

Transiting Exoplanet Science with the Spitzer Space Telescope

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ExoPAG-13, January 3, 2016



Motivation & Outline

- 2016 Senior Review
 - cancellation previously threatened (2014)
 - compelling recent science

Outline

Spitzer's capabilities for transiting exoplanets

Science highlights:

(Microlensing planets)

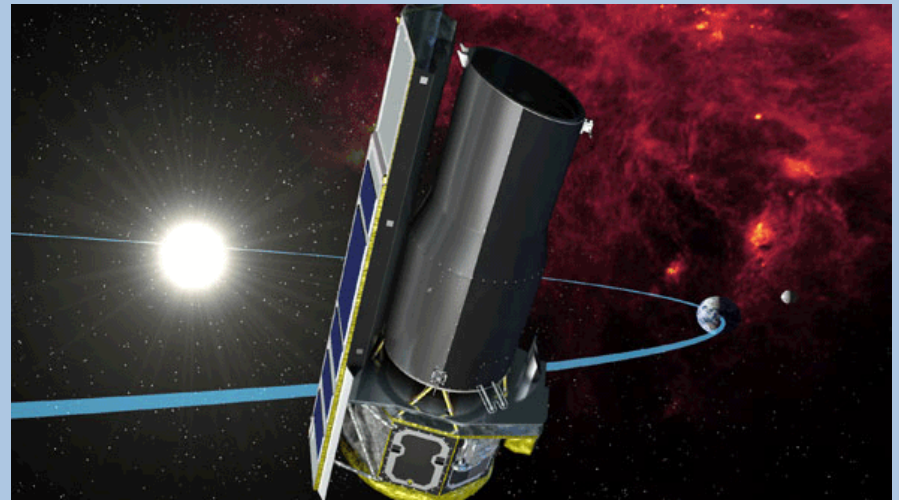
Synergy with K2: improved ephemerides

Phase curves for giant planets and exo-Neptunes

Synergy with HST: haze and clouds in giant planet atmospheres

Finding nearby habitable-zone super-Earths,
and initial atmospheric characterization

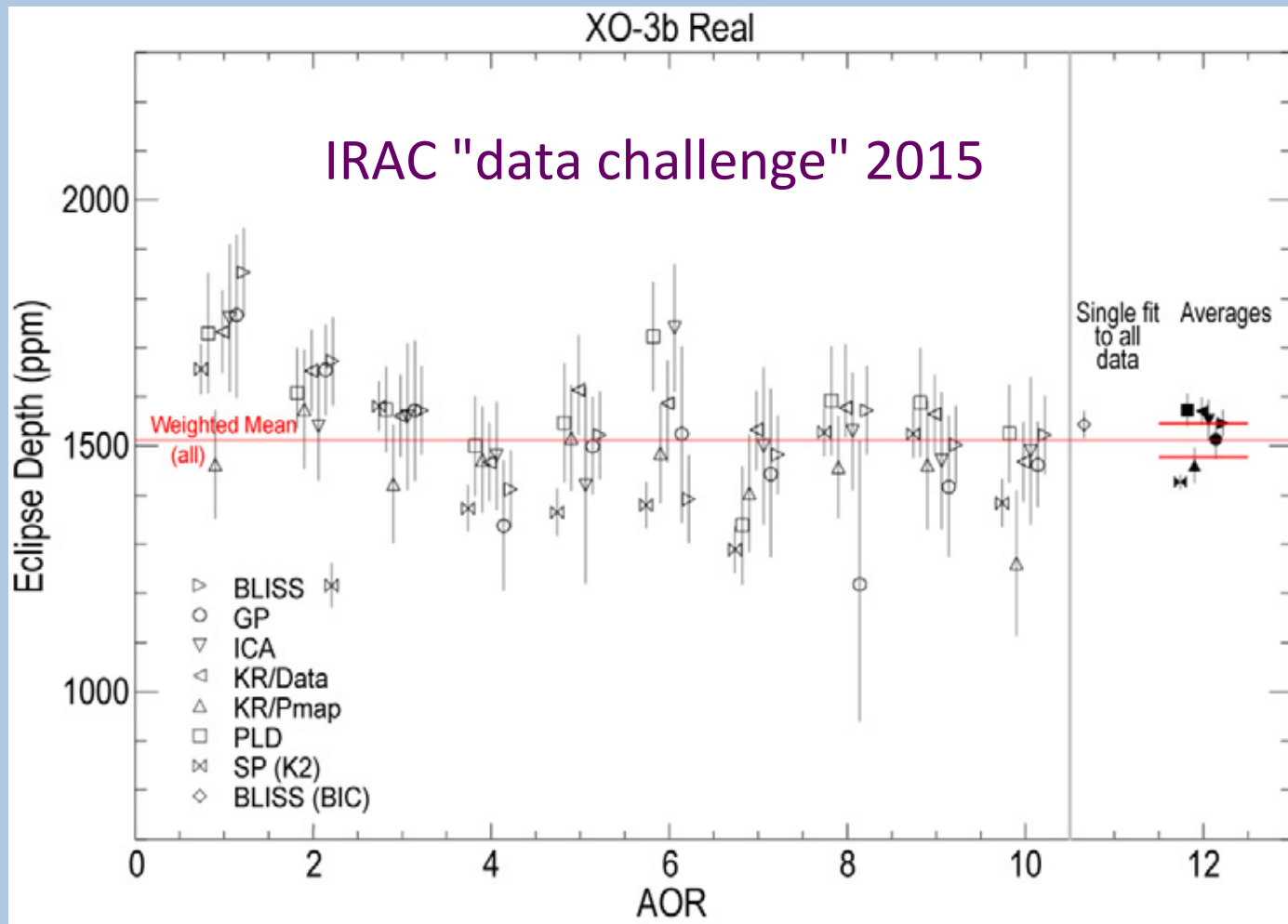
A future without Spitzer?



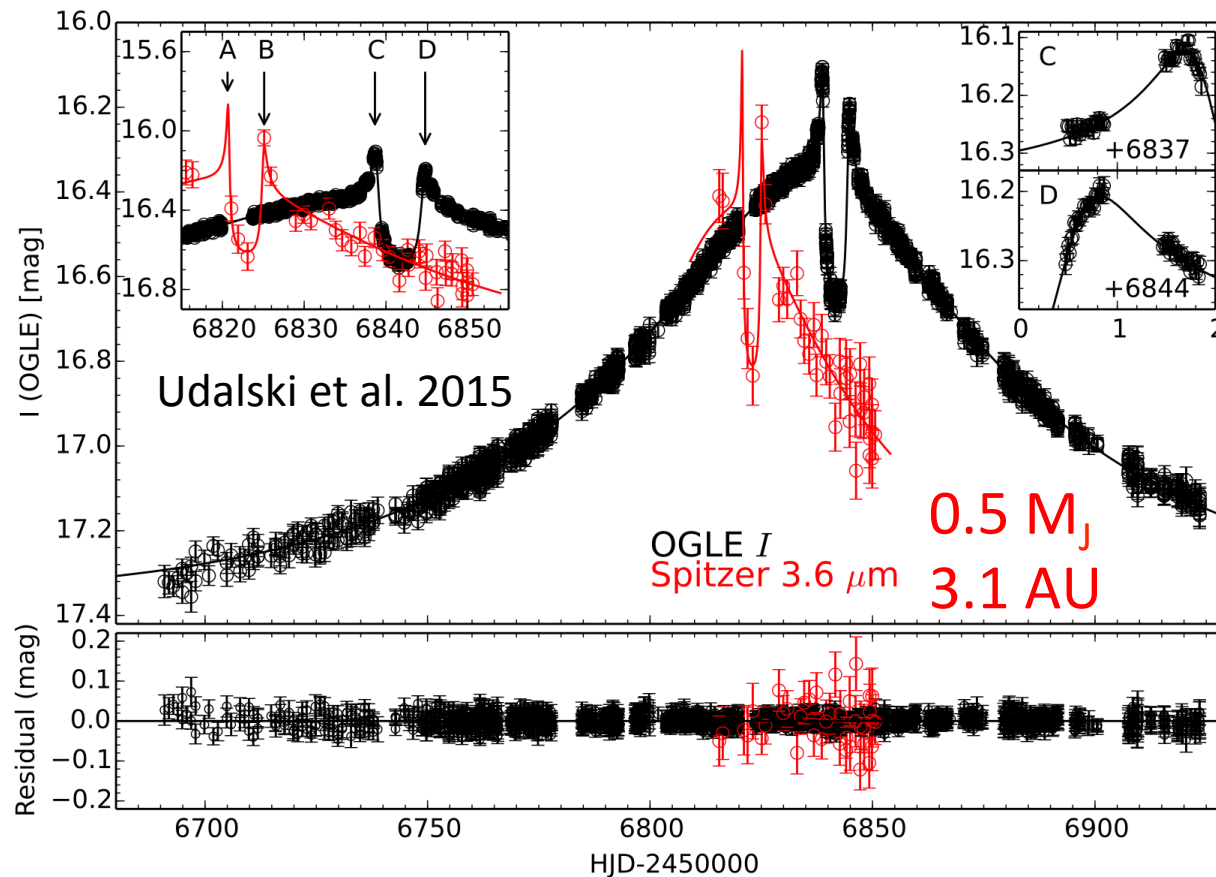
Spitzer capabilities for transiting exoplanets

1. Reliable hardware (compare Kepler)
2. Exoplanets emit strongly at Spitzer's wavelengths
3. Uninterrupted 24/7 observations (compare HST)
4. Pointing to any sky location (compare K2)
5. Sensitivity to methane and CO (compare HST)
6. Sensitivity for M-dwarfs..! (compare JWST!)
7. Tested (and improving..!) photometry

Tested and proven Spitzer photometry

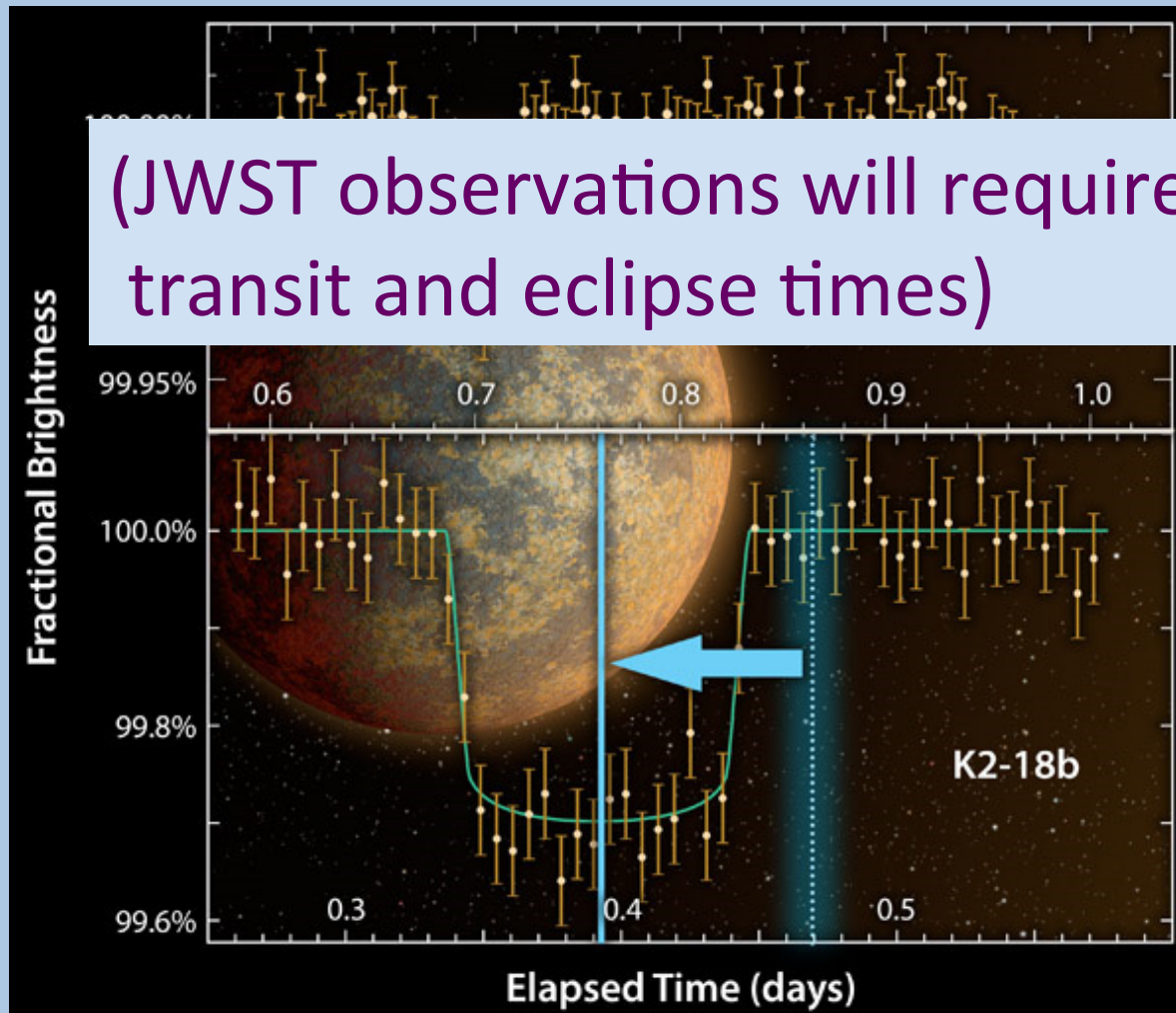


Spitzer's position > 1 AU from Earth gives a different view of microlensing events - *breaking degeneracies*



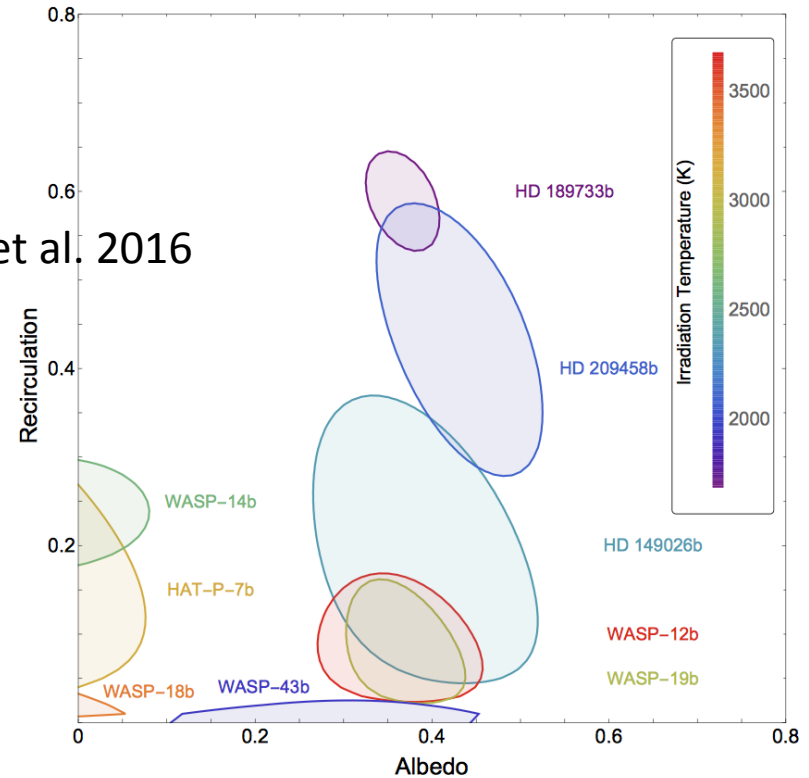
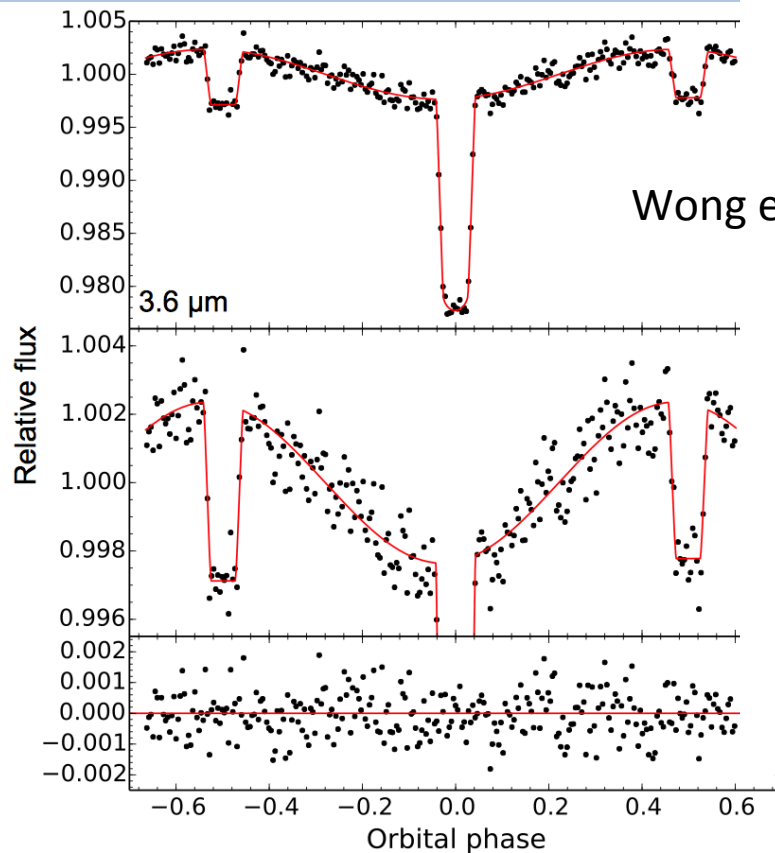
Synergy with K2: improved ephemerides

(JWST observations will require precise transit and eclipse times)

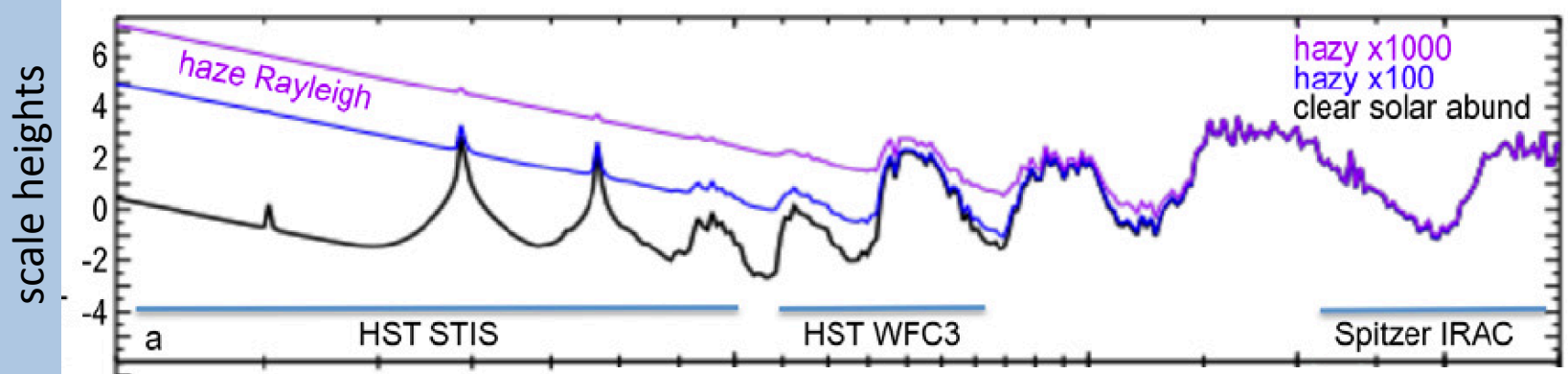


Spitzer phase curves for giant planets

- suggest a differentiation by mass
- but need better statistics
- and extend to Saturn mass and below

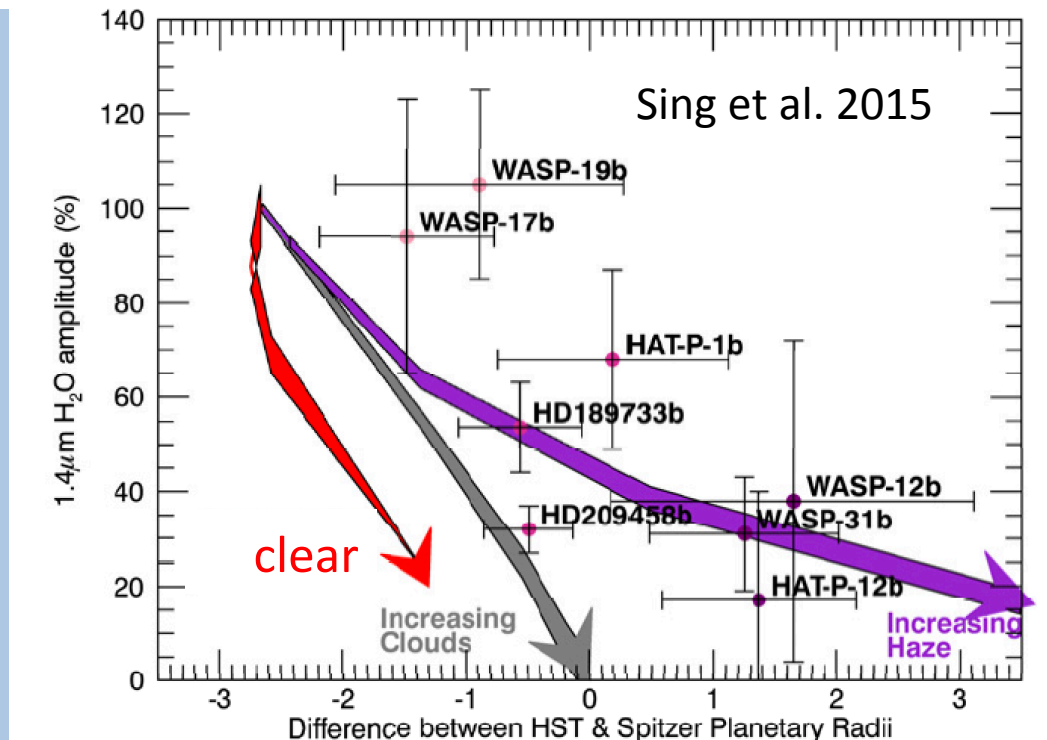


Synergy with HST: haze/clouds in transit spectroscopy

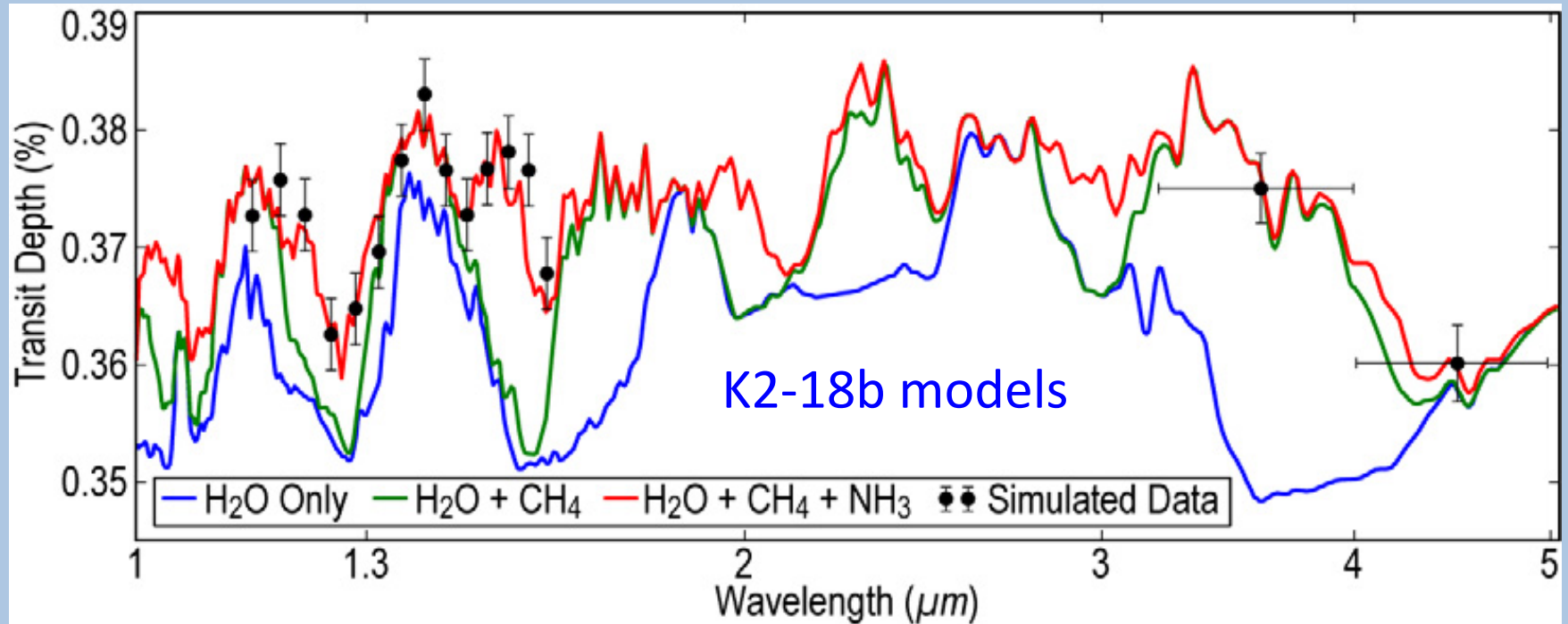


Spitzer gives the
atmospheric temperature

and with HST, Spitzer
transits break the
haze-abundance
degeneracy

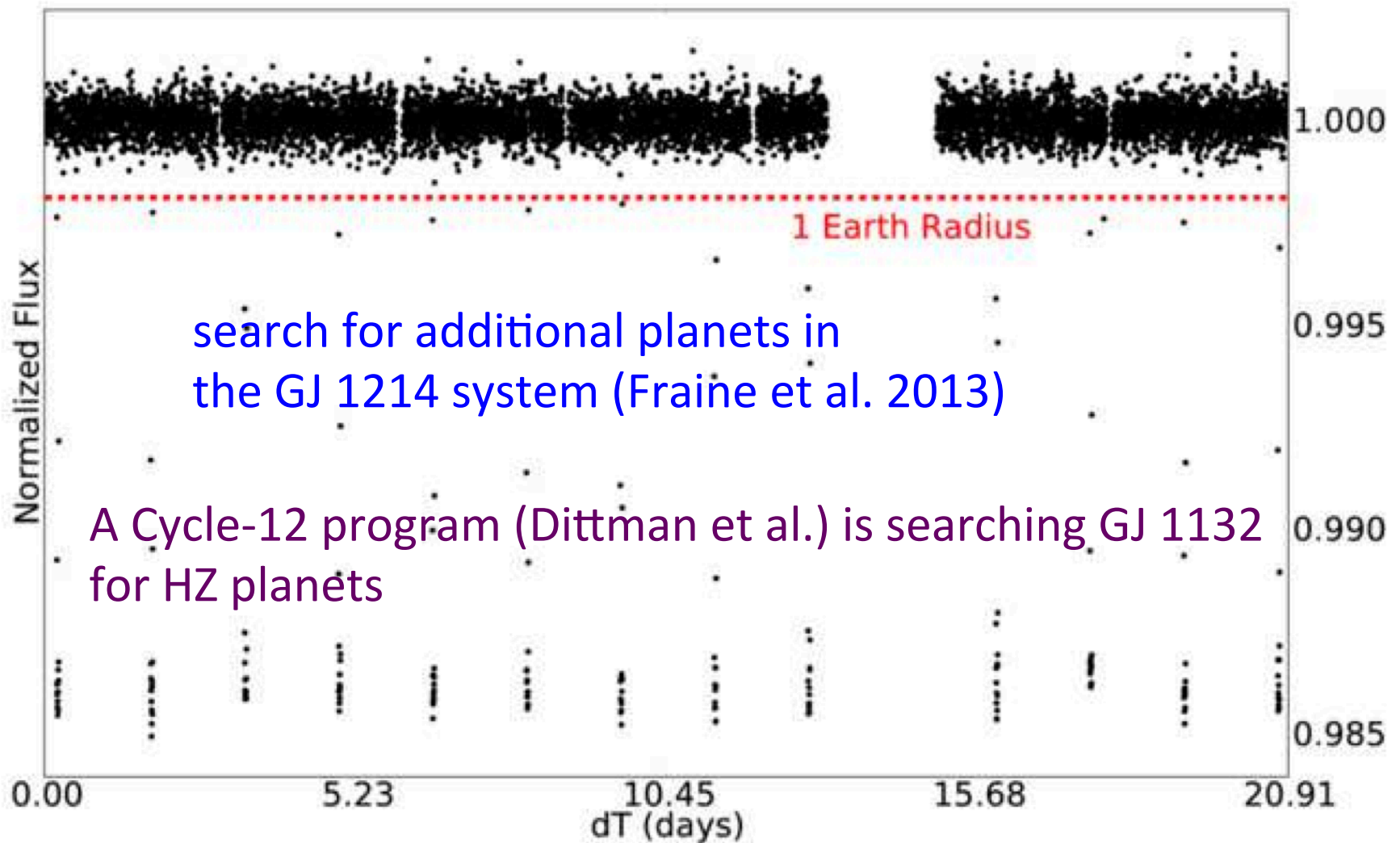


Spitzer provides sensitivity to atmospheric methane and CO



Nearby (habitable-zone) transiting super-Earths

- K2 cannot find the best ones (TESS will)
- RV surveys can find candidate systems
 - search for transits in HZ with Spitzer
 - and do initial atmospheric characterization using HST & Spitzer
 - Spitzer's precision M-dwarf photometry is key



Without Spitzer beyond Cycle-12?

(a partial list of bad stuff)

- Fewer microlensing planet masses
- K2 planet ephemerides become problematic
 - JWST would have to locate the transits
- Statistics of heat redistribution remain sketchy
 - and we cannot extend to lower mass planets
- HST giant planet transit spectroscopy is severely compromised
 - we need Spitzer temperatures for scale heights..!
 - and more difficult to resolve cloud-abundance degeneracies
 - and no sensitivity to methane or CO
- We lose the near-term ability to search for transits of HZ super-Earths orbiting nearby M-dwarfs