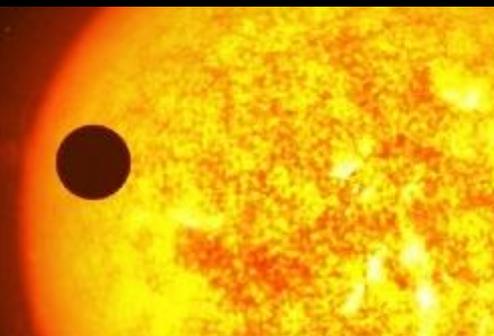
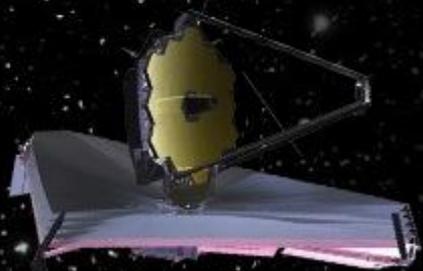


Hands-on Session: Detection and Spectroscopic Characterization of Transiting Exoplanets with the James Webb Space Telescope

Nikole K. Lewis
JWST Project Scientist
Space Telescope Science Institute

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Why Transiting Extrasolar Planets?

See cyclical variations in brightness of planet

See thermal radiation and reflected light from planet disappear and reappear

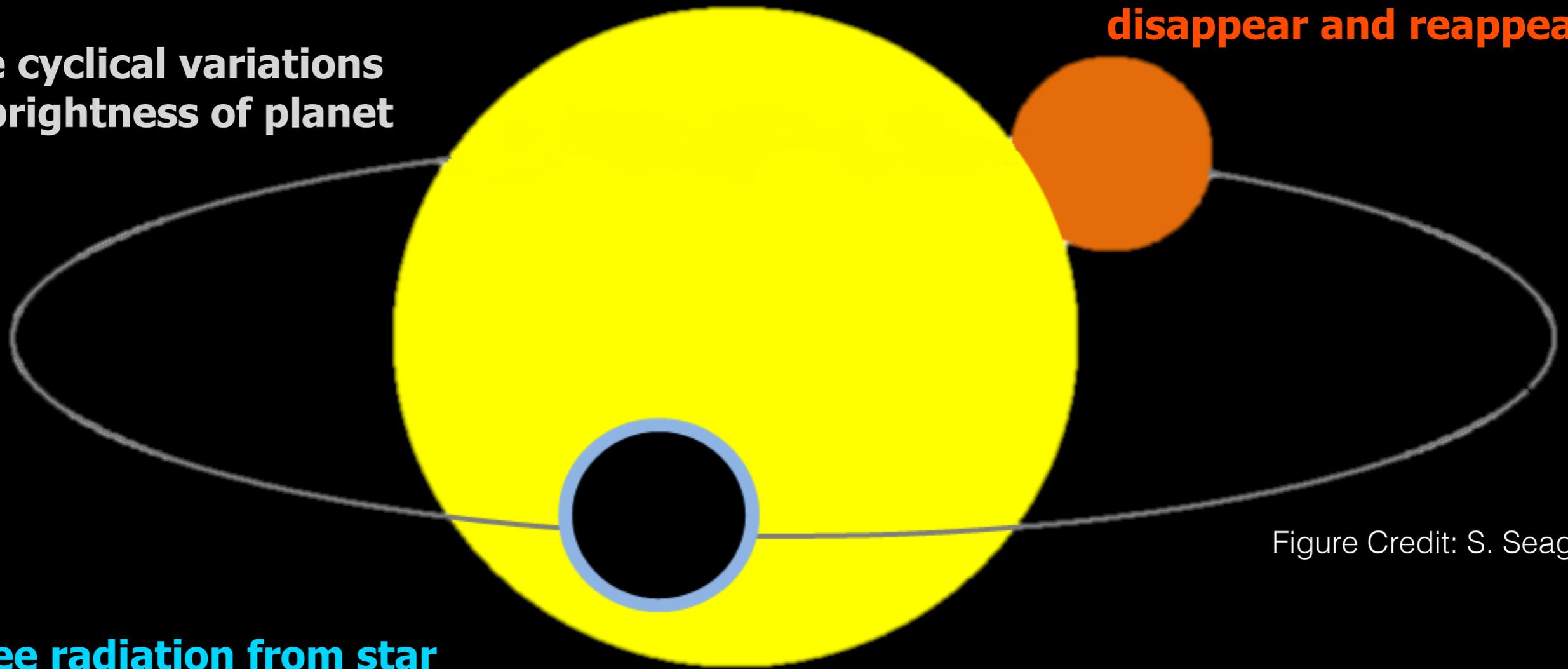


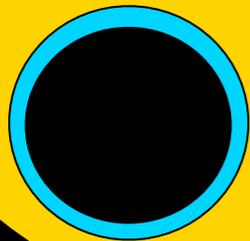
Figure Credit: S. Seager

See radiation from star transmitted through the planet's atmosphere

Currently more than 3000 confirmed transiting extrasolar planets!

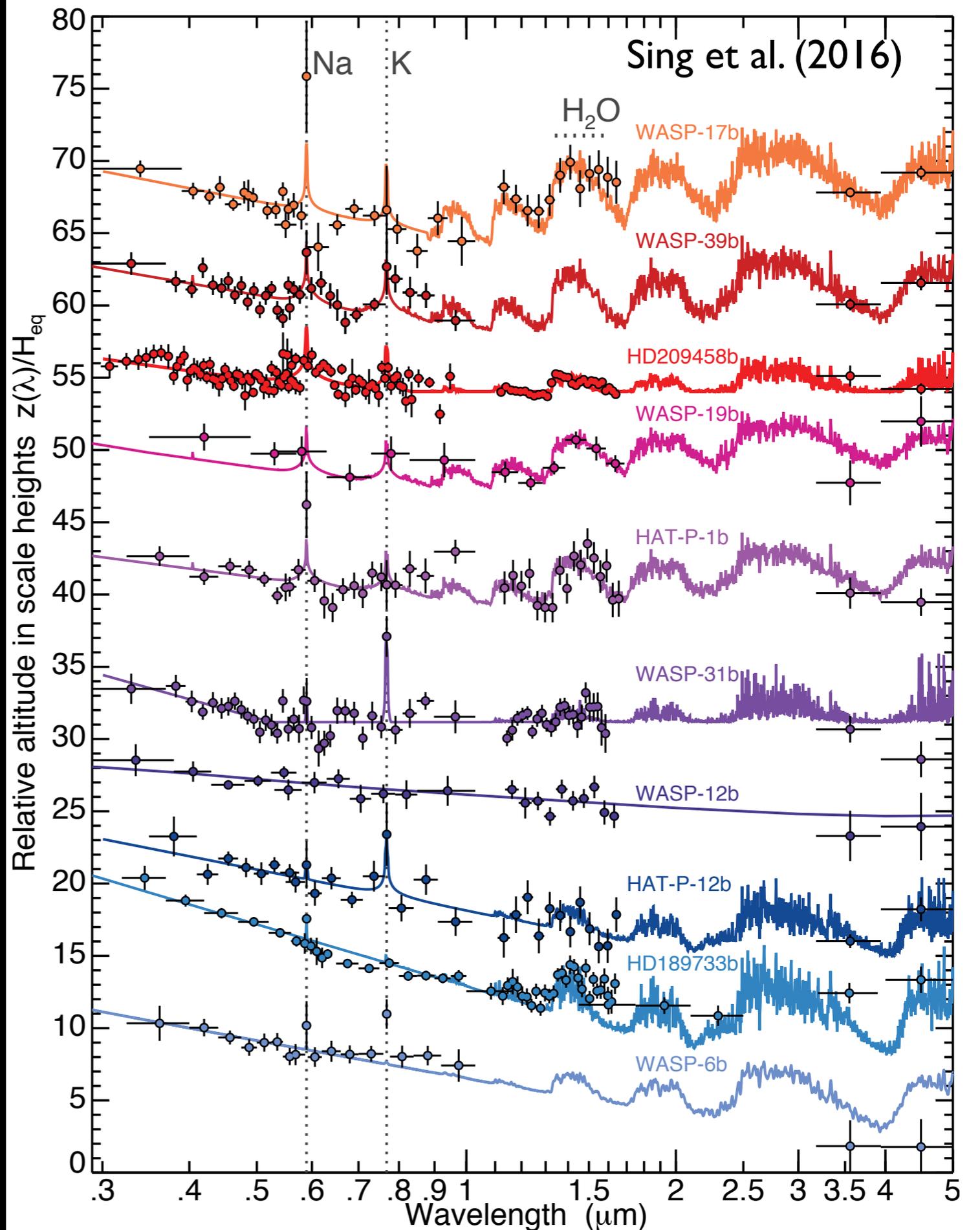
Transits

$$\frac{R_p^2}{R_\star^2} \sim 0.01\% \text{ to } 1\%$$

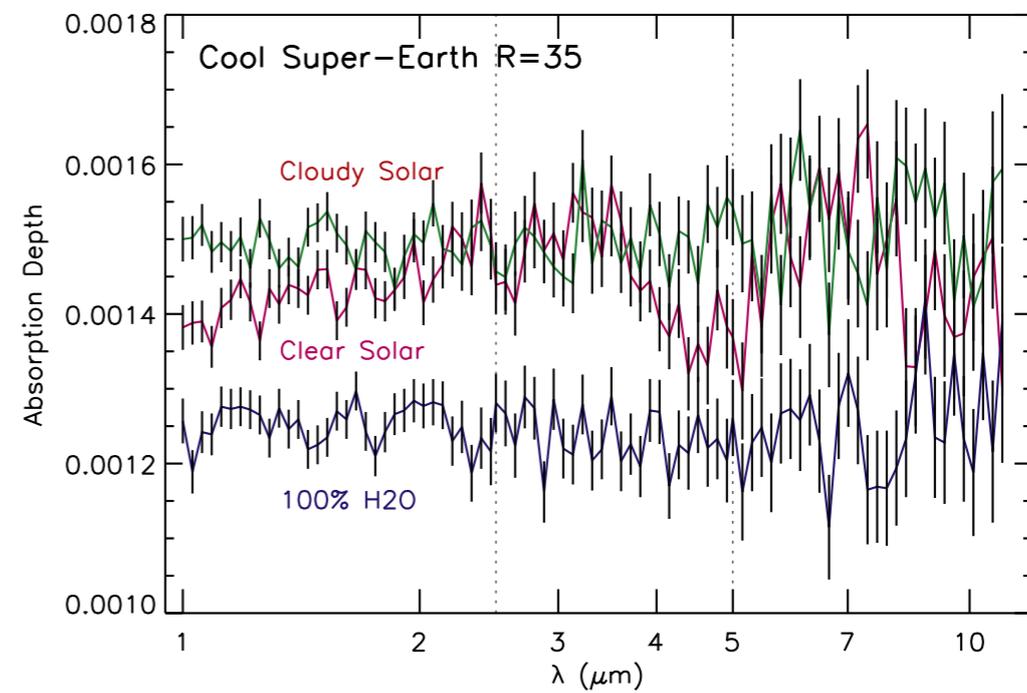
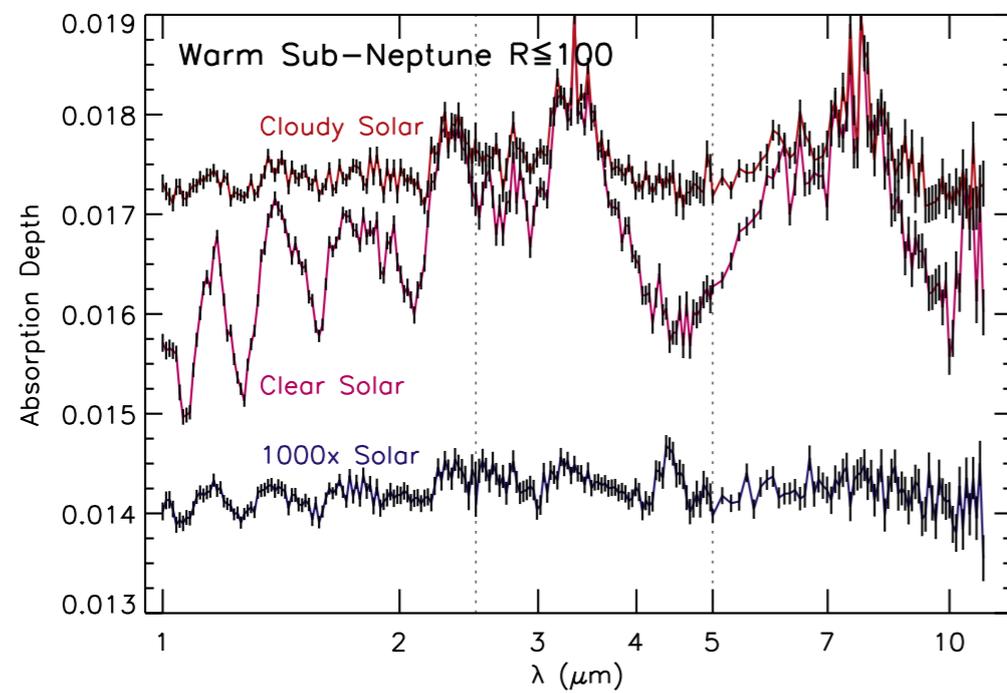
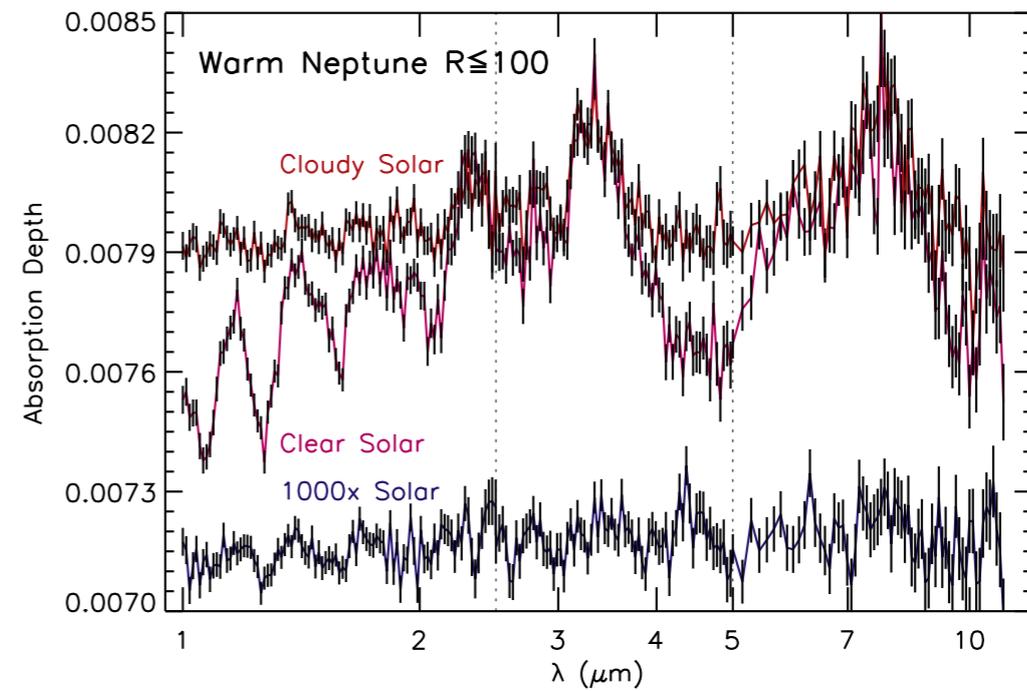
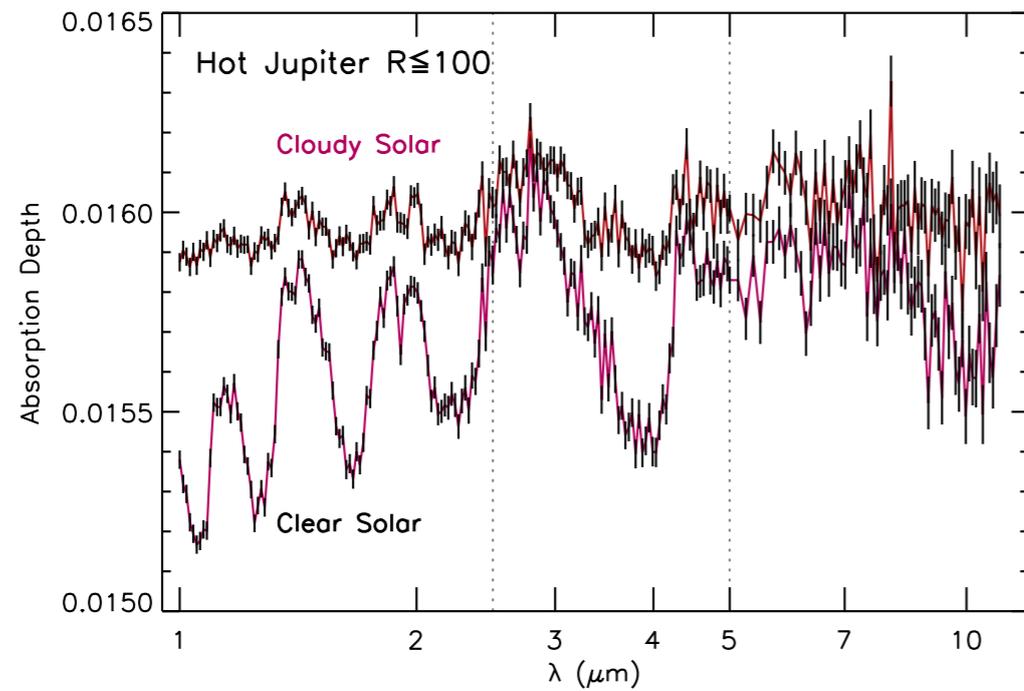


$$\propto \frac{R_p}{R_\star^2} H$$

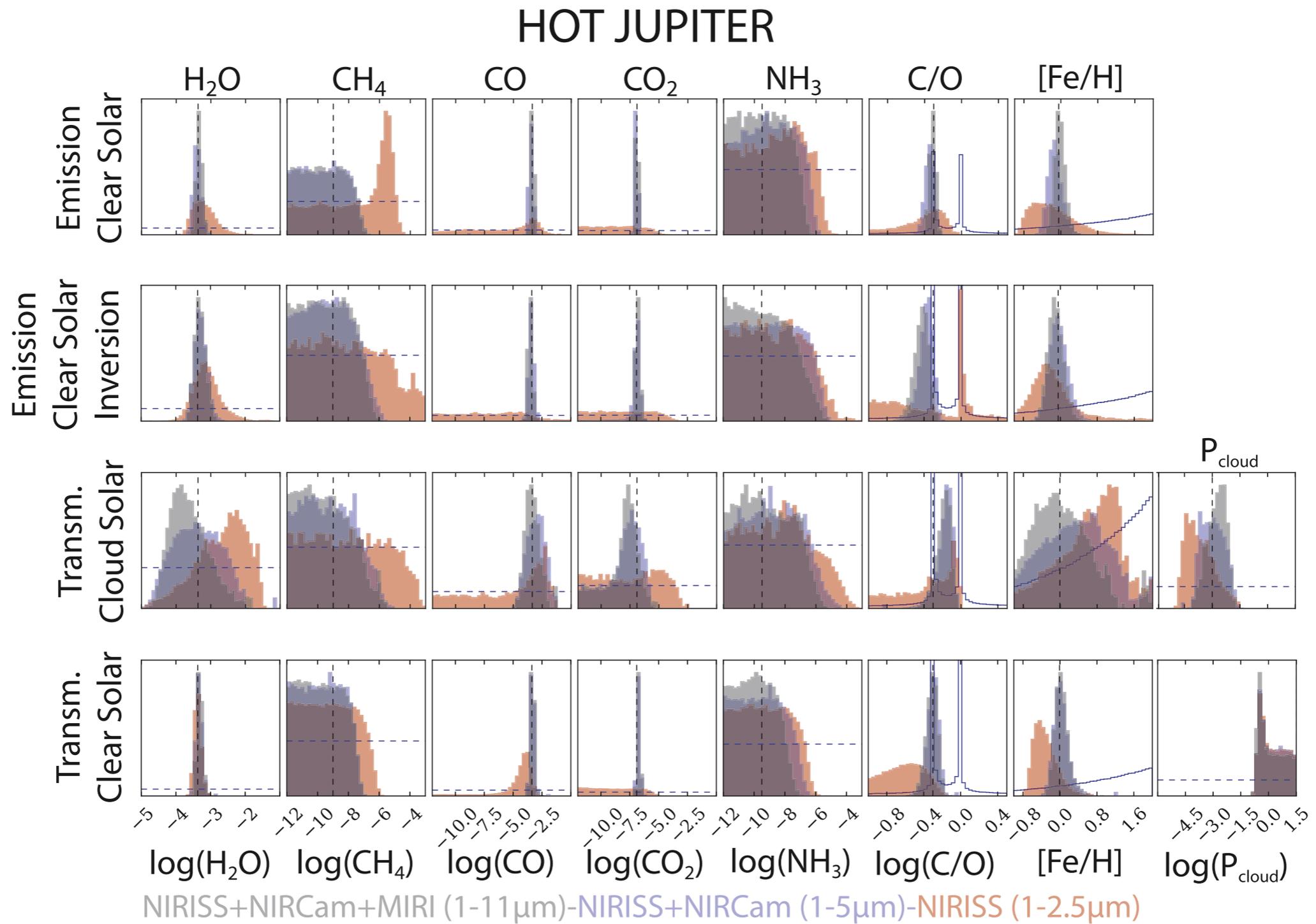
Probes Pressures
100-1 mbar
Near Planetary Limb



In the Era of Webb....

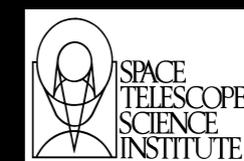
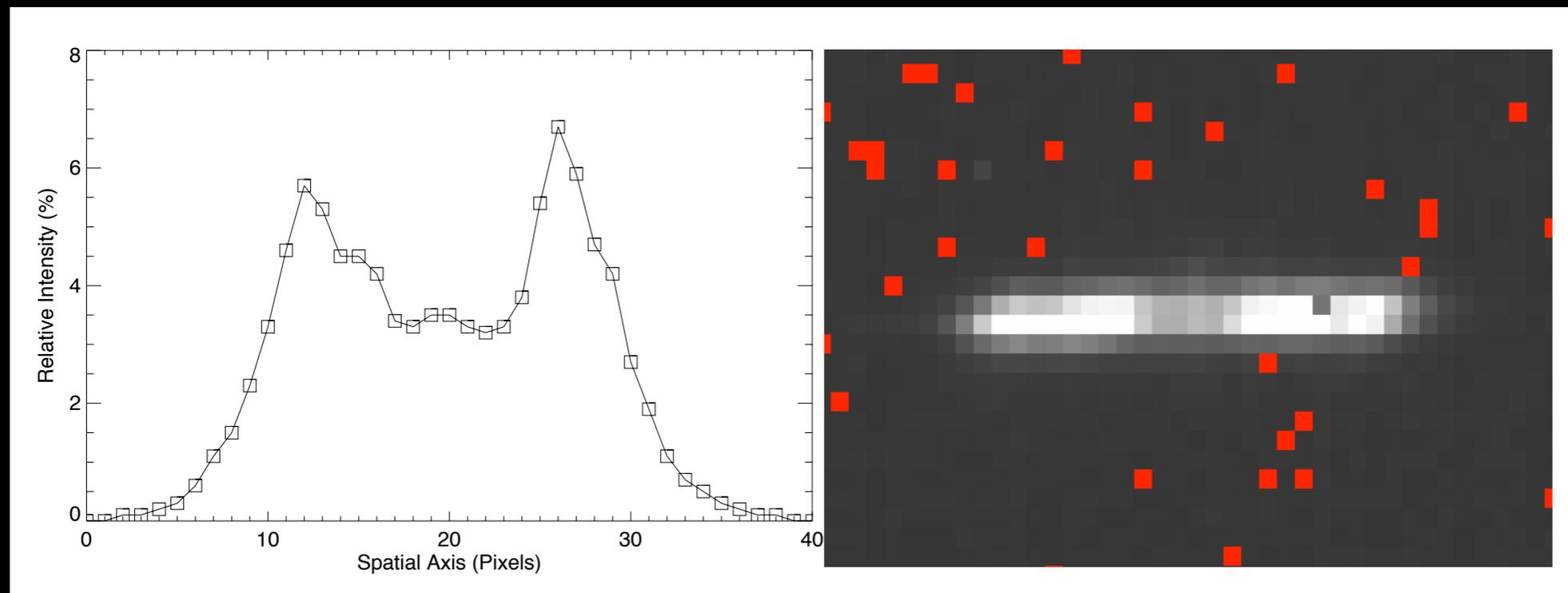
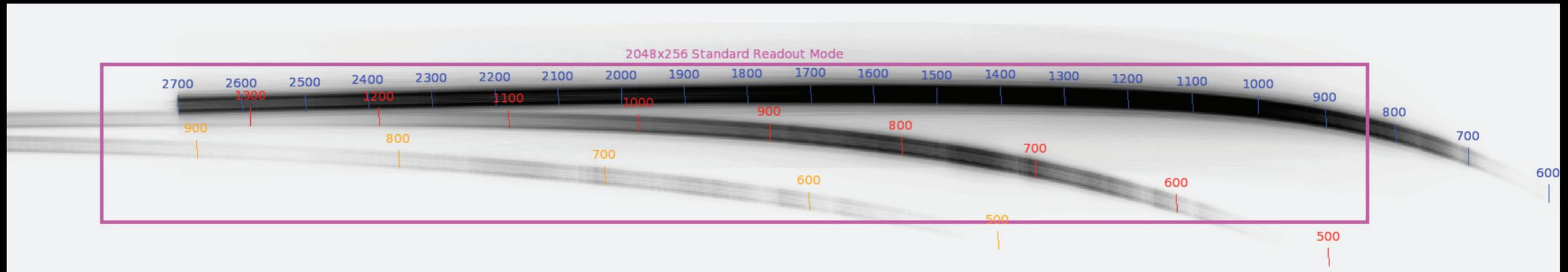


In the Era of Webb....



The Near Infrared Imager and Slitless Spectrograph

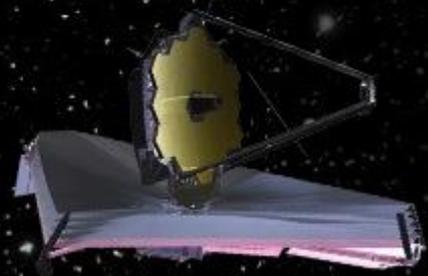
Single Object Slitless Spectroscopy mode: NIRISS SOSS



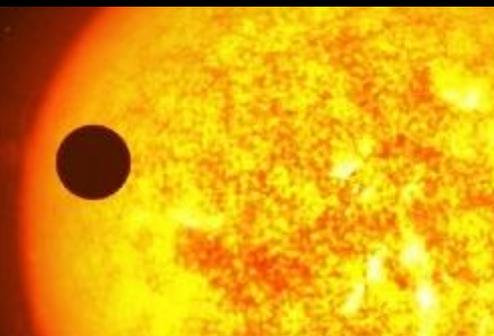
Beichman et al. (2015)

The participants in this hands-on exercise will complete a three-step process to detect and characterize the planet in their JWST NIRISS SOSS data

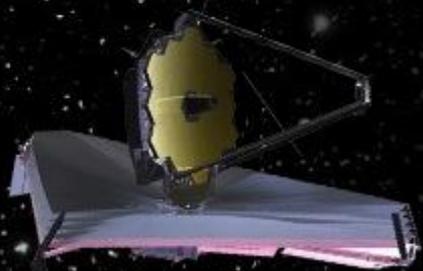
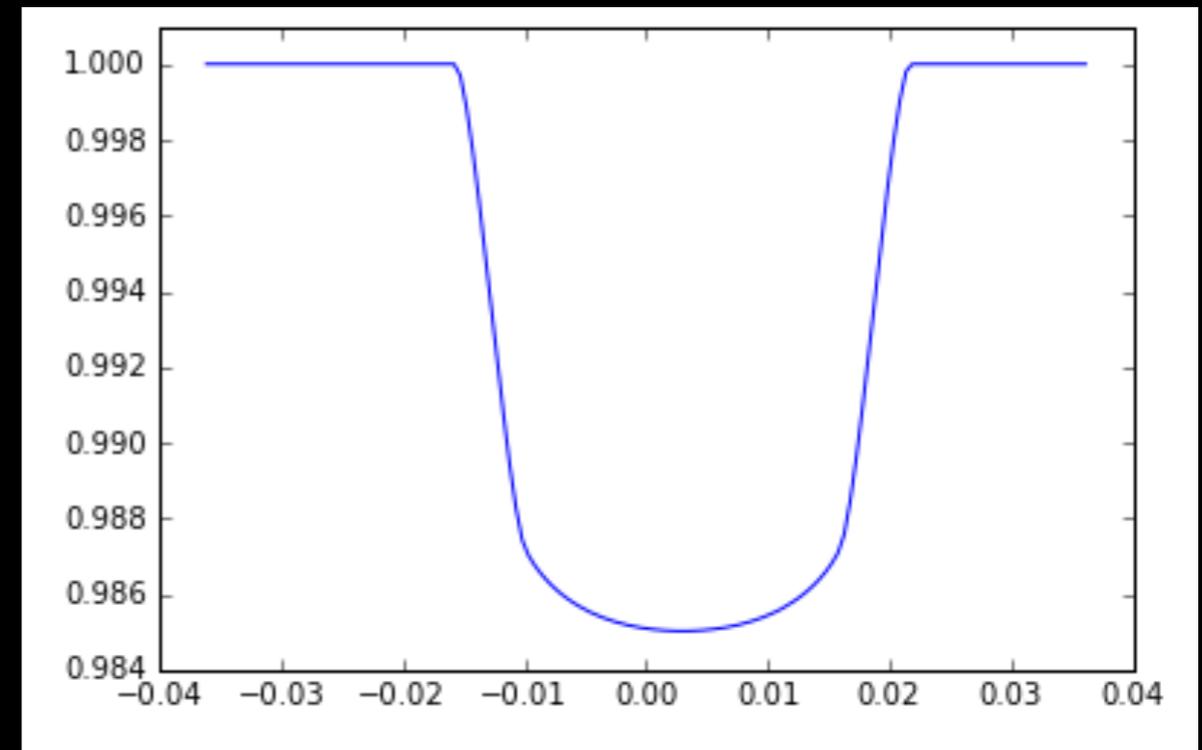
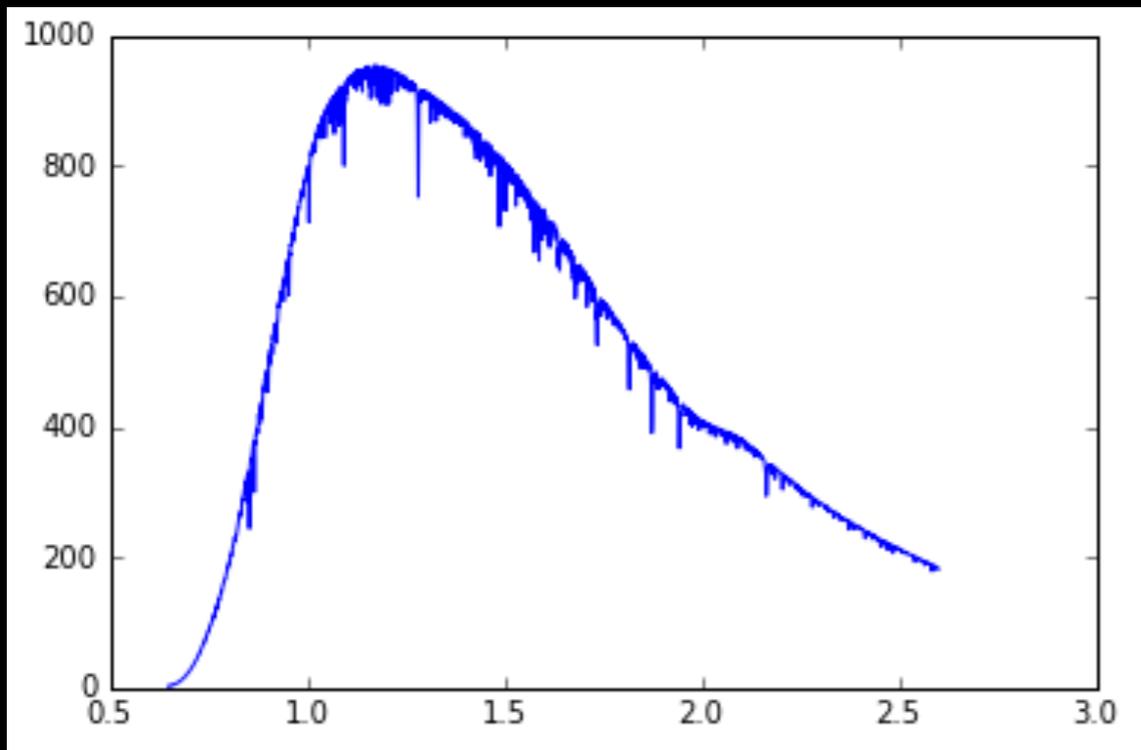
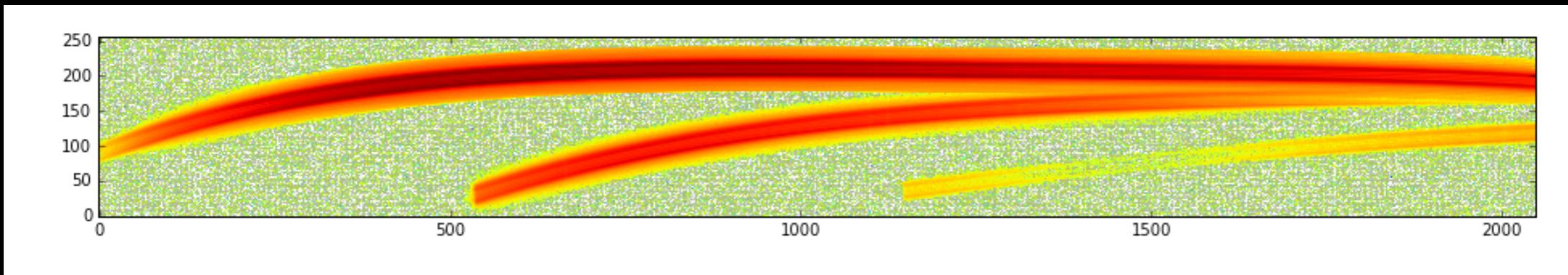
1. Work with high-level data products from the JWST pipeline to find the planetary transit as a function of wavelength.
2. Use MCMC-based fitting tools to measure changes in the planetary radius with wavelength to find the planetary spectrum from 0.6 to 2.5 microns.
3. Determine the atmospheric composition of the planet using spectroscopic retrieval tools.



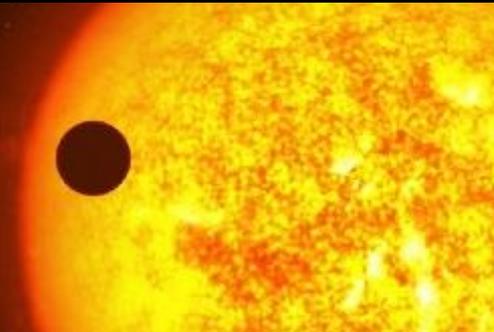
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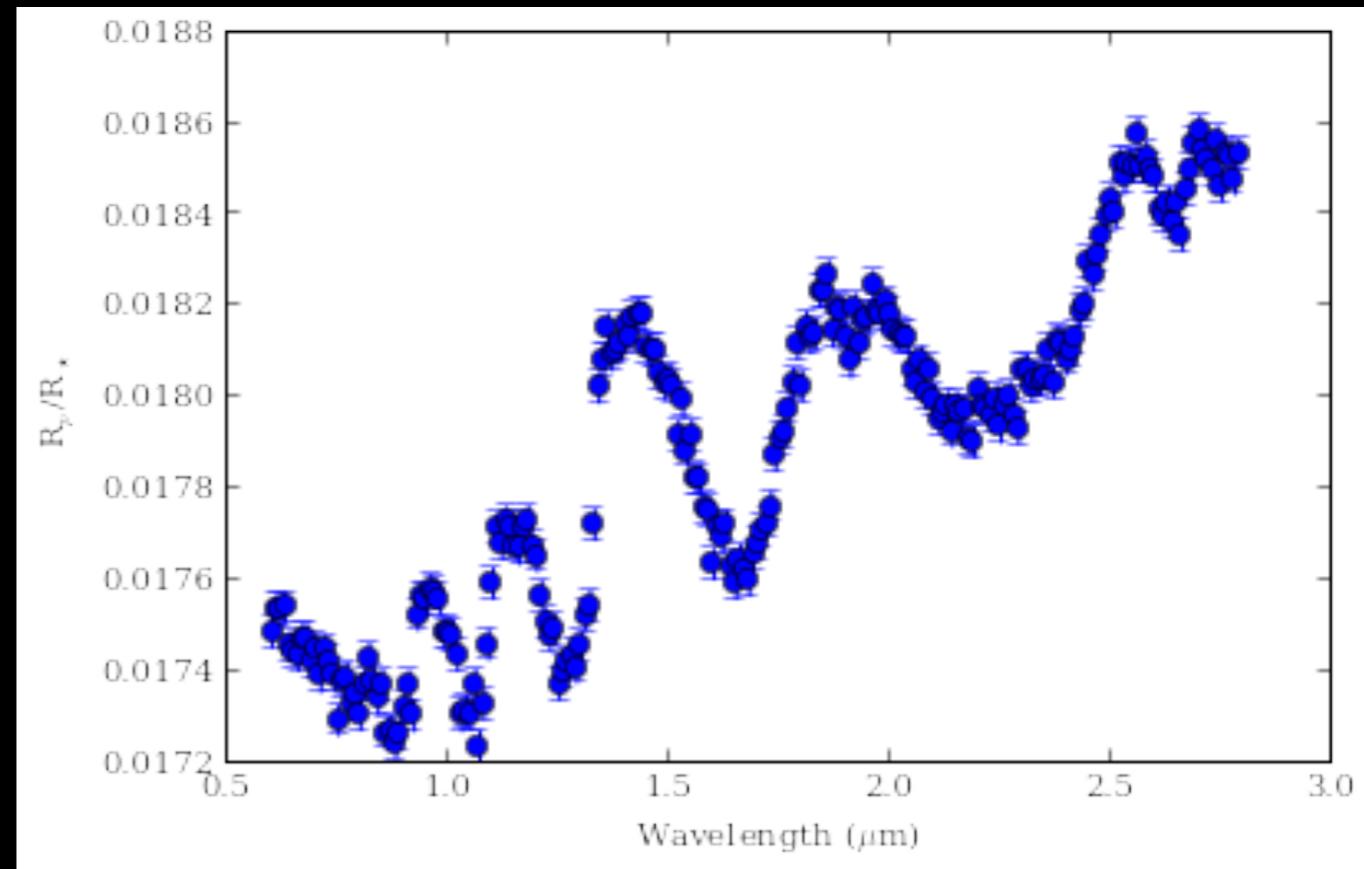
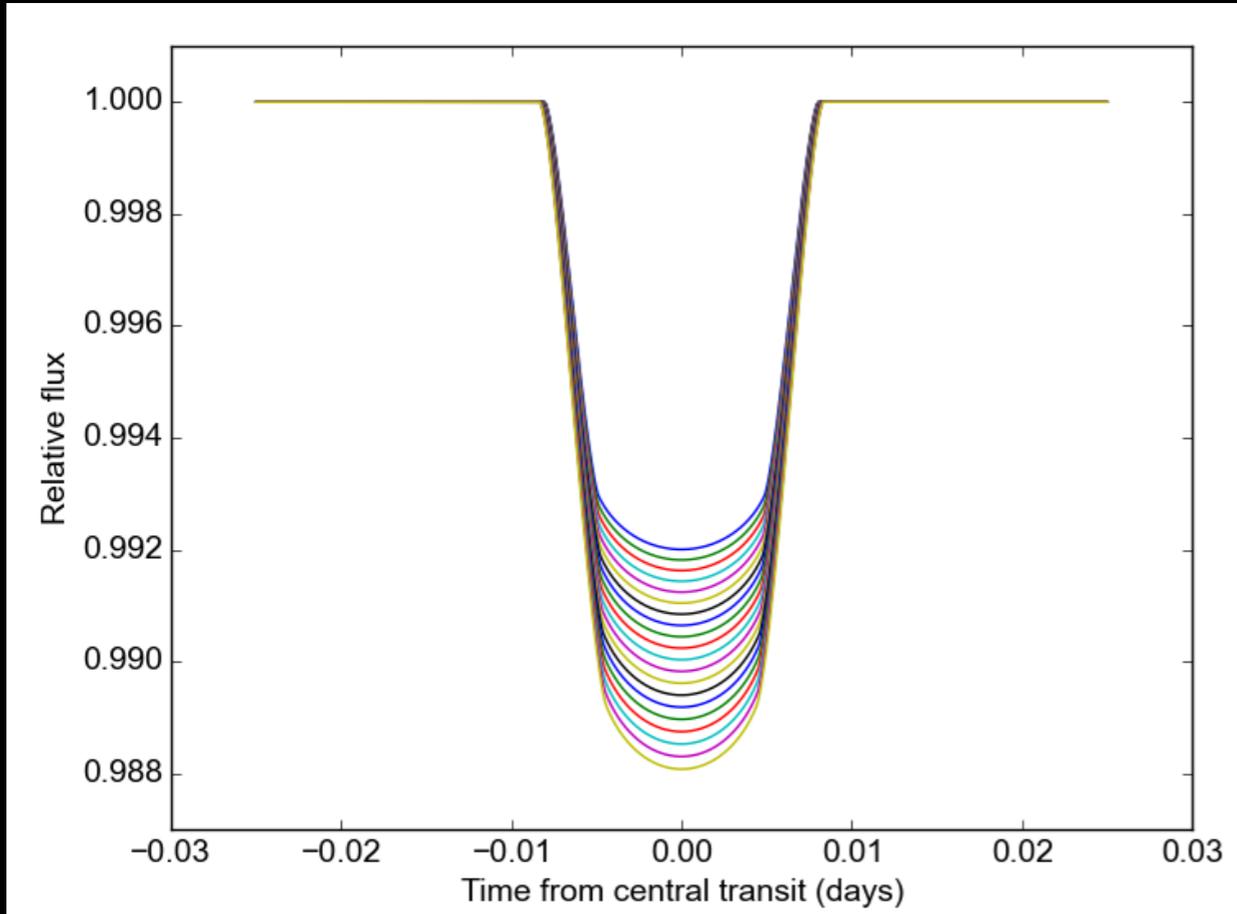
Work with high-level data products from the JWST pipeline to find the planetary transit as a function of wavelength.



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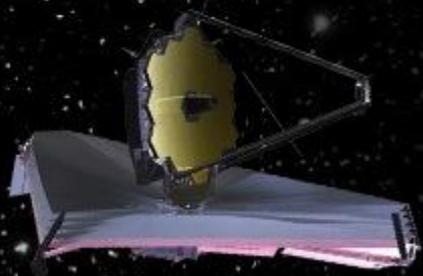


Use MCMC-based fitting tools to measure changes in the planetary radius with wavelength to find the planetary spectrum from 0.6 to 2.5 microns.

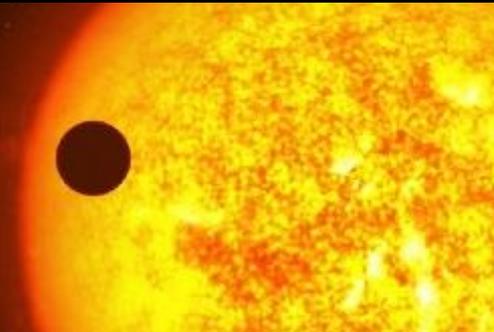


batman: BAsic Transit Model cAlculationN in Python

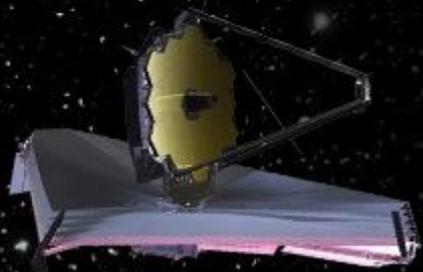
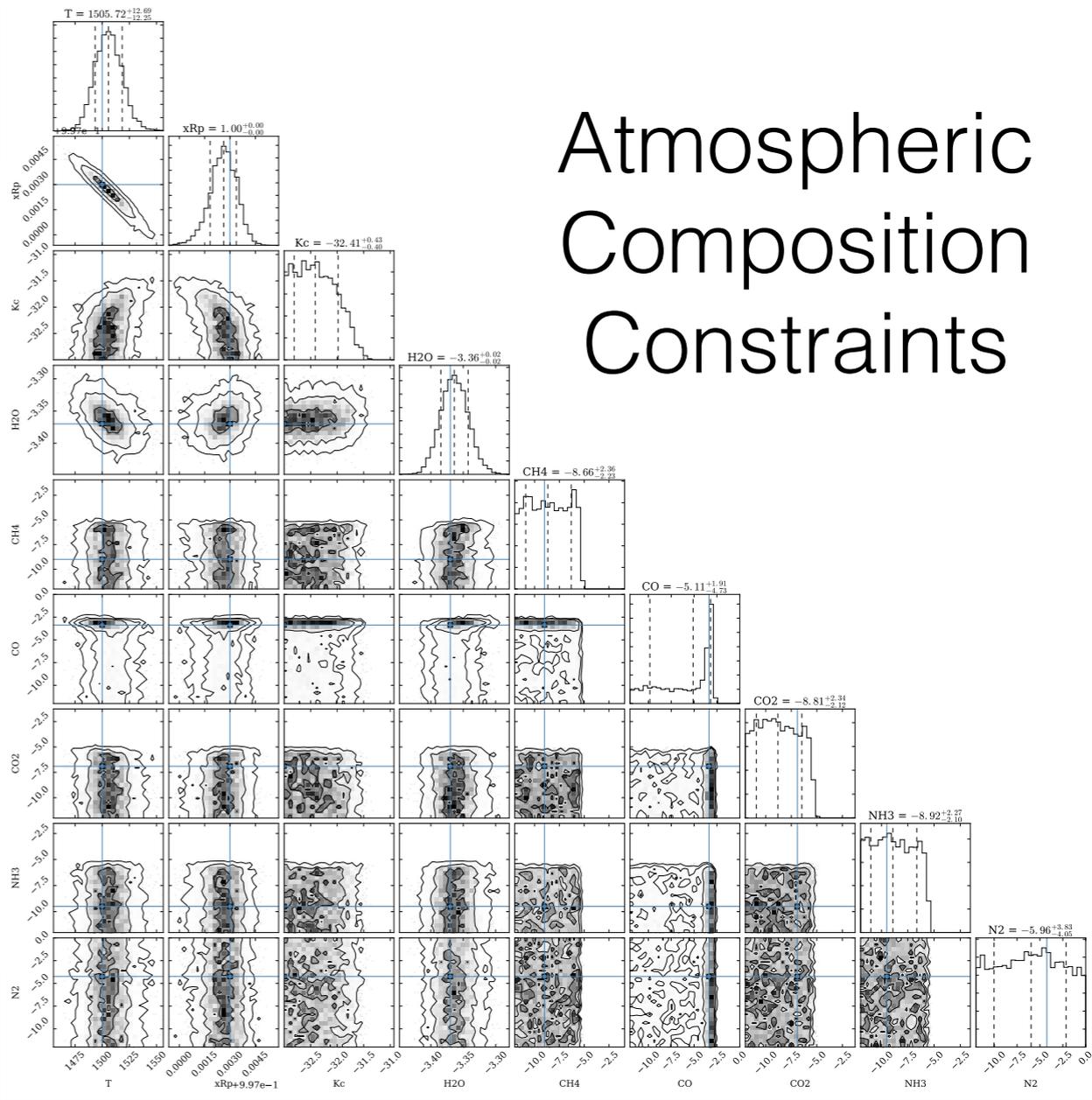
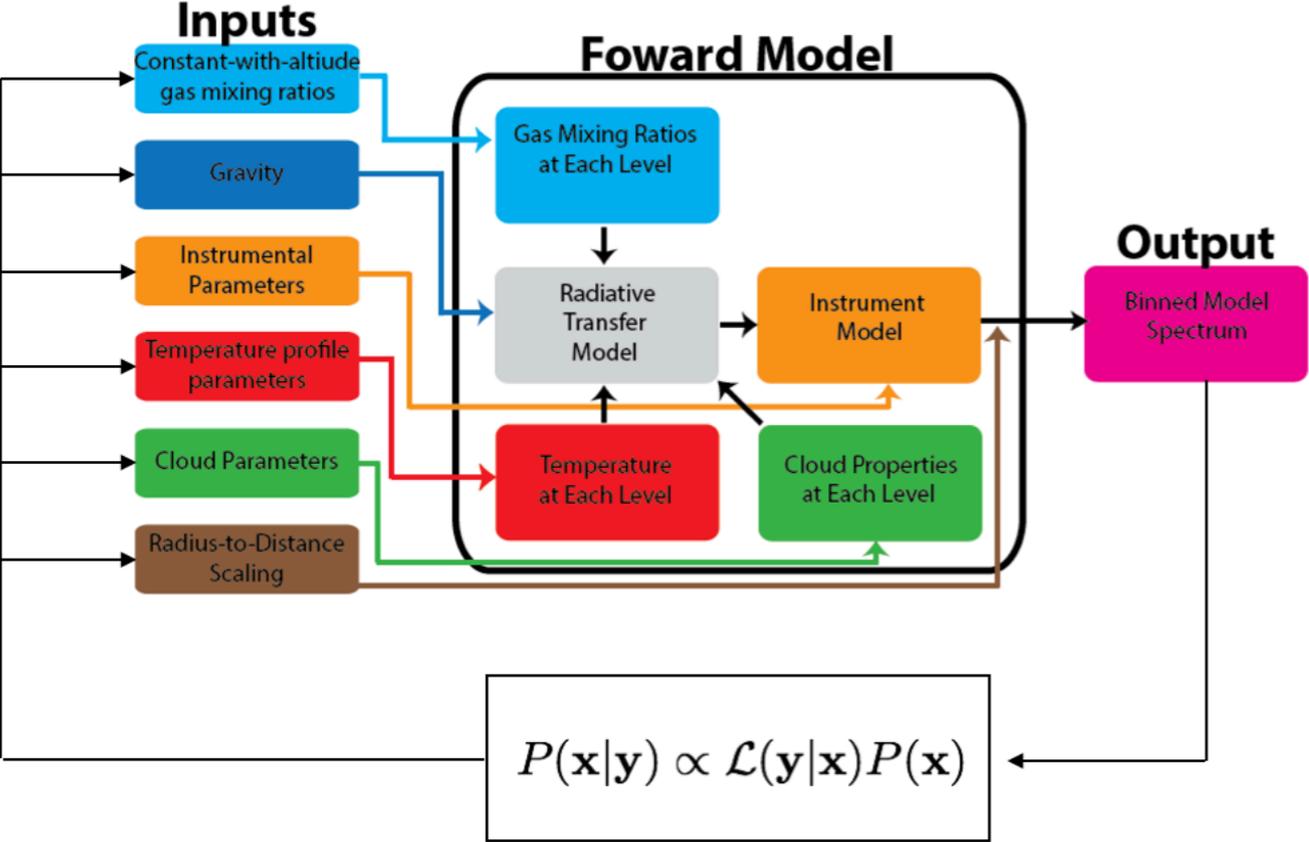
© Laura Kreidberg, Kreidberg (2015)



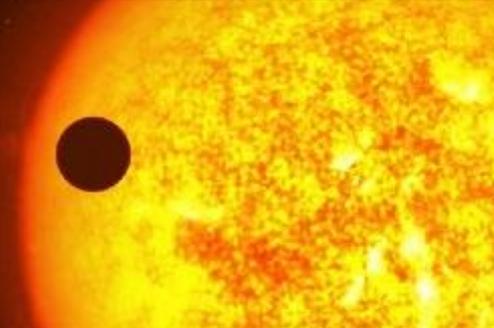
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Determine the atmospheric composition of the planet using spectroscopic retrieval tools.



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Goals of Transit Hands-on Session

- Get participants familiar with the types of data products that will be produced by JWST pipeline and delivered to MAST archive.
- Help participants understand the basics of transit data and how to extract a planetary spectrum given spectroscopic time-series observations.
- Guide participants through a robust process for determining exoplanet atmospheric composition.
- Introduce participants to python, which will be the language in which all JWST pipeline modules, tools, etc. will be built.

Questions?

Sagan Summer Work 2016
Is There a Planet in My Data?

