Exoplanet Science with Webb

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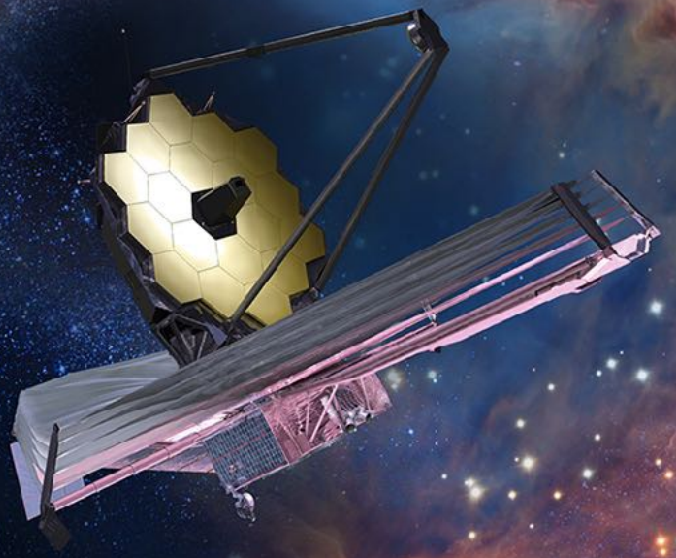
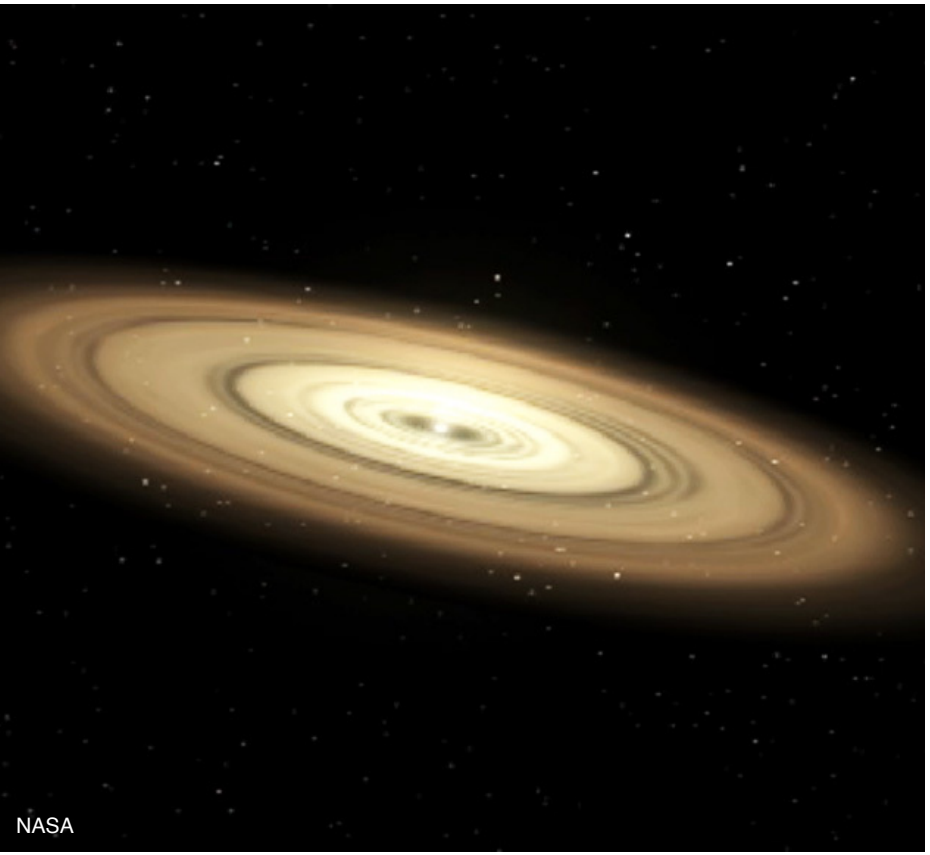
AAS 238th Meeting
8 June 2021



WEBB JAMES WEBB SPACE TELESCOPE

Exoplanet Science with Webb

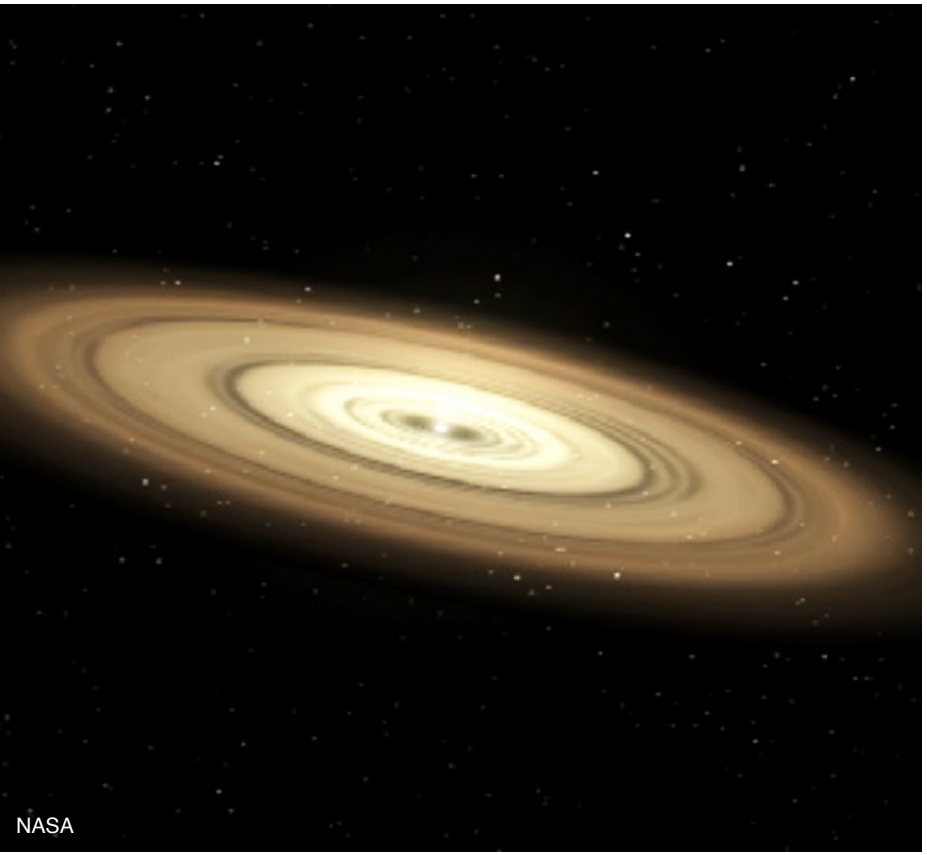
How do exoplanets form
and evolve?

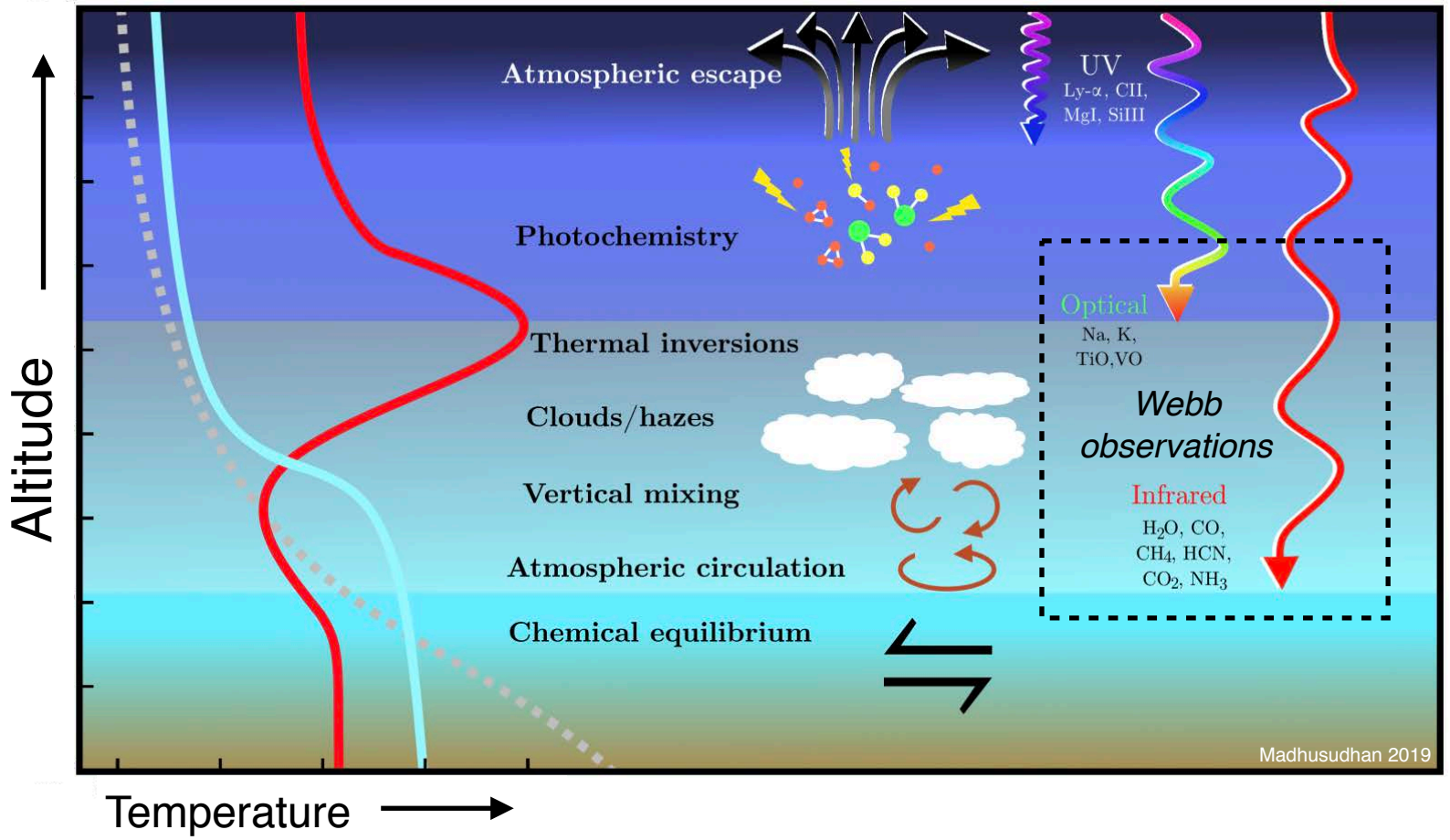


Exoplanet Science with Webb

How do exoplanets form and evolve?

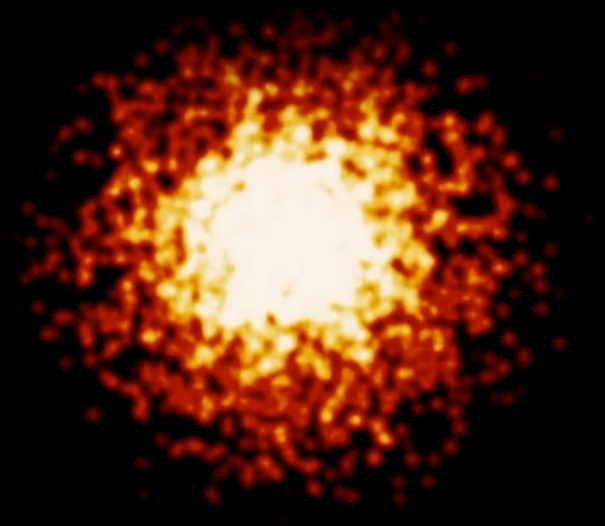
What are exoplanets and their atmospheres made of?





Observing Exoplanets with Webb

Direct Imaging: resolves a faint disk or exoplanet around the host star



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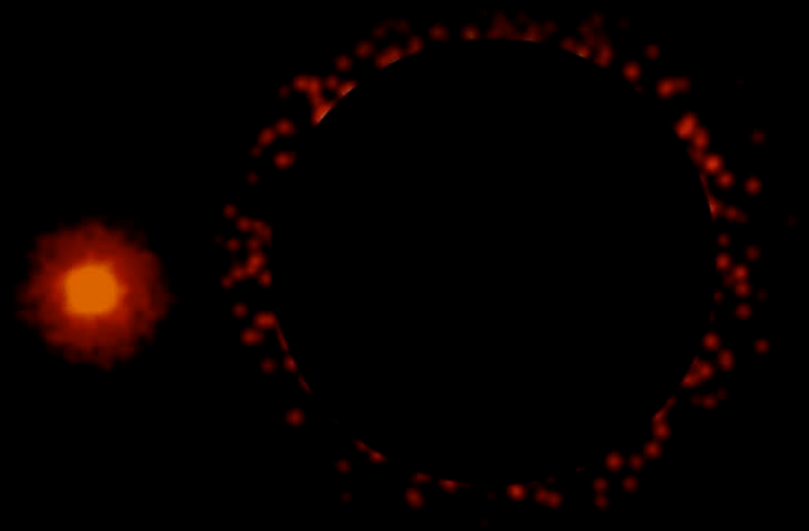
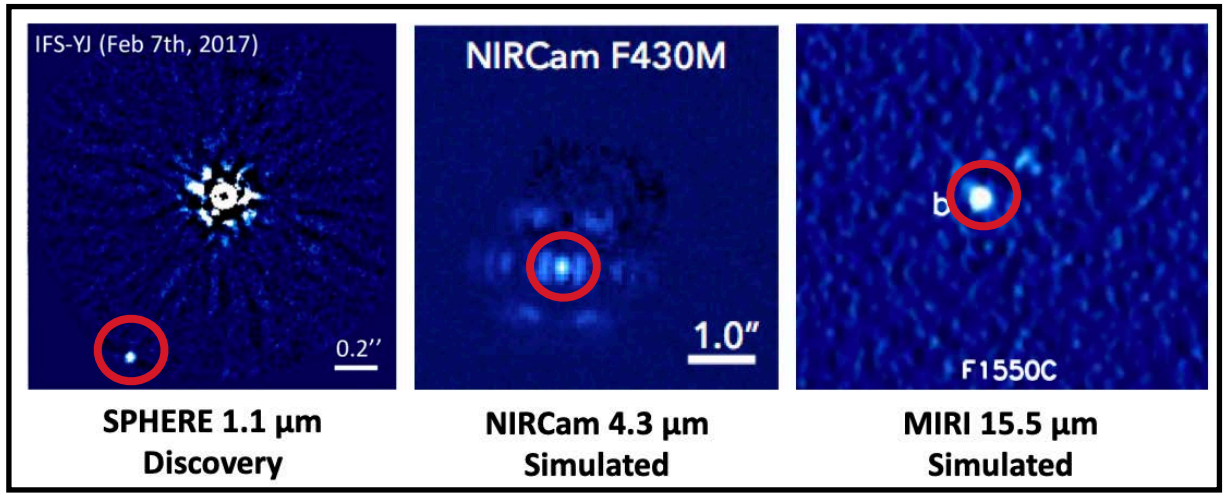


ALMA image of HD 163296, a
Webb Cycle 1 target

Webb Direct Imaging Exoplanet Science

Webb offers unique advantages for exoplanet imaging especially thanks to its large mirror, the stability of the telescope, and its access to infrared wavelengths where young exoplanets are brightest. Around 40 different stars will be observed in Webb Cycle 1 with direct imaging techniques, to reveal images of known exoplanets or to search for as-yet-undiscovered exoplanets. Webb will specifically image young giant exoplanets such as HIP 65426 b and will be used to search for giant exoplanets around a number of stars including around our nearest neighbor, Alpha Cen A.



Webb Cycle 1 Target HIP 65426 b (Chauvin et al. 2017; Sasha Hinkley)

Observing Exoplanets with Webb

Transits: an indirect technique to study exoplanet atmospheres

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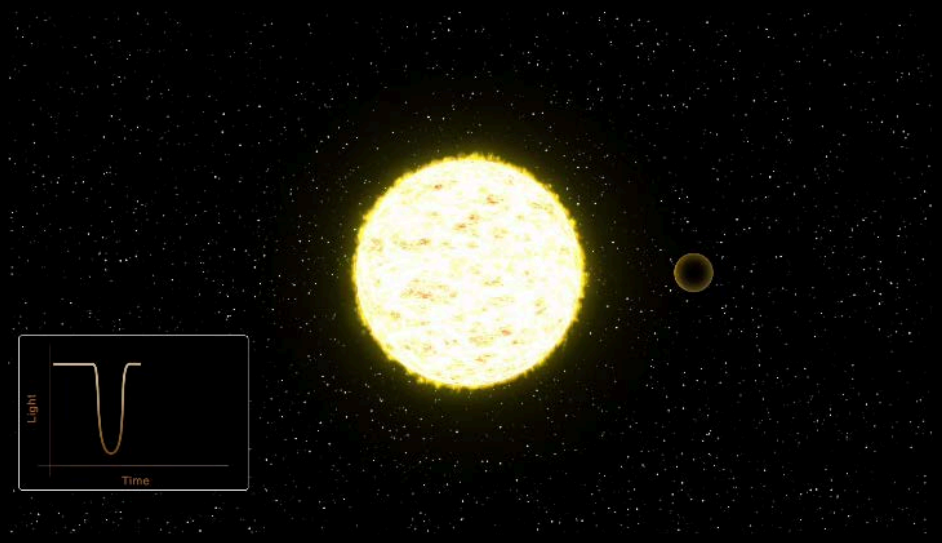
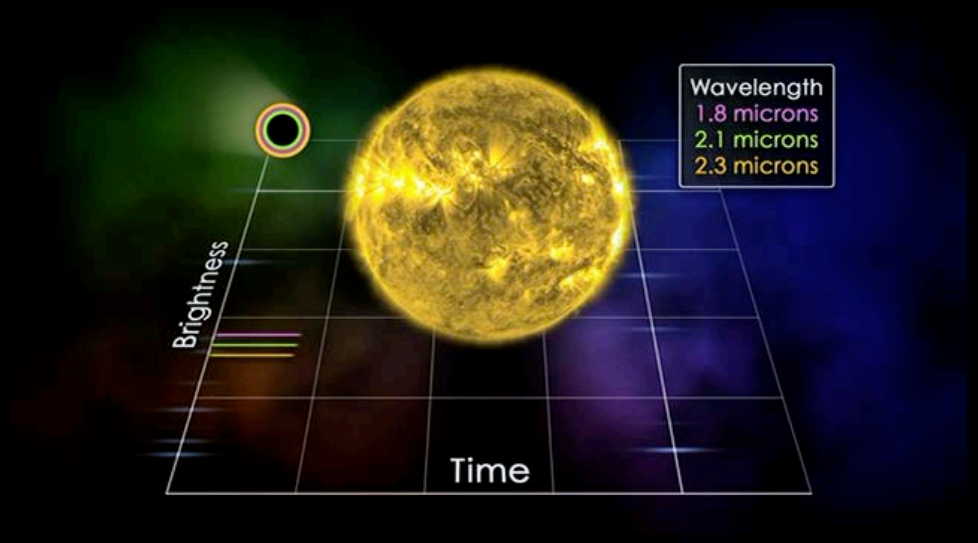
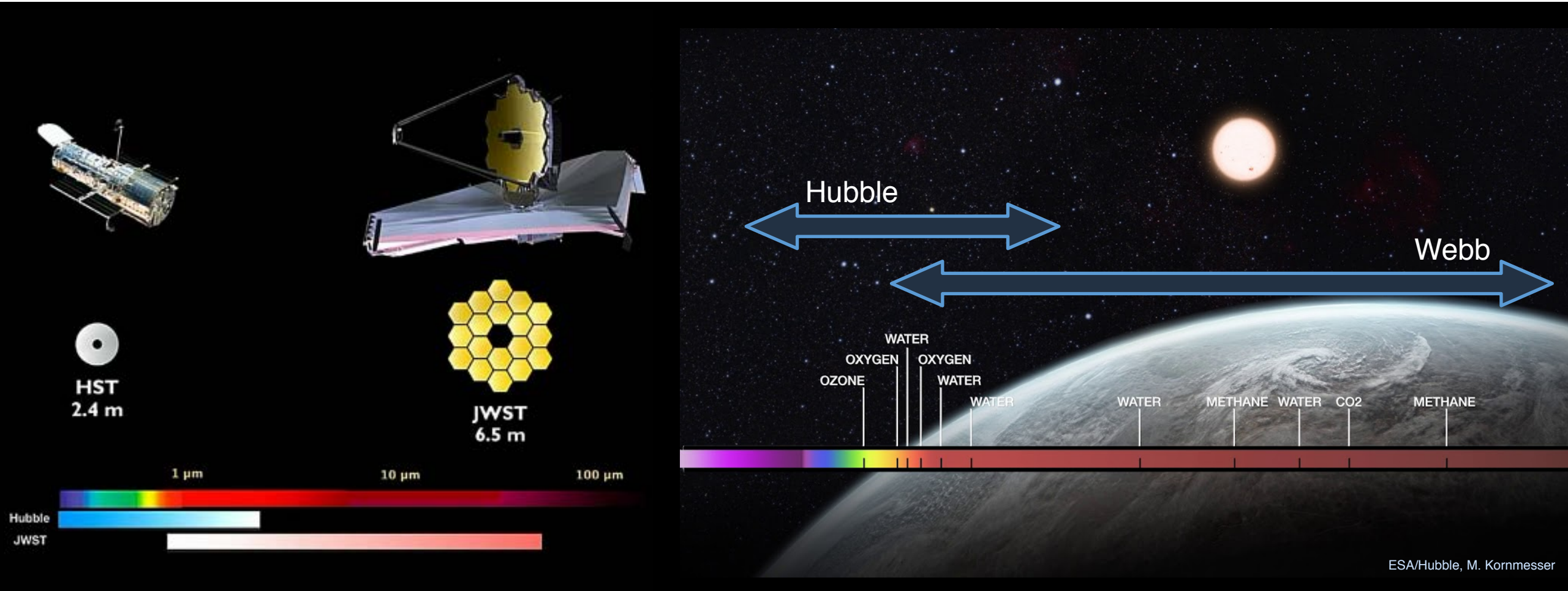




Observing Exoplanets with Webb

Webb will provide high-precision data at infrared wavelengths of light that Hubble and other observatories cannot reach in their study of transiting exoplanets. At these wavelengths, Webb will observe transits of exoplanets to look for absorption from water, carbon dioxide, methane, and other molecules in the atmospheres of exoplanets.

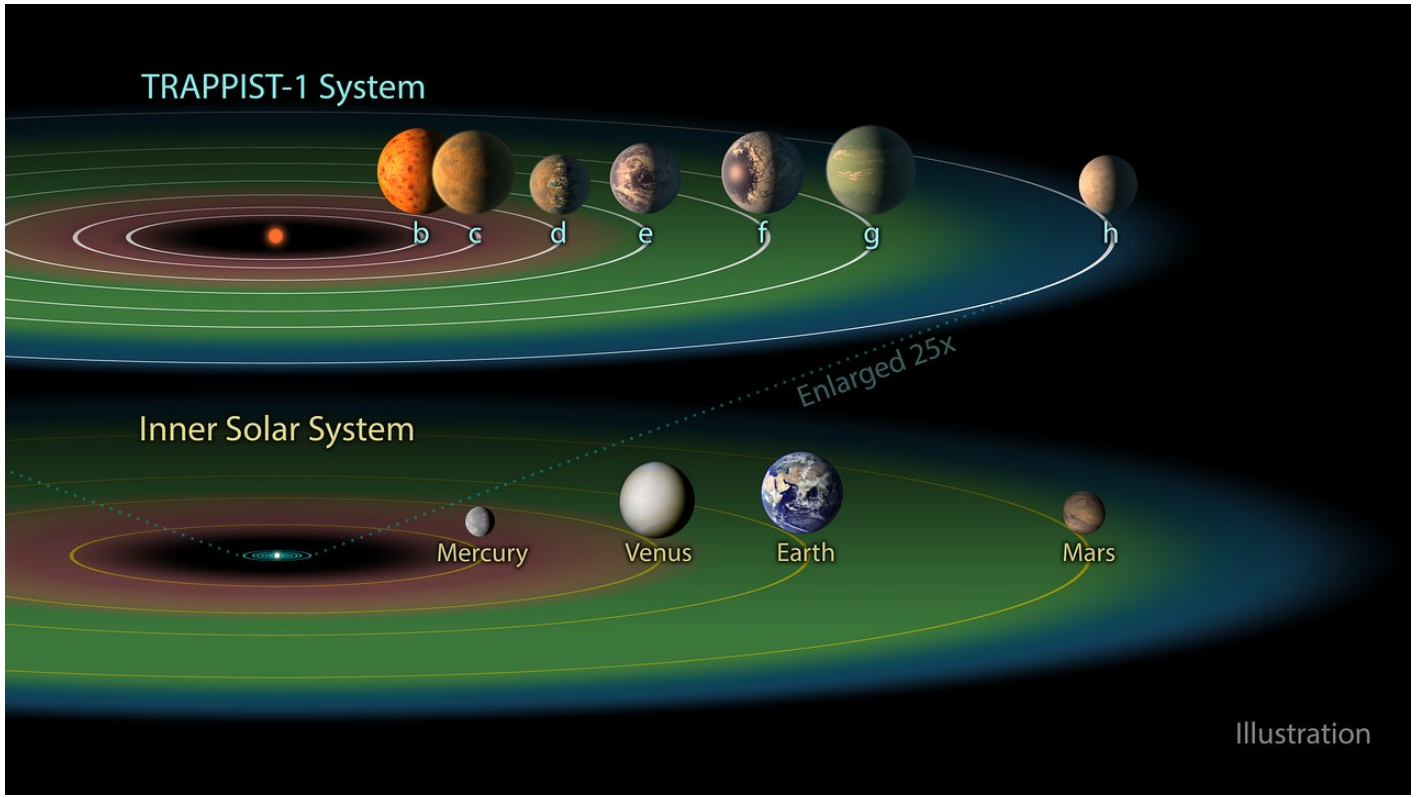


ESA/Hubble, M. Kornmesser

Webb Transiting Exoplanet Science

Nearly 70 different transiting exoplanets will be observed in Webb Cycle 1. These include:

- 31 Earth-size exoplanets (around 1-2x the size of Earth)
- 14 Neptune-size exoplanets (around 3-8x the size of Earth)
- 23 Jupiter-size exoplanets (more than 8x the size of Earth)

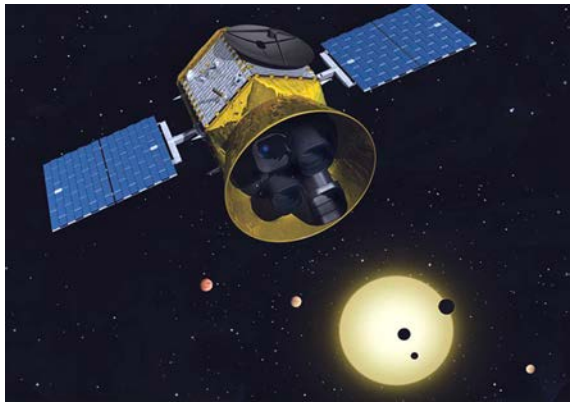


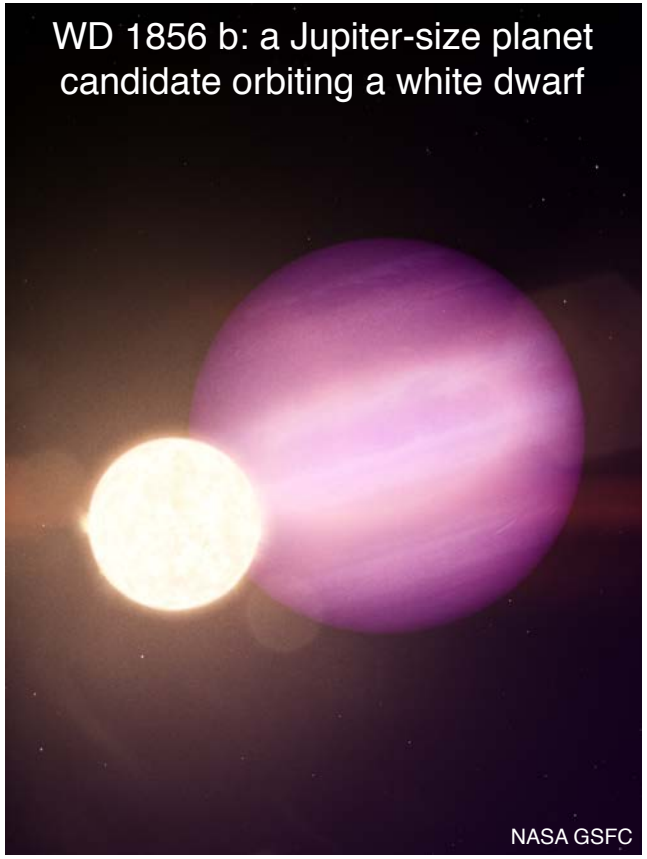
All seven terrestrial-size planets in the TRAPPIST-1 system will be observed in Webb Cycle 1.

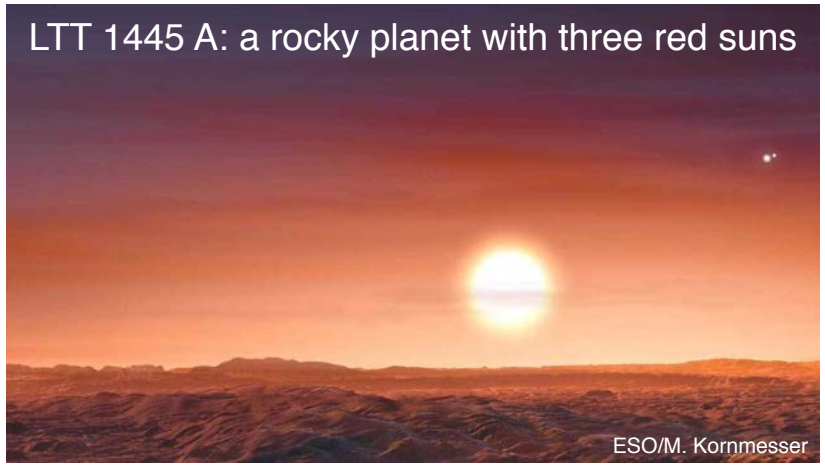
55 Cancri e: a super-hot super-Earth to be observed in Webb Cycle 1

Webb Transiting Exoplanet Science

Twenty-five of the transiting exoplanets to be observed in Webb Cycle 1 were discovered by the Transiting Exoplanet Survey Satellite (TESS). TESS launched in April 2018 and has been discovering small transiting exoplanets around bright, nearby stars since then. Such exoplanets make excellent targets for detailed atmospheric characterization with Webb.







Summary of Exoplanet Science with Webb

- Webb will provide a new view of disks and of exoplanets and their atmospheres thanks to its infrared wavelength coverage, stability, and sensitivity.
- Nearly a quarter of Webb Cycle 1 time will be spent studying disks and exoplanets, and many of the exoplanets to be observed by Webb in its first year of science are predominantly small and potentially rocky exoplanets discovered by TESS.
- Webb will ultimately enable new investigations of how exoplanets formed and evolved and of what the structure and composition of their atmospheres are like, to provide a better understanding of how exoplanets connect back to planets in our Solar System.