

# Exoplanets: What's new and next for HST?

Jennifer Wiseman

NASA GSFC

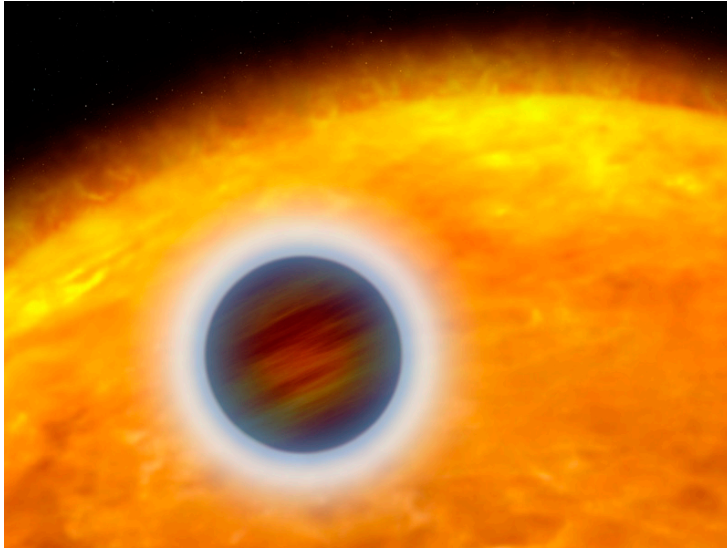
# Thoughts on Exoplanets with HST

Not an original goal for HST, but HST has become a major contributor to exoplanet studies, via transit spectroscopy, astrometry, and imaging.

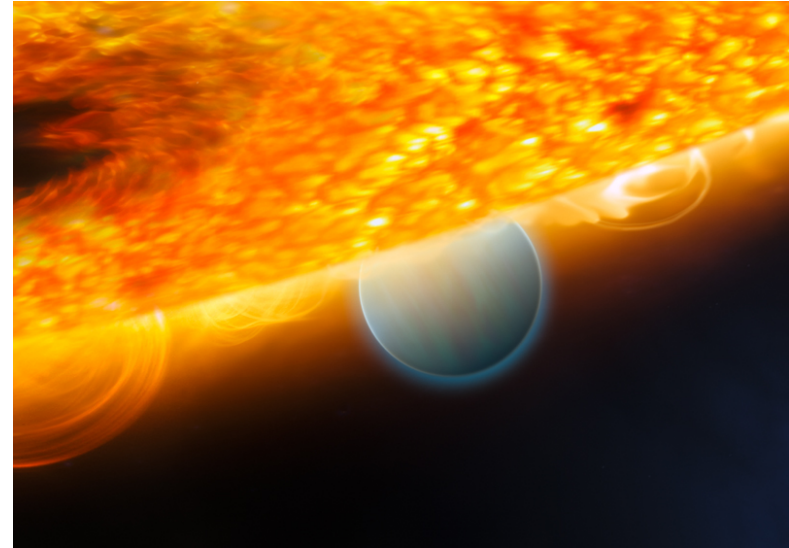
Moving beyond simply detection (most exoplanets detected by radial velocity motions of the associated star), Hubble (in concert with other facilities like Spitzer) is now being used for beginning *characterization* of exoplanets (generally gas giants).

Astro2010 recommended WFIRST as the next flagship mission, which would enable exoplanet statistics using microlensing, complementing Kepler's statistical study via distant transits. Neither allows followup spectroscopic study and characterization. JWST will allow IR studies of circumstellar disks and transit IR spectroscopy of mostly gas giants (and hopefully super-Earths). SO, in the meantime, important to maximize scientific use of unique HST capabilities for exoplanet characterization while we still can.

# TRANSITING EXOPLANETS (“HOT JUPITERS”)



PRIMARY ECLIPSE –  
Spectroscopy/Photometry probe  
terminator region in absorption

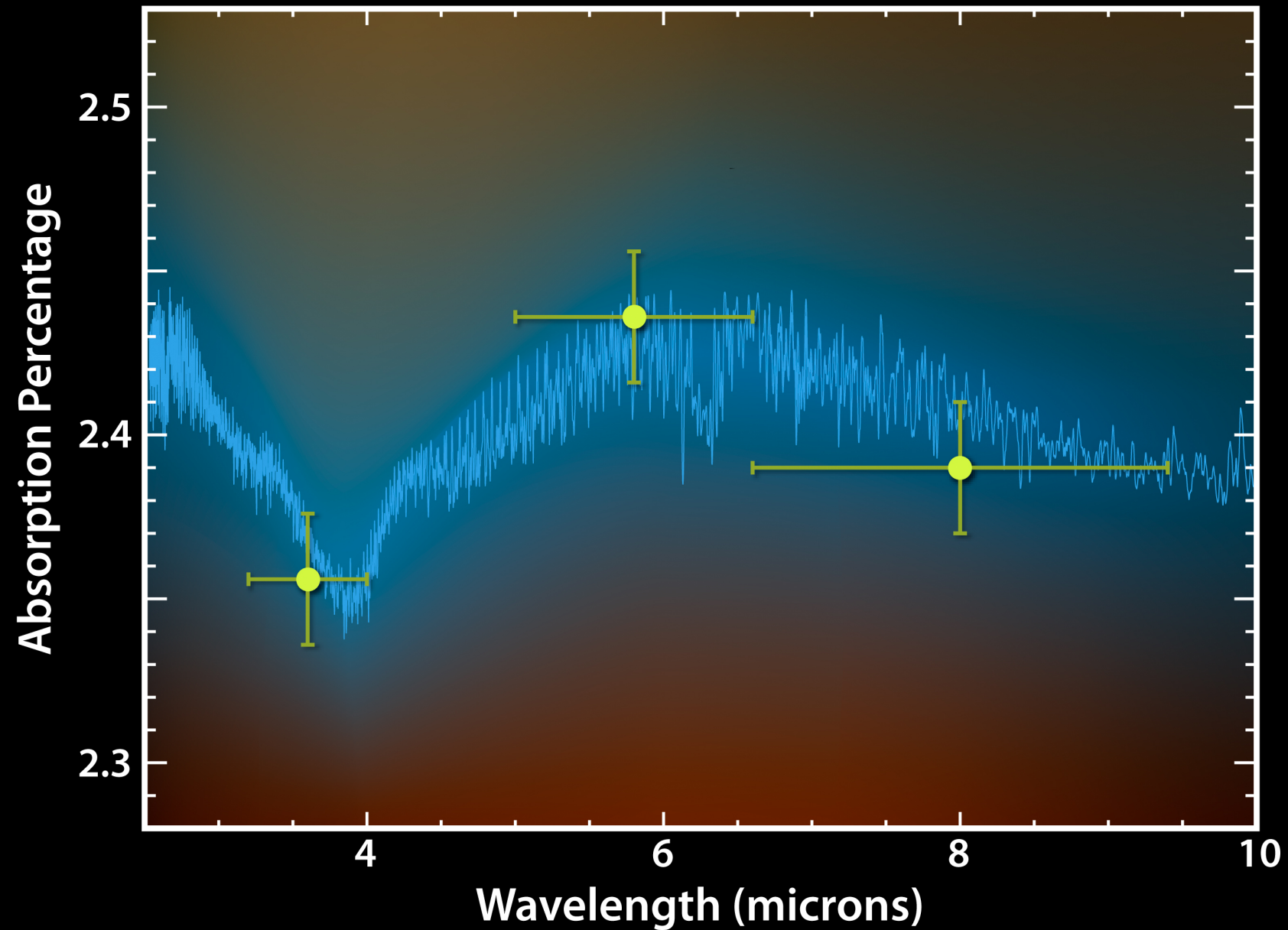


SECONDARY ECLIPSE –  
Spectroscopy/Photometry probe  
dayside in emission/reflection

## OBSERVATIONS WITH HUBBLE (NICMOS) AND SPITZER

- Enable identification of atmospheric molecular and atomic constituents
- Provide information about thermal profiles, dynamics of atmospheres
- At least four “hot Jupiters” observed to date
- Observed constituents include  $\text{CH}_4$ ,  $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{CO}$

e.g. G. Tinelli, M. Swain, et al.



Water Signatures in Exoplanet HD189733b

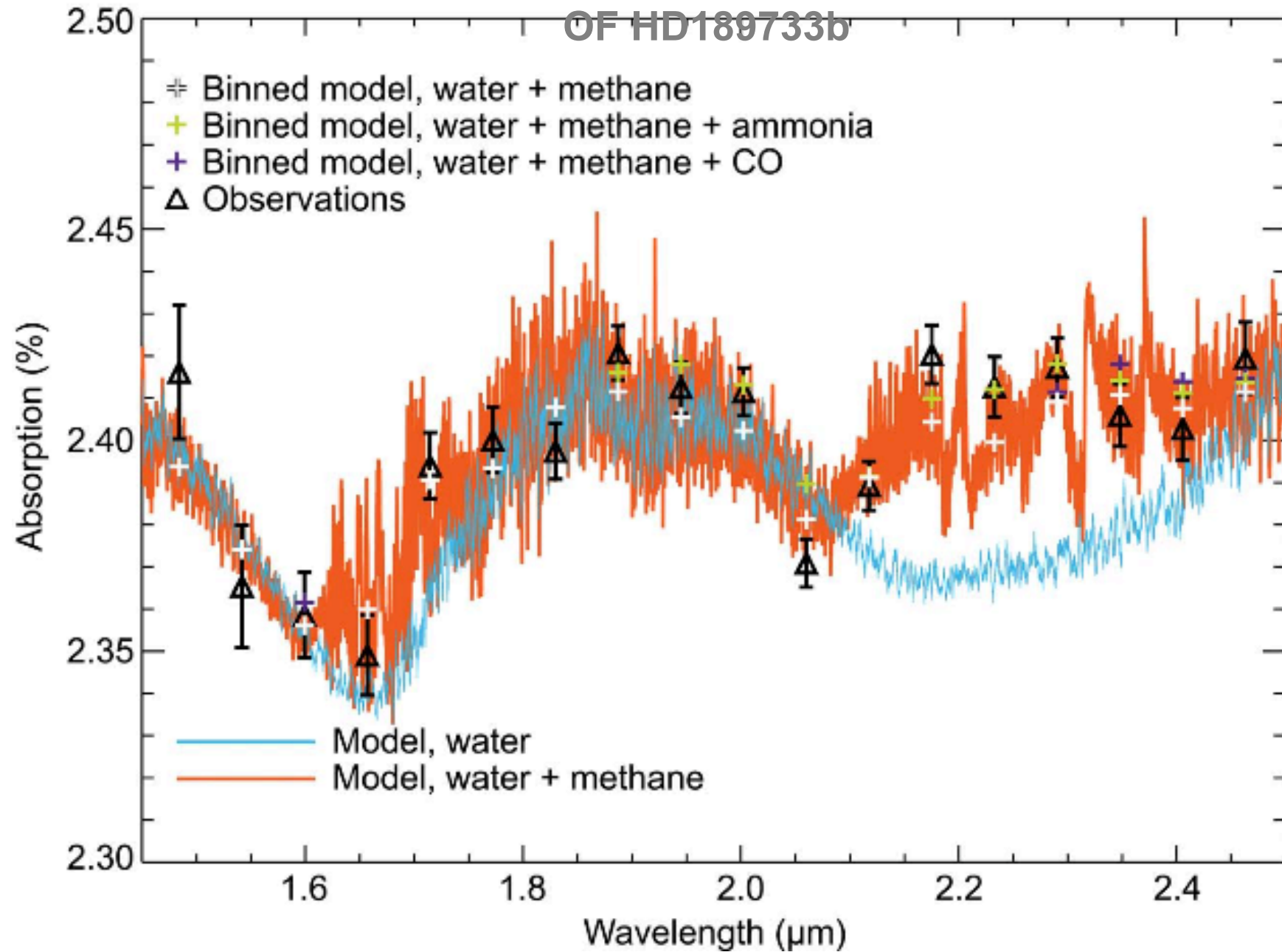
Spitzer Space Telescope • IRAC

NASA / JPL-Caltech / G. Tinetti (Institute d'Astrophysique de Paris)

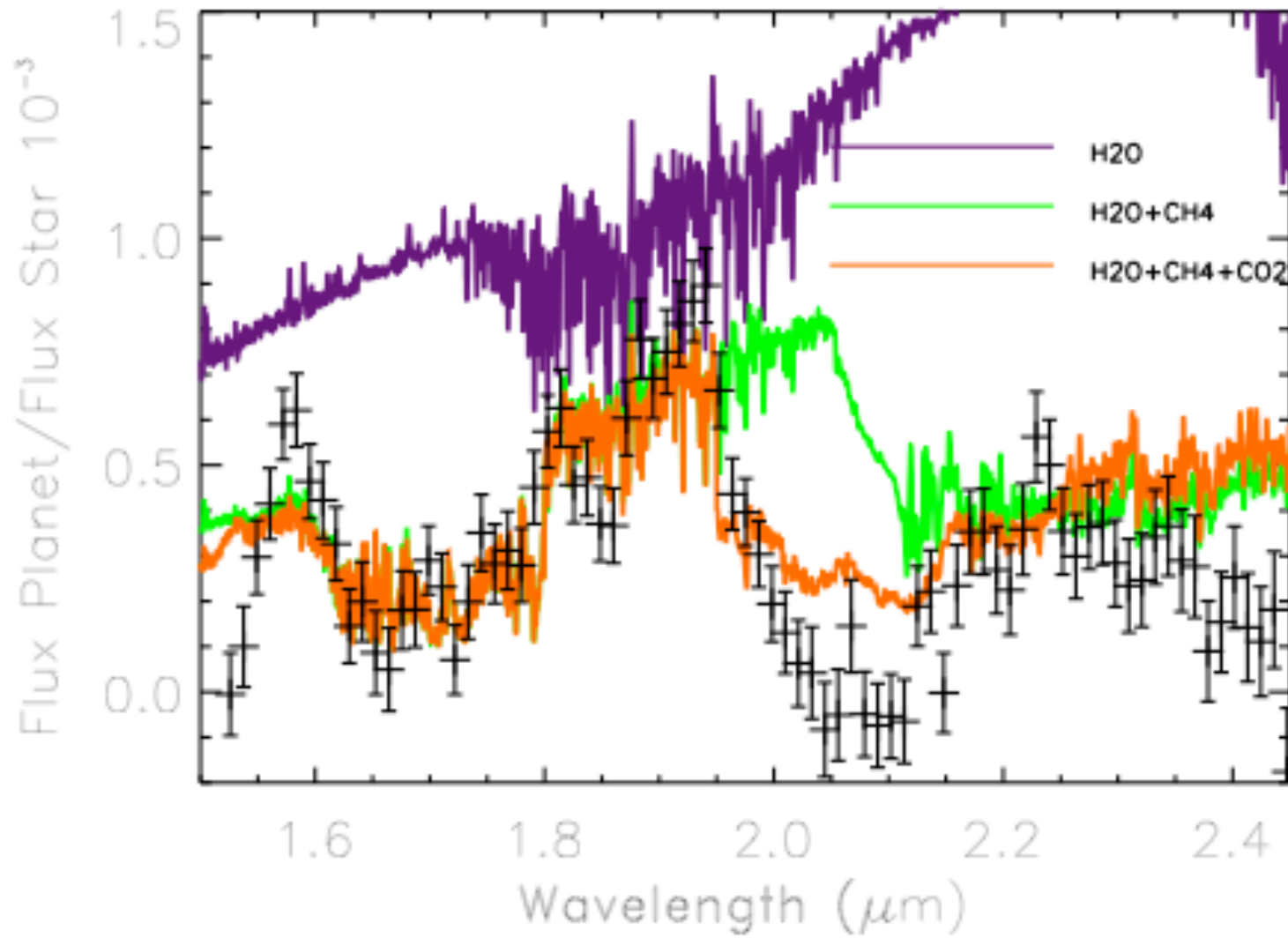
ssc2007-12a

# HUBBLE/NICMOS PRIMARY ECLIPSE SPECTROSCOPY

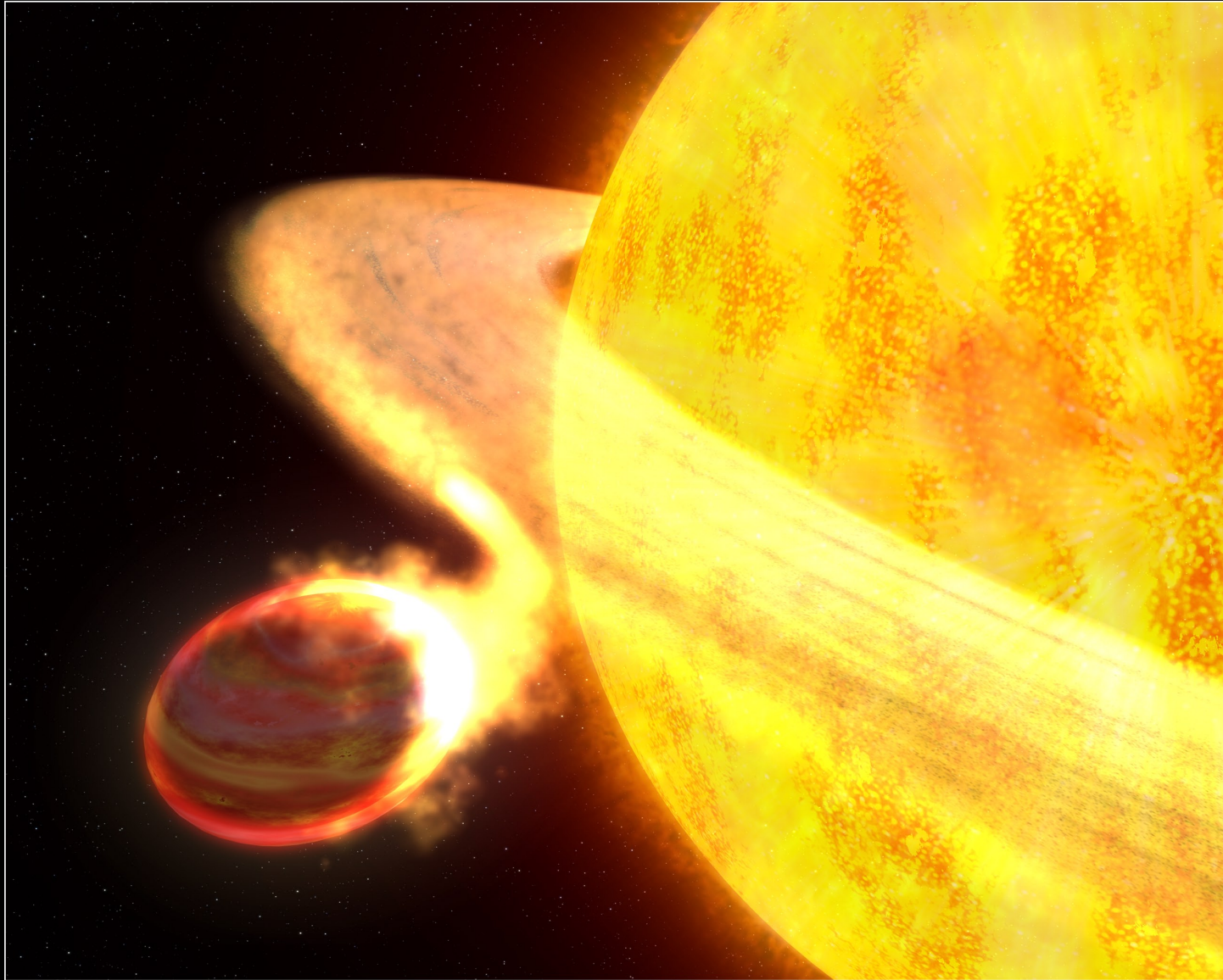
OF HD189733b



# HUBBLE/NICMOS SECONDARY ECLIPSE SPECTROSCOPY OF HD209458b

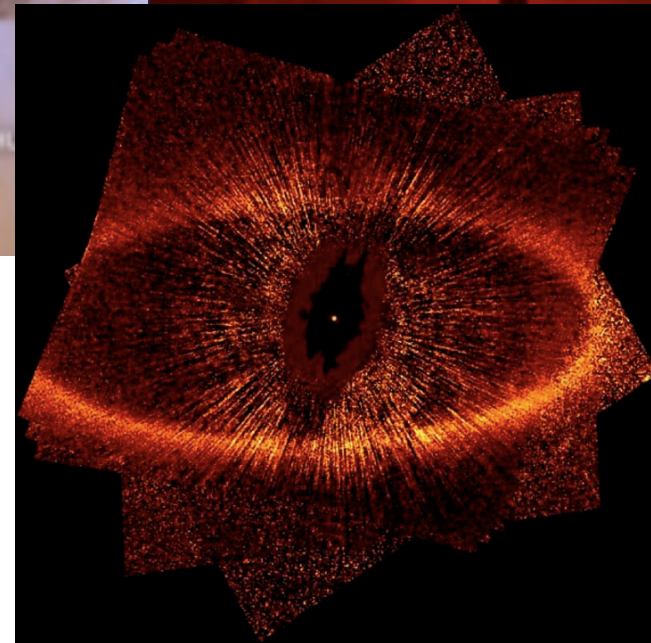
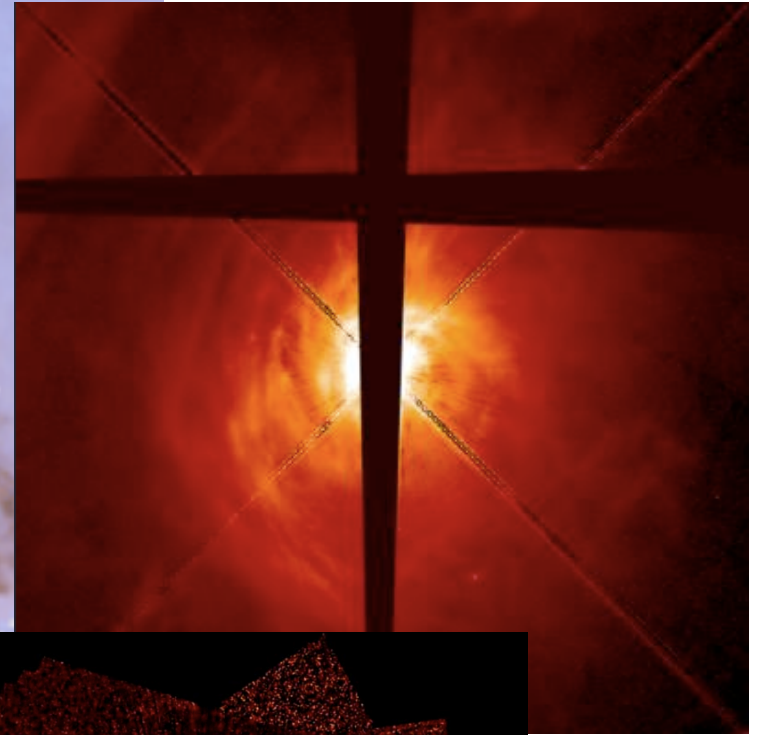






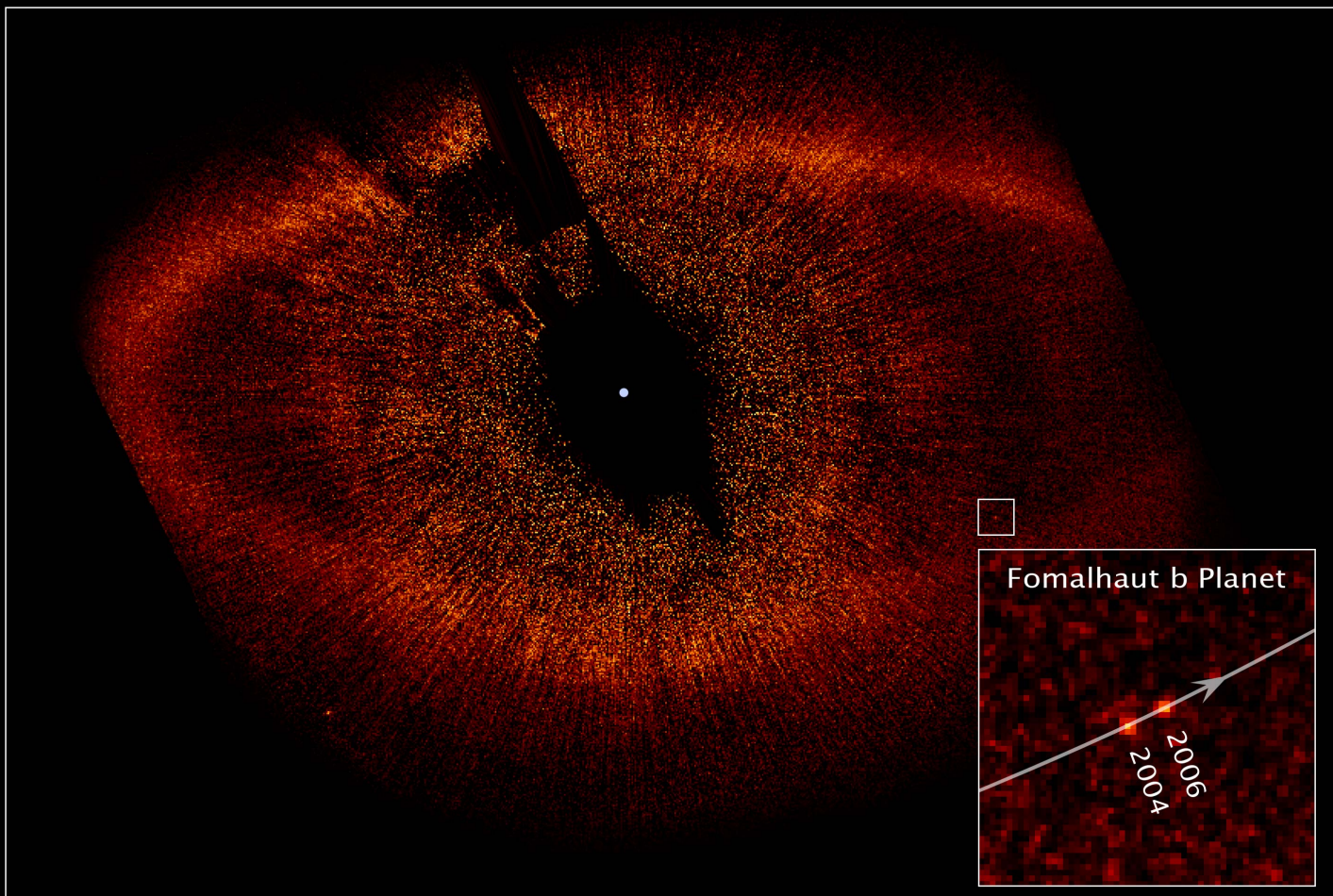
**Artist's View of Extrasolar Planet WASP-12b**

NASA, ESA, and G. Bacon (STScI) ■ STScI-PRC10-15



# Planetary System Formation





**Fomalhaut System**  
*Hubble Space Telescope • ACS/HRC*

# Thoughts on Exoplanets with HST, continued...

- Maximize use HST's *unique* spectral capabilities for studying exoplanet atmospheres via transit spectroscopy
  - UV (COS, STIS) (e.g. tidal stripping of atmospheres; outer atmosphere component identification)
  - NICMOS? (Reaches beyond the WFC3 1.7 micron limit) (atmospheric components like Methane)
- Image circumstellar disks and exoplanets with STIS (e.g. Fomalhaut-B)
- Many sources left to study: primary, secondary transits, imaging of disks (and associated exoplanets!)
  - Pursue JWST / HST potential to study super-Earths around M dwarf stars