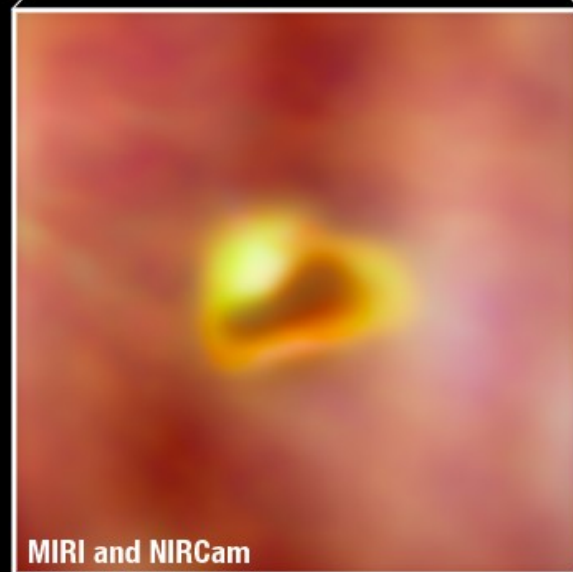
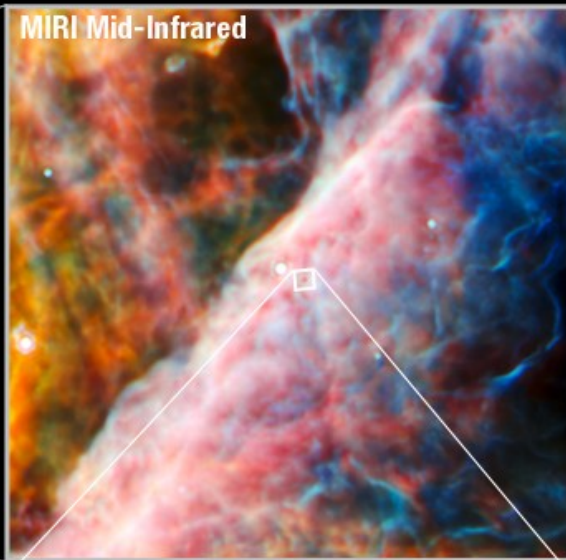


# NIRCam - HH211

- Herbig-Haro objects are formed when stellar winds or jets of gas spewing from newborn stars form shock waves colliding with nearby gas and dust at high speeds



# Orion





# Ring Nebula - NIRCams



# Westerhout 5 nebula - HST

- **free-floating Evaporating Gaseous Globule (frEGG)**  
[KAG2008] globule 13 in the upper left is a denser region of gas that photoevaporate less easily than their surroundings



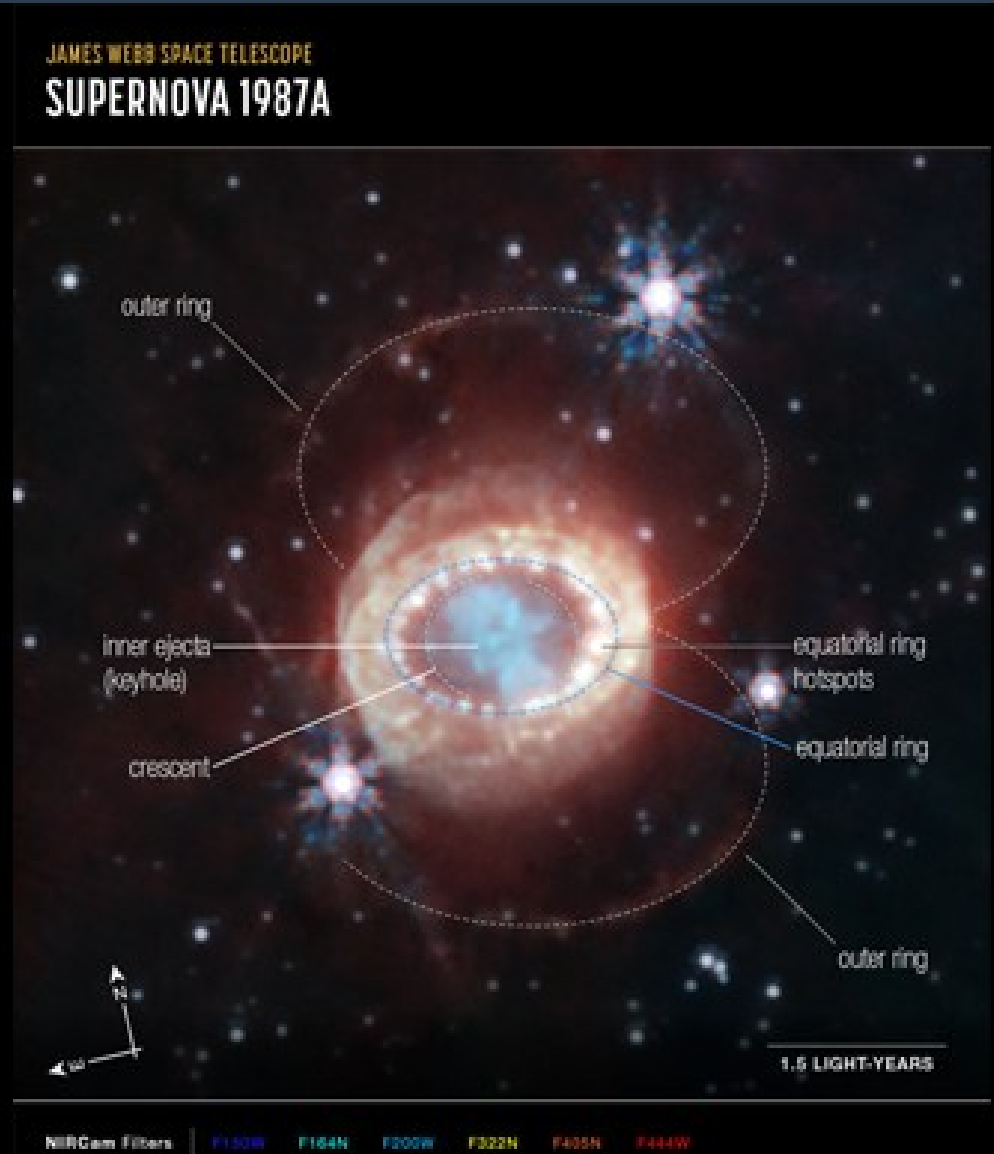
# WR 124 - JWST

- **NIRCam and MIRI image of WR 124, which is a runaway star surrounded by a nebula of emitted gas.**

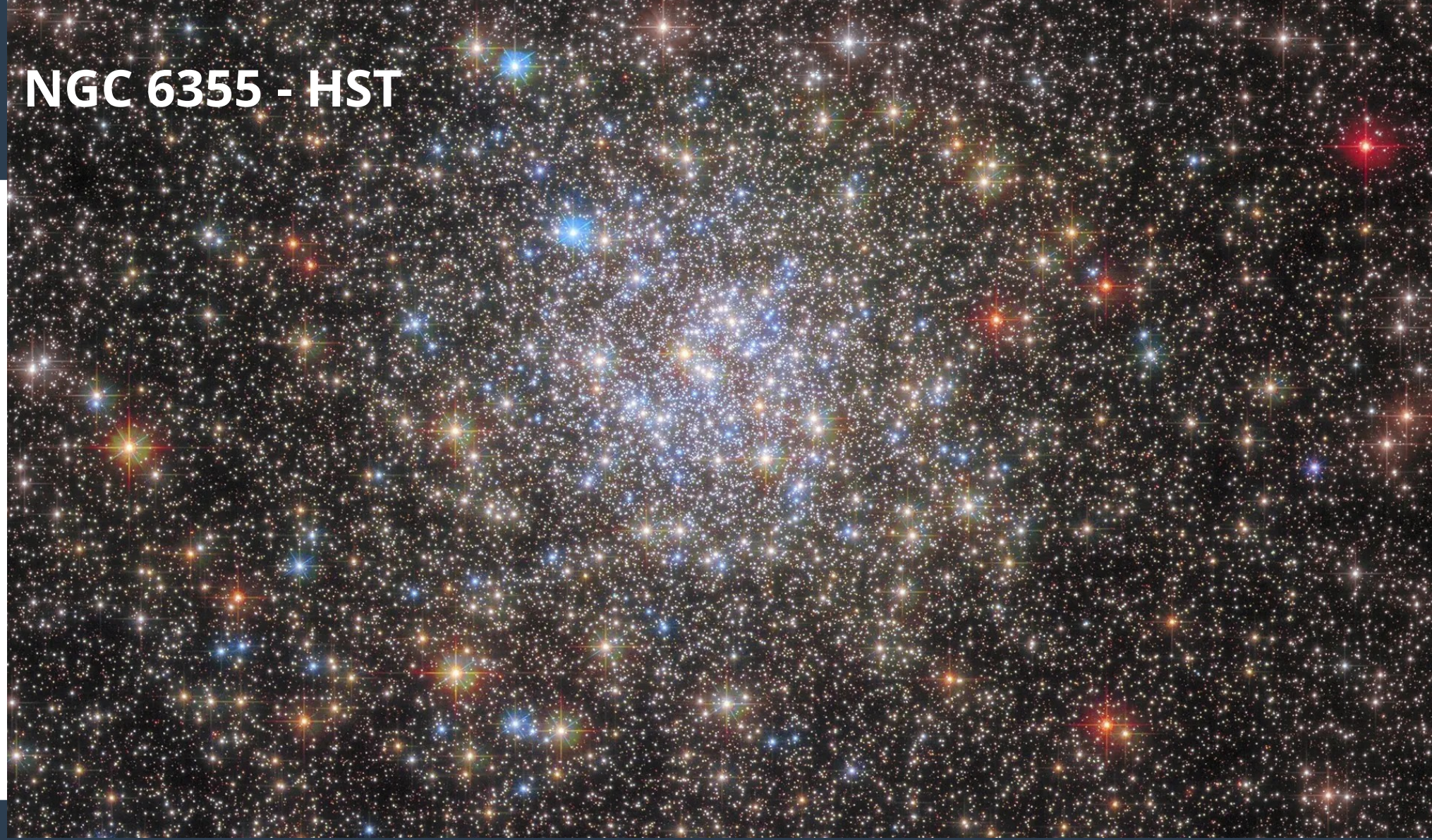


# SN1987A - NIRCam

- SN1987A in the Large Magellanic Cloud is the nearest SN since the invention of the telescope.



# NGC 6355 - HST



# Tarantula Nebula

- Tarantula Nebula in the Large Magellanic Cloud from NIRCam

JAMES WEBB SPACE TELESCOPE

TARANTULA NEBULA | NGC 2070



NIRCam Filters

F090W

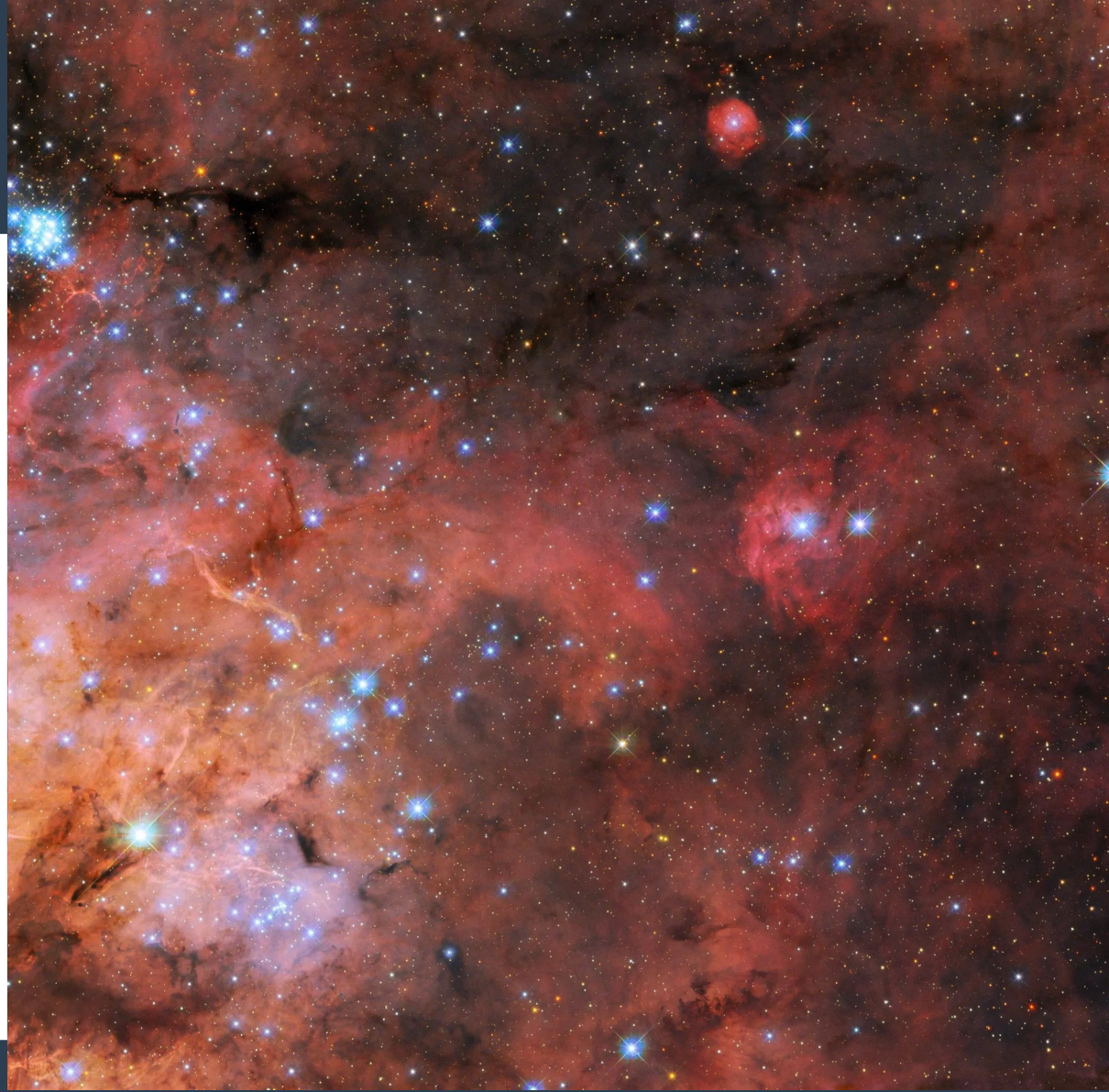
F200W

F335M

F444W

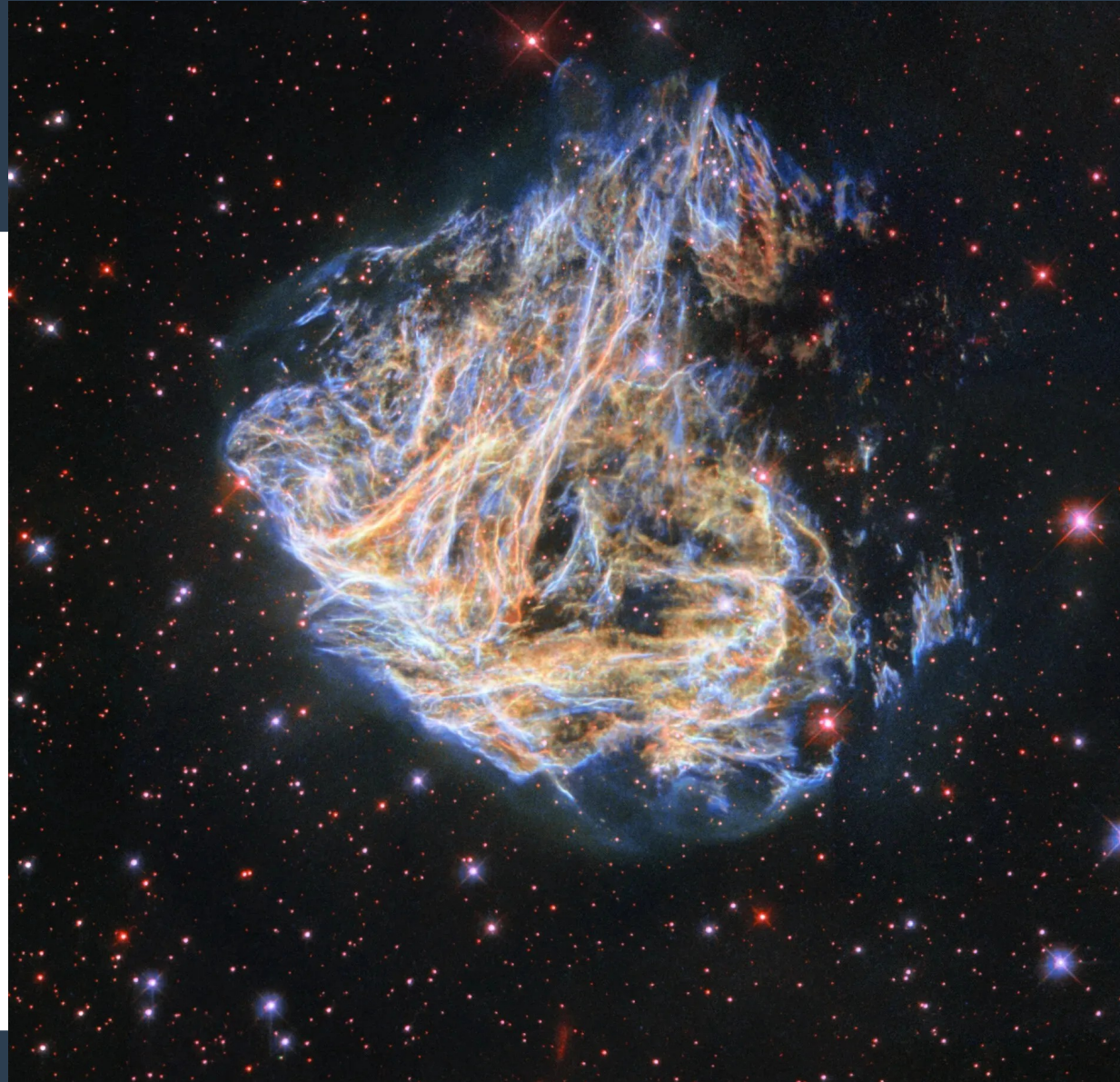
# Tarantula Nebula HST

- **The Tarantula Nebula is a large star-forming region of ionized hydrogen gas that lies 161,000 light-years from Earth in the Large Magellanic Cloud.**



# DEM L 190 - HST

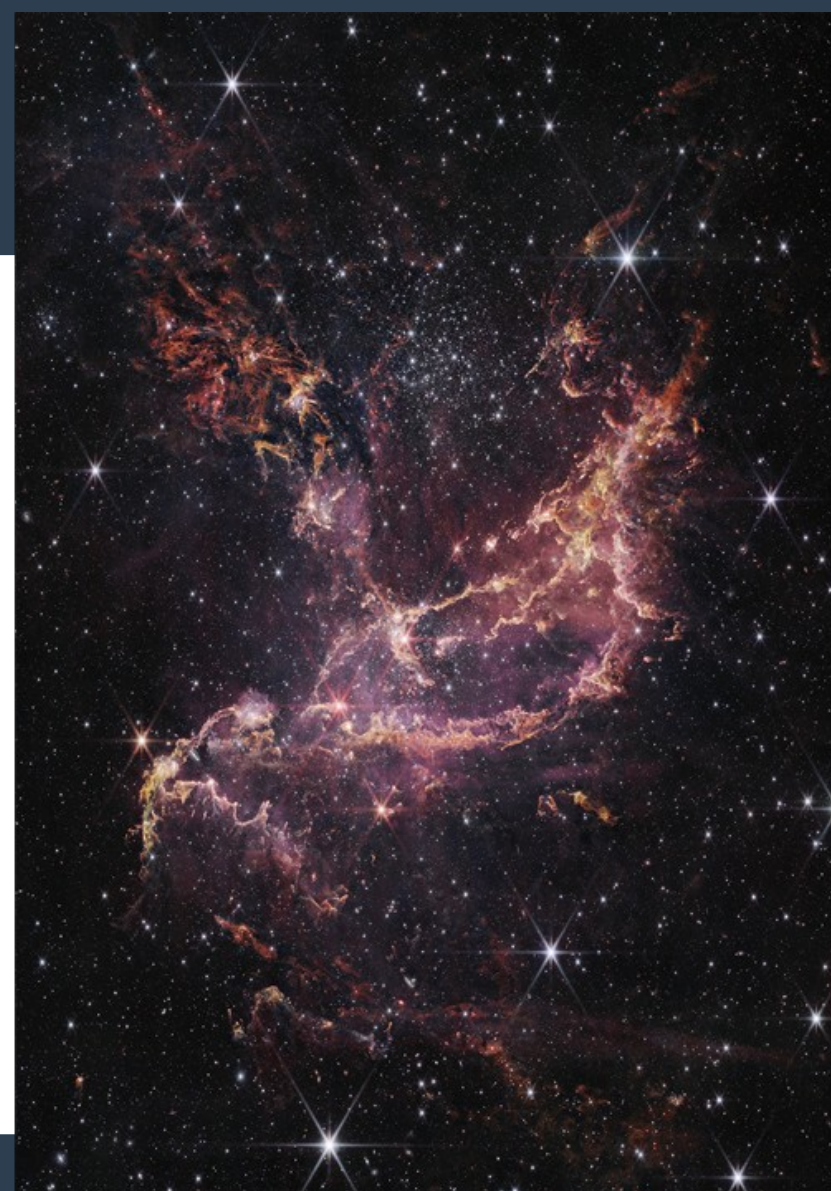
- **The brightest SN remnant in the LMC, this image combines data from the retired WFPC2 with new data from WFC3**





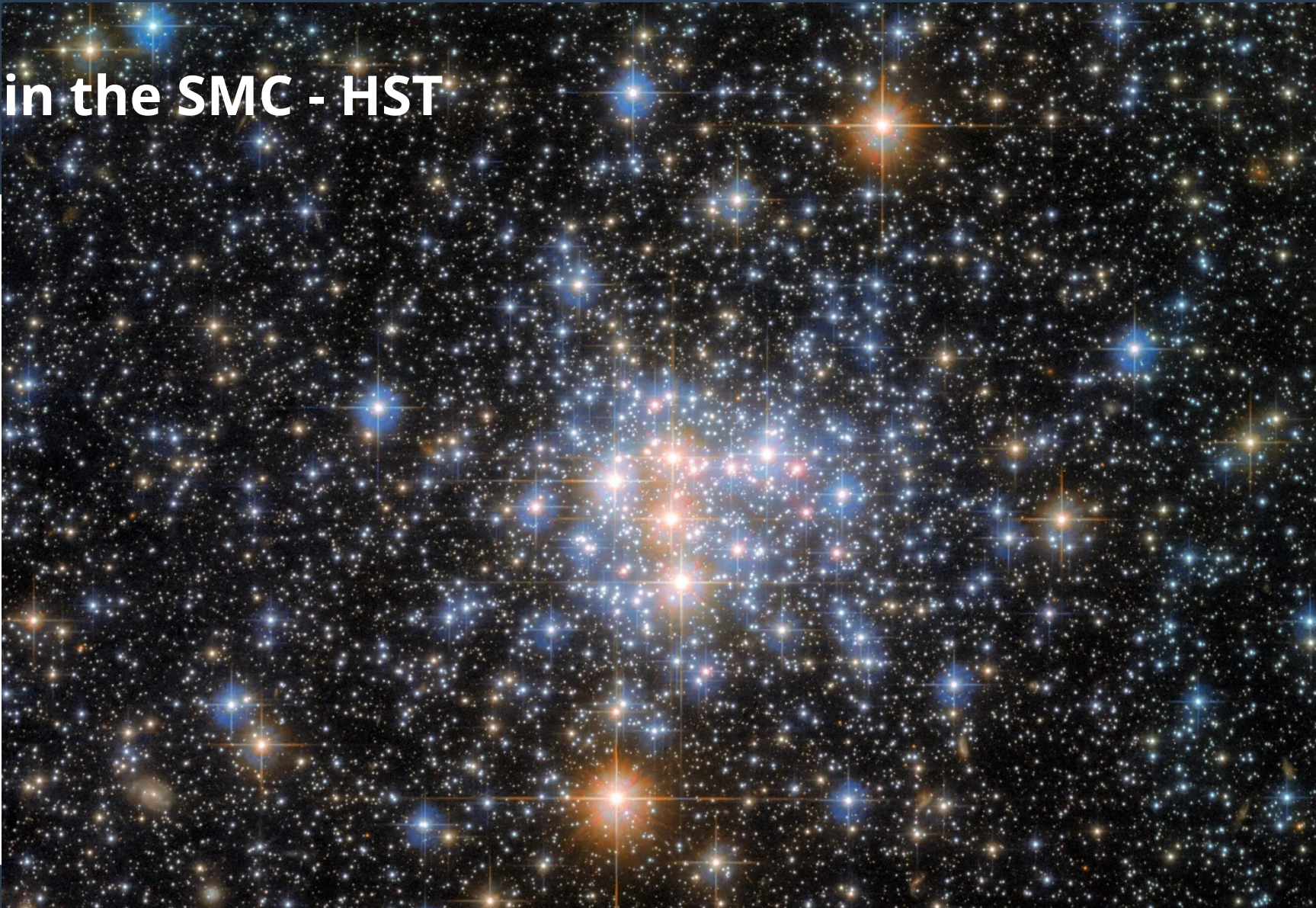
# NGC 346 in the SMC

- **NGC 346 in the Small Magellanic Cloud. NIRCam filters are: F200W is blue; F277W is green; F335M is orange; and F444W is red.**
- **F335M samples PAHs and CH<sub>4</sub> (methane).**



# NGC 376 in the SMC - HST

The open cluster NGC 376, which has a total mass only about 3,400 times that of the Sun. ACS and WFC3.

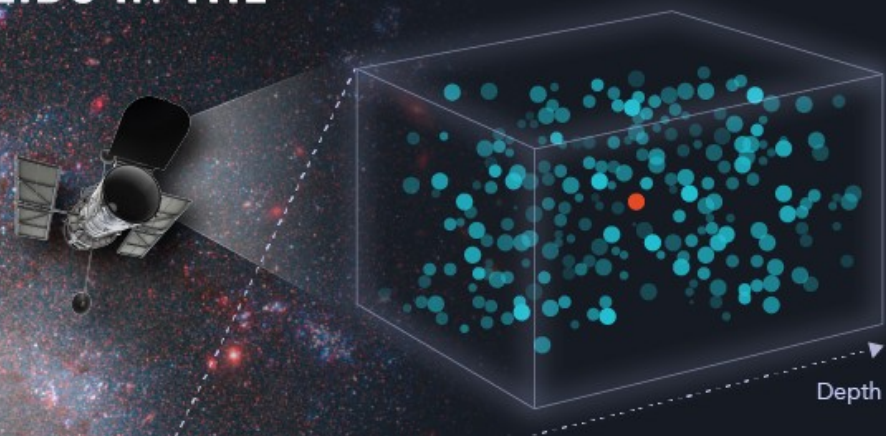


# NGC 5584

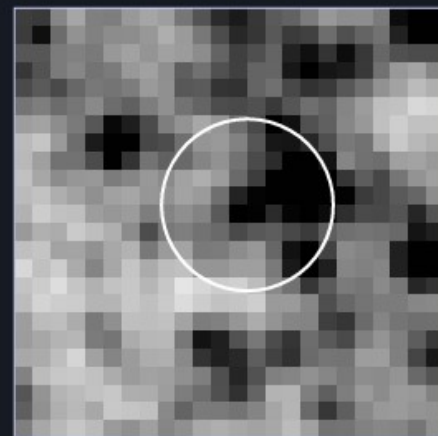
- JWST NIRCam + HST WFC3 – NGC 5584 has Cepheid variables and Type Ia supernova, reliable distance indicators



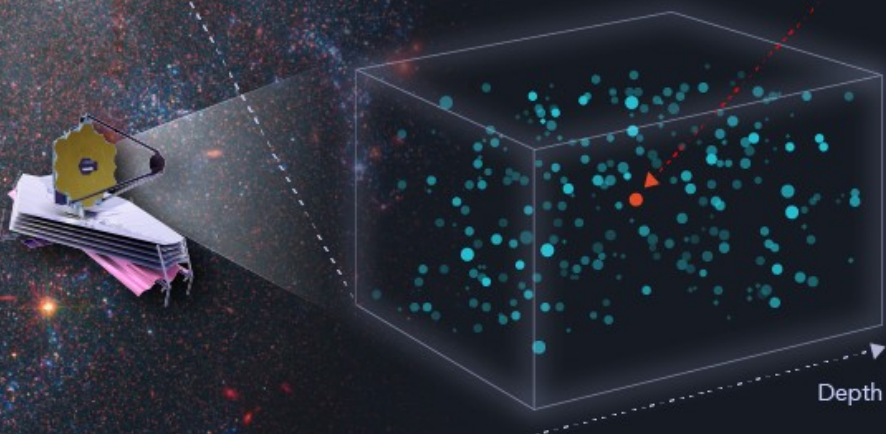
# UNCROWDING CEPHEIDS IN THE NEAR-INFRARED



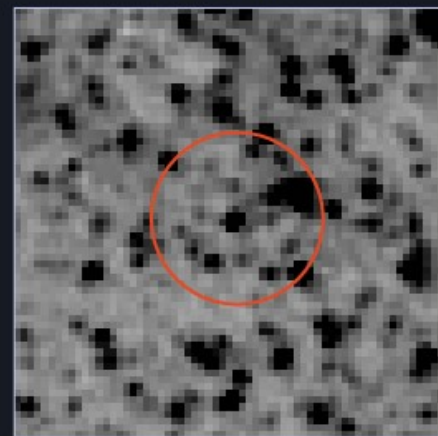
HST WFC3-IR



Cepheid



JWST NIRCAM



# JWST Cosmic ?-mark

- **This detail of a JWST image caught everyone's attention. It turns out to be the chance alignment of 3 galaxies, two of the galaxies might be merging.**



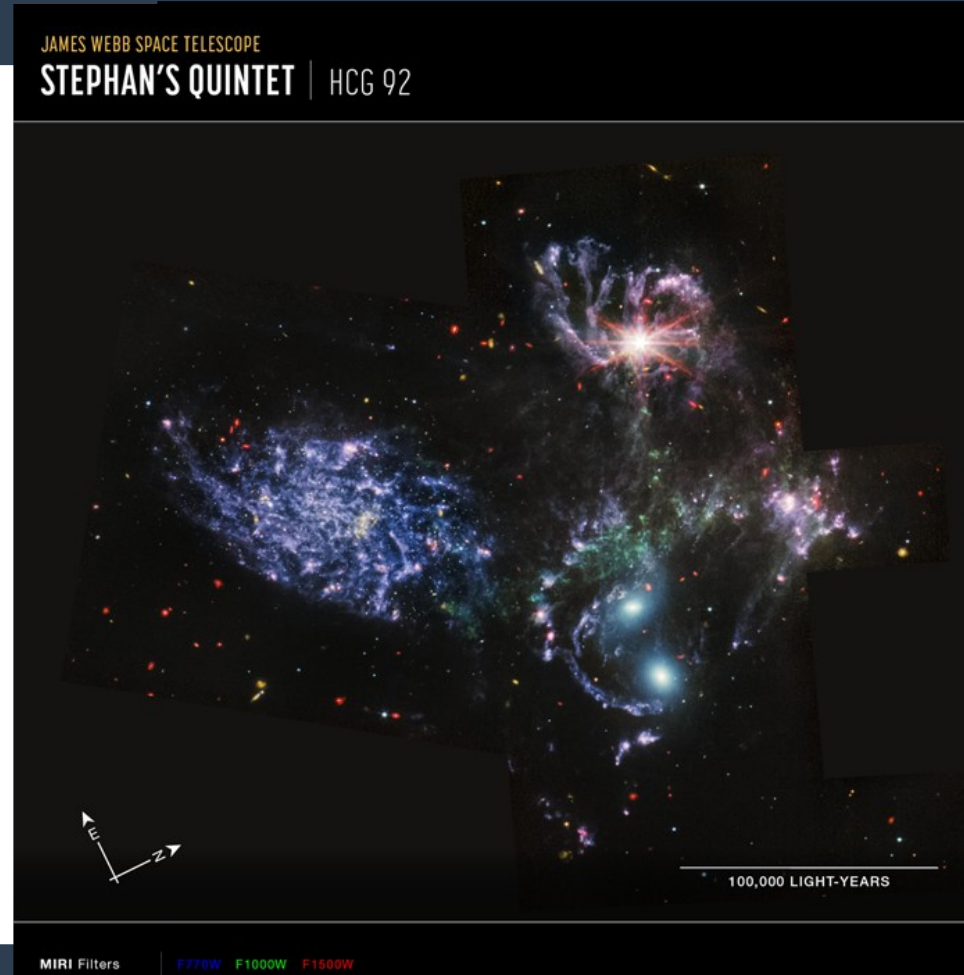
# JWST Stephan's Quintet

- Image of a group of five galaxies that appear close to each other in the sky, the blue galaxy to the left is not part of the physical grouping of the other four galaxies but is in the foreground.
- The NIRCam filters from left to right: F090W is blue; F150W is blue; F200W is green; F277W is yellow; F356W is red; and F444W is also red. The MIRI filters from left to right: F770W is orange; F1000W is red.



# JWST Stephan's Quintet MIRI

- MIRI image of 4 galaxies that are close to each other, the blue galaxy to the left is not part of the physical grouping of the other four galaxies but is in the foreground.
- The MIRI filters from left to right: F770W is blue; F1000W is green; and F1500W is red.



# Cartwheel Galaxy

- **Combined NIRCam and MIRI image of the Cartwheel Galaxy. MIRI data are colored red while NIRCam data are colored blue, orange, and yellow.**



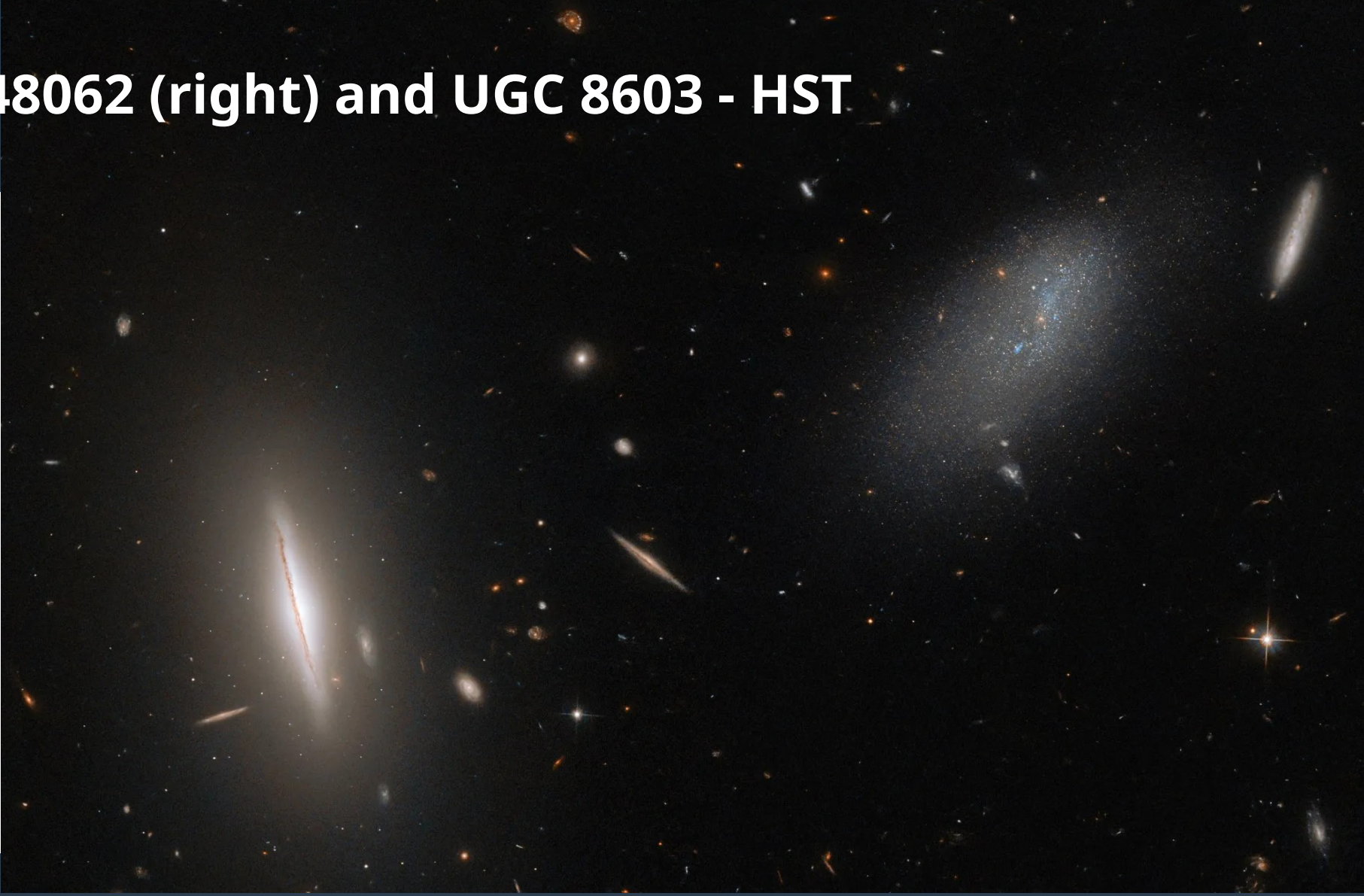


# Dwarf Irregular Galaxy UGC 7983 – HST



# LEDA 48062 (right) and UGC 8603 - HST

Part of  
“Every  
Known  
Nearby  
Galaxy”  
program



# UGCA 307 - HST

- **UGCA 307 is a diminutive dwarf galaxy located roughly 26 million light-years from Earth in the constellation Corvus.**



# Donatiello II Dwarf Galaxy (HST)



# NGC 1433 - MIRI

**NGC 1433  
from  
MIRI, a  
Seyfert  
galaxy 46  
million  
light-years  
from  
Earth.**



# NGC 7496 - MIRI

- NGC 7496 taken with MIRI, which lies over 24 million light-years away in the constellation Grus (latin for Crane).





GRB 230307A  
kilonova

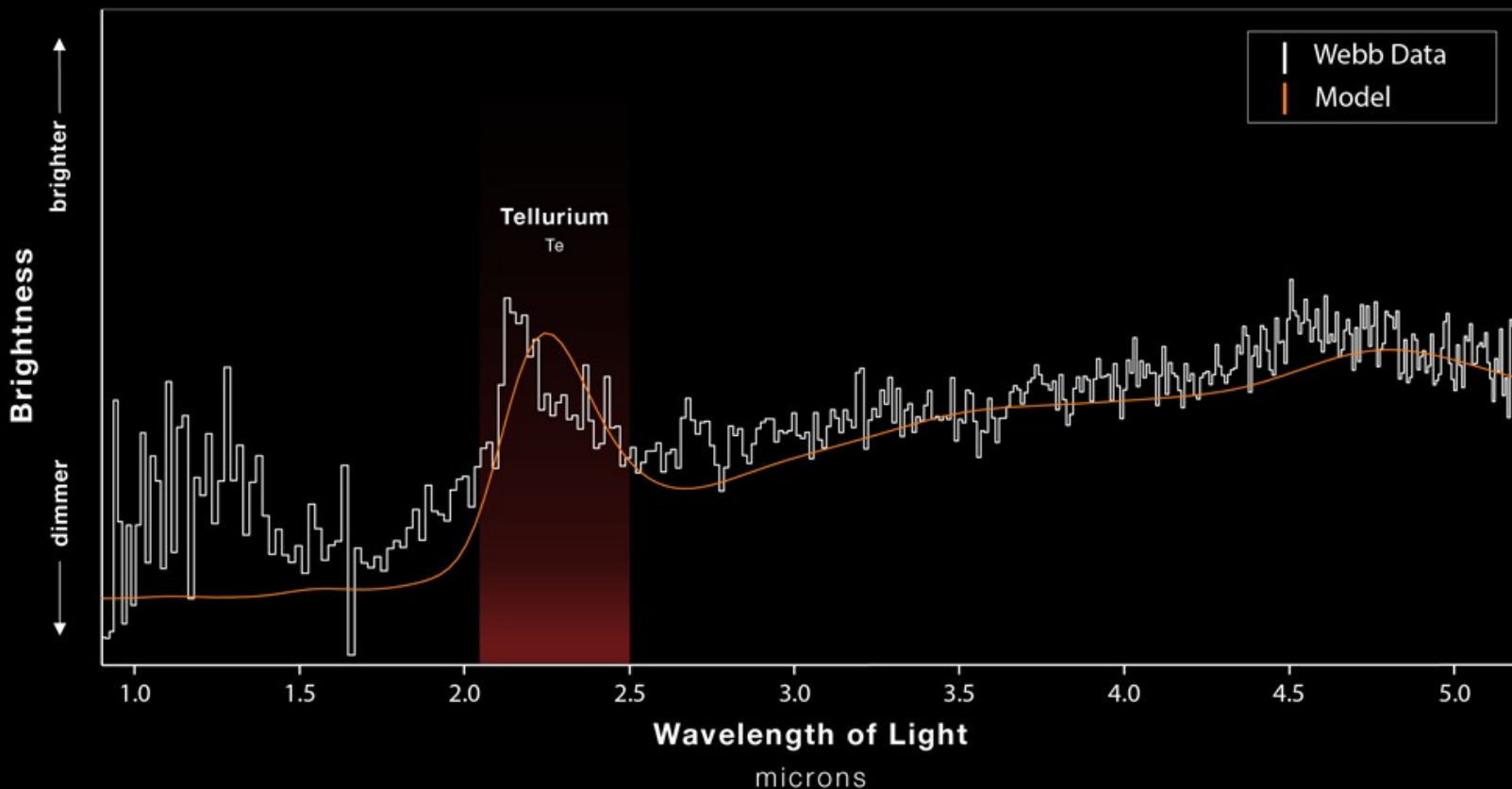
former home galaxy



GRB 230307A

# KILONOVA EMISSION SPECTRUM

NIRSpec | PRISM





# SPT-CL J0019-2026 - HST

- **Cluster SPT-CL J0019-2026 gravitationally lenses more distant galaxies which appear as arcs.**



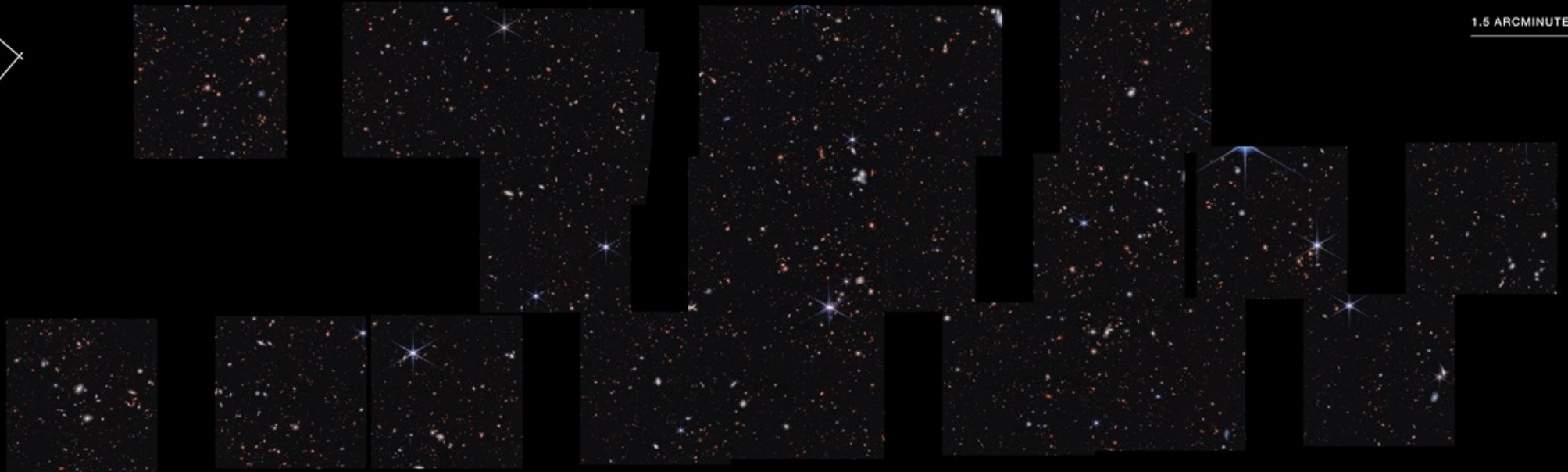
# CEERS Survey - NIRCam

JAMES WEBB SPACE TELESCOPE

## EXTENDED GROTH STRIP FIELD



1.5 ARCMINUTES

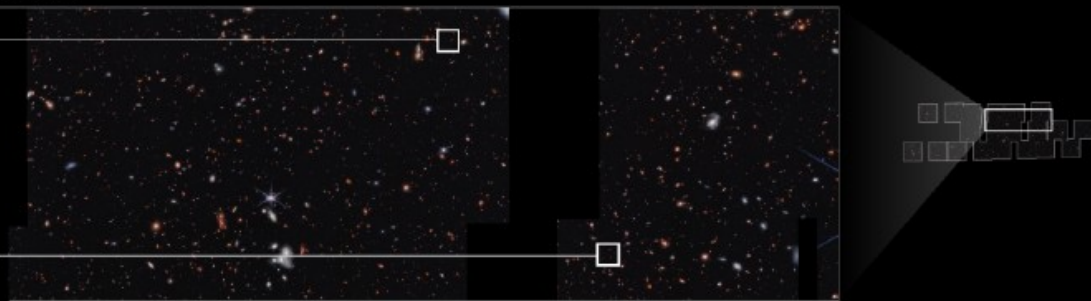


NIRCcam Filters | F110W F150W F200W F277W F356W F444W

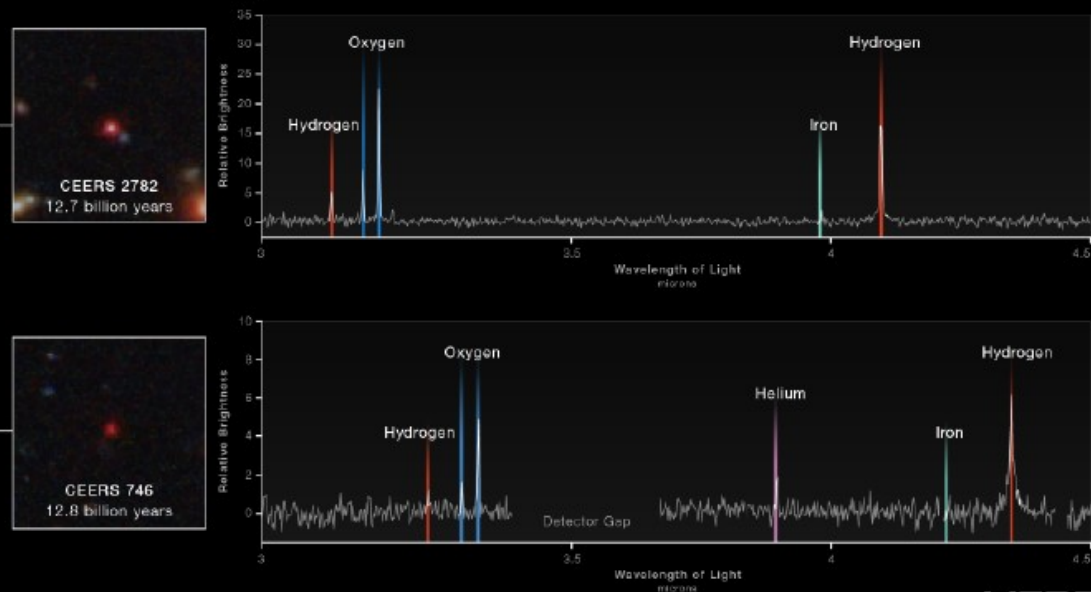


# TWO EXTREMELY DISTANT ACTIVE SUPERMASSIVE BLACK HOLES

NIRCam Imaging

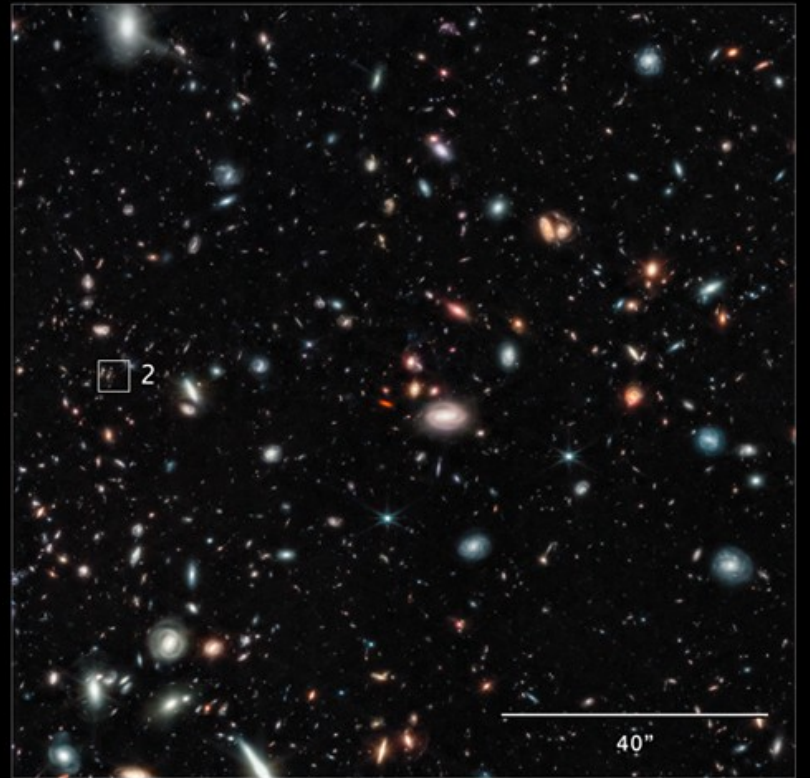
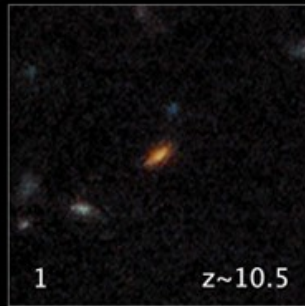
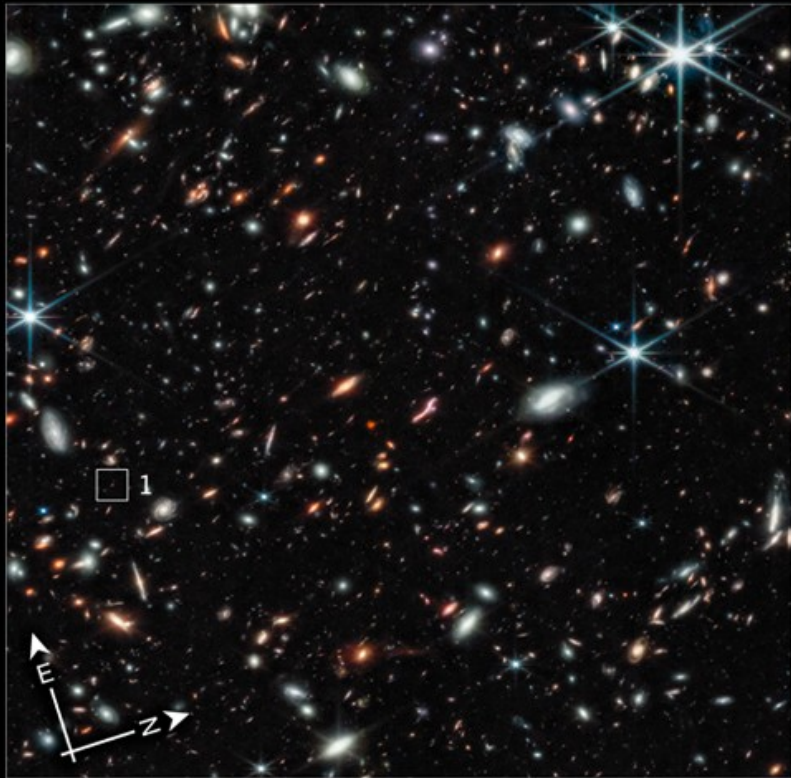


NIRSpect Microshutter Array Spectroscopy



JAMES WEBB SPACE TELESCOPE

# PANDORA'S CLUSTER | ABELL 2744



NIRCam Filters

F090W

F115W

F150W

F200W

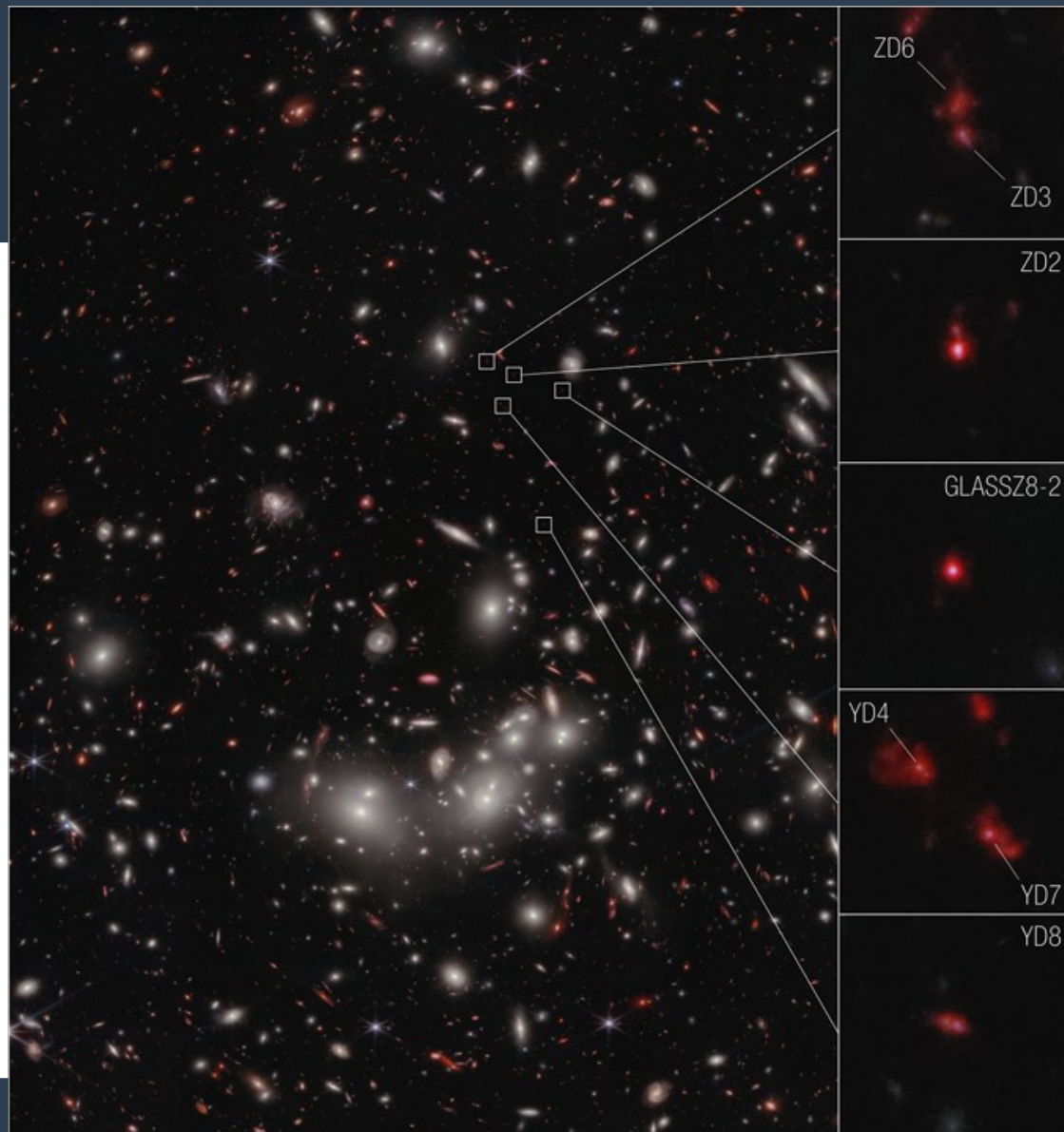
F277W

F356W

F444W

# Galaxy Protocluster

- The seven galaxies highlighted in this JWST image have been confirmed to be at a redshift of 7.9, which correlates to 650 million years after the big bang. This makes them the earliest galaxies yet to be spectroscopically confirmed as part of a developing cluster.



**JADES**

**JWST  
Advanced  
Deep  
Extragalactic  
Survey**

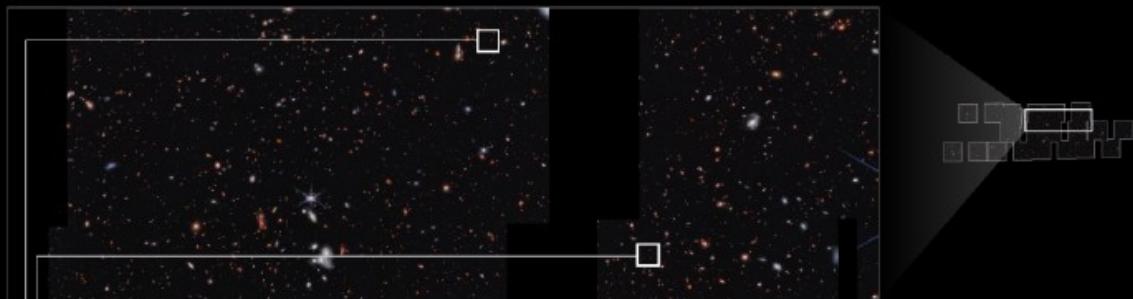


# Quasar J0100+2802 - JWST



# TWO EXTREMELY DISTANT ACTIVE SUPERMASSIVE BLACK HOLES

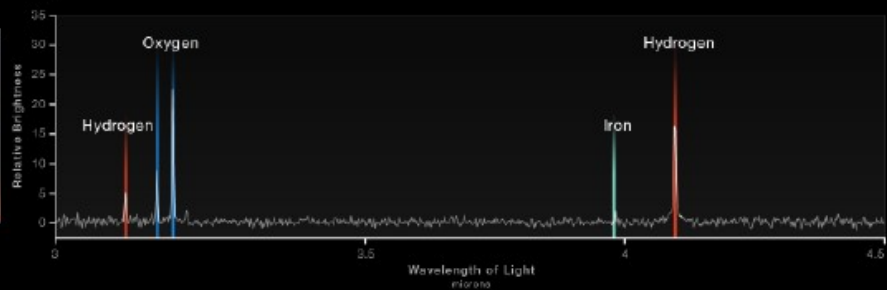
NIRCam Imaging



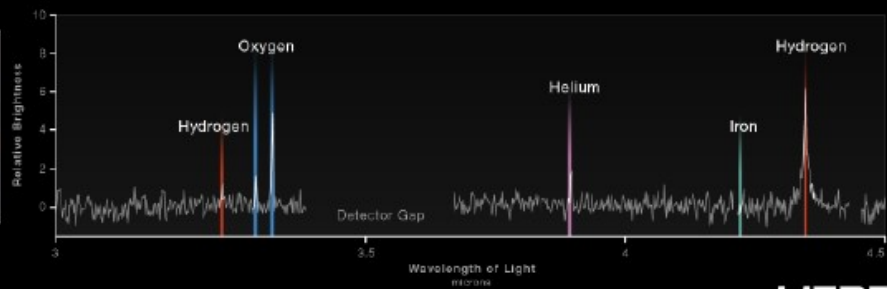
NIRSpec Microshutter Array Spectroscopy



CEERS 2782  
12.7 billion years



CEERS 746  
12.8 billion years







**That's All Folks**