GTC Transiting Exoplanet Atmospheric Survey: Comparative Exoplanetology From Narrowband Spectrophotometry

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Extreme Solar Systems II: Jackson Hole

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David K. Sing GTC Atmospheric Survey

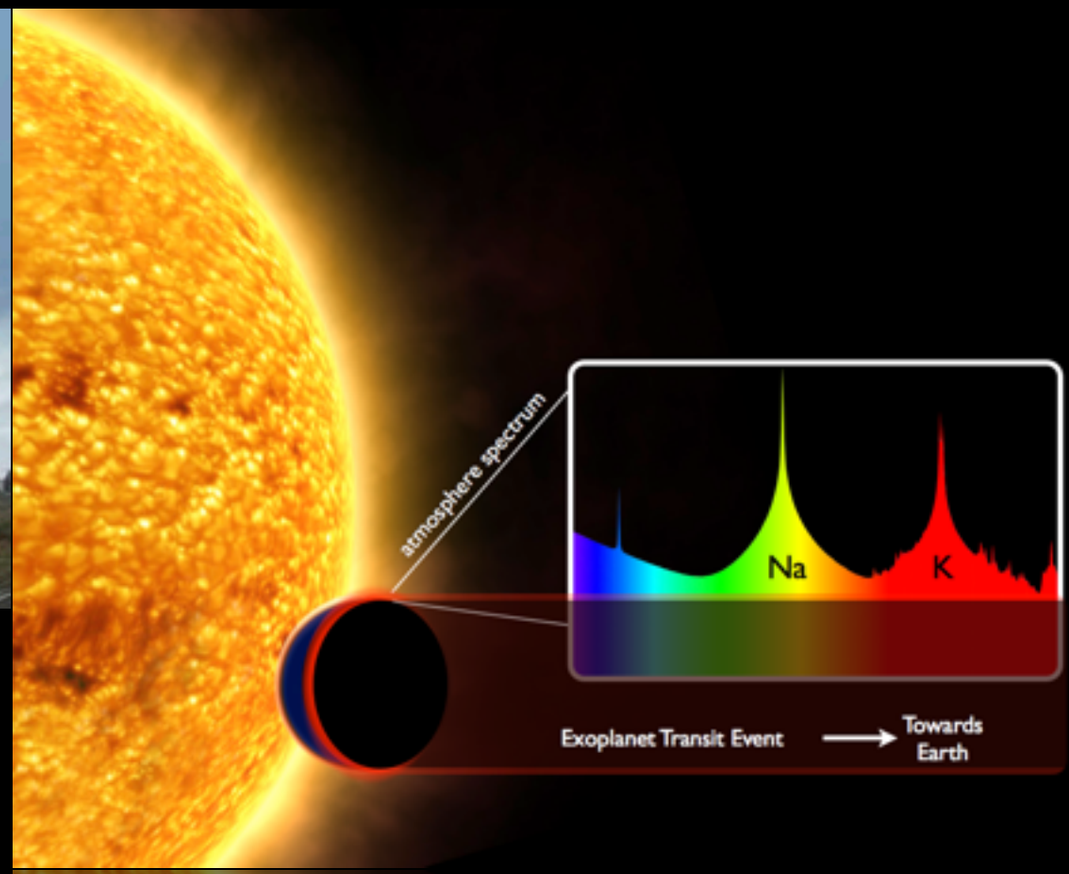
The Next Generation Transit Follow-up Project:

Exoplanet Characterization and Detection Through Fast Photometry & Spectroscopy

Wide Survey of Hot-Jupiter Atmospheres

Large ESO program

P.I. - D. Sing



- 11 Hot-Jupiters, 1 super-Earth
- Granted 180 hours (2009-2012). 49 Transits (38% complete)
- Unique Instrument: Narrowband, tuneable filter, fast-photometry
- Study: Na, K, TiO/VO, Haze, H_2 Rayleigh
- Comparative exoplanetology

Why Narrowband Photometry?

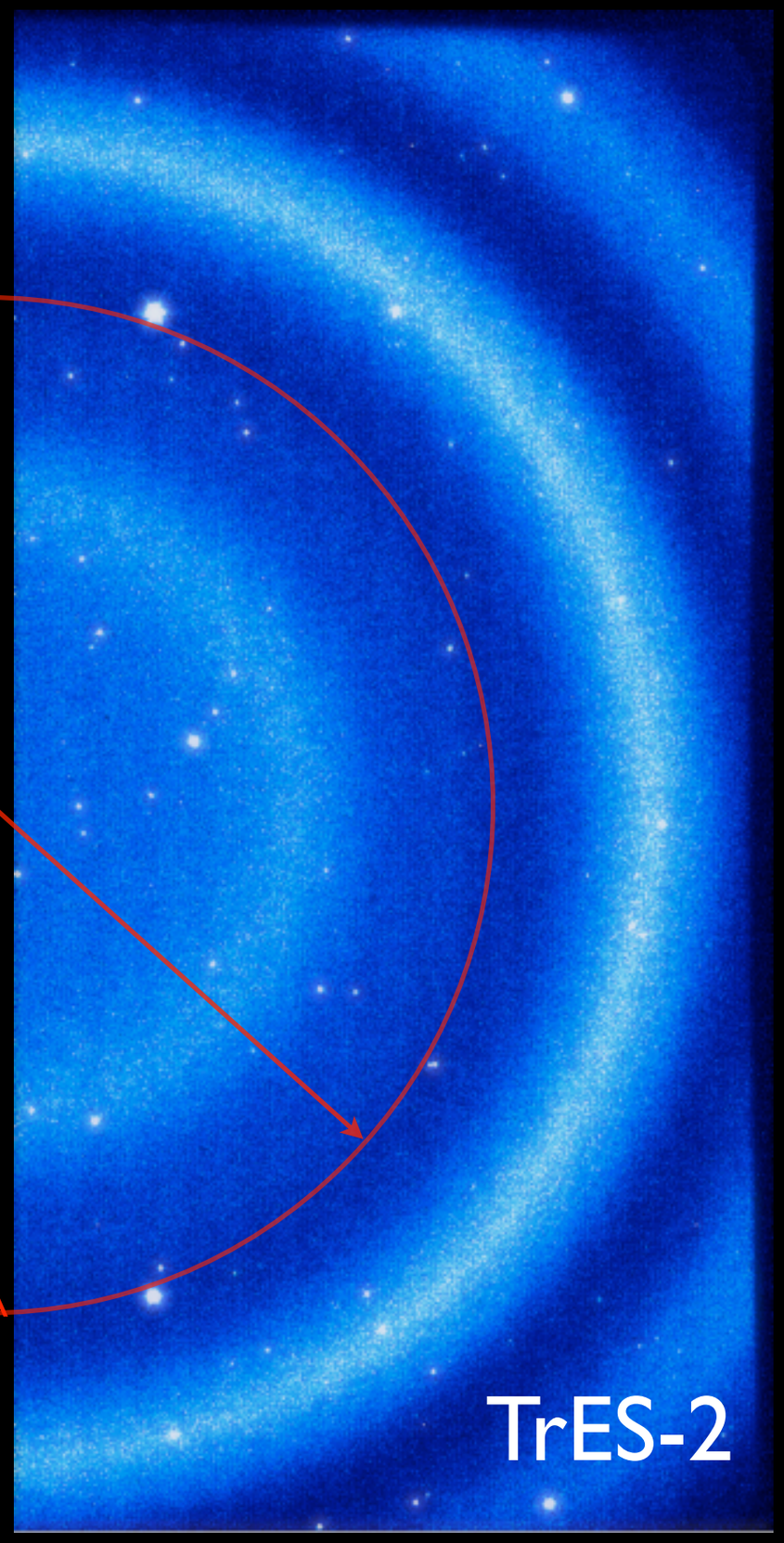
<u>Strengths</u>

- Sub-mmag differential photometry
  - Wide Field
  - Tune between sky lines
- Good Spectral Resolution
- Good data quality

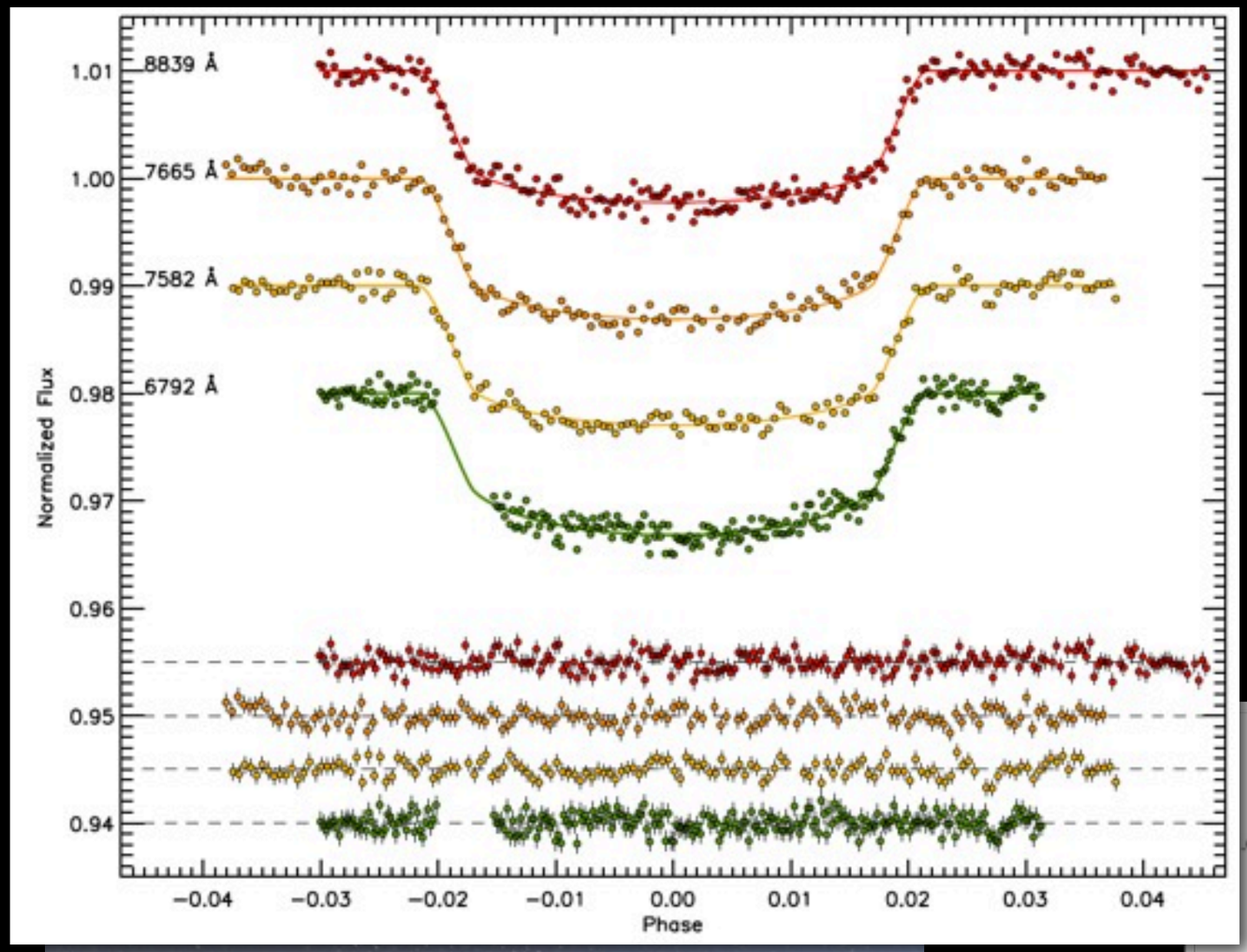
<u>Drawbacks</u>

- Limited λλ coverage
- Limited simultaneous λλ coverage

<u>Ideal for Na, K detection</u>

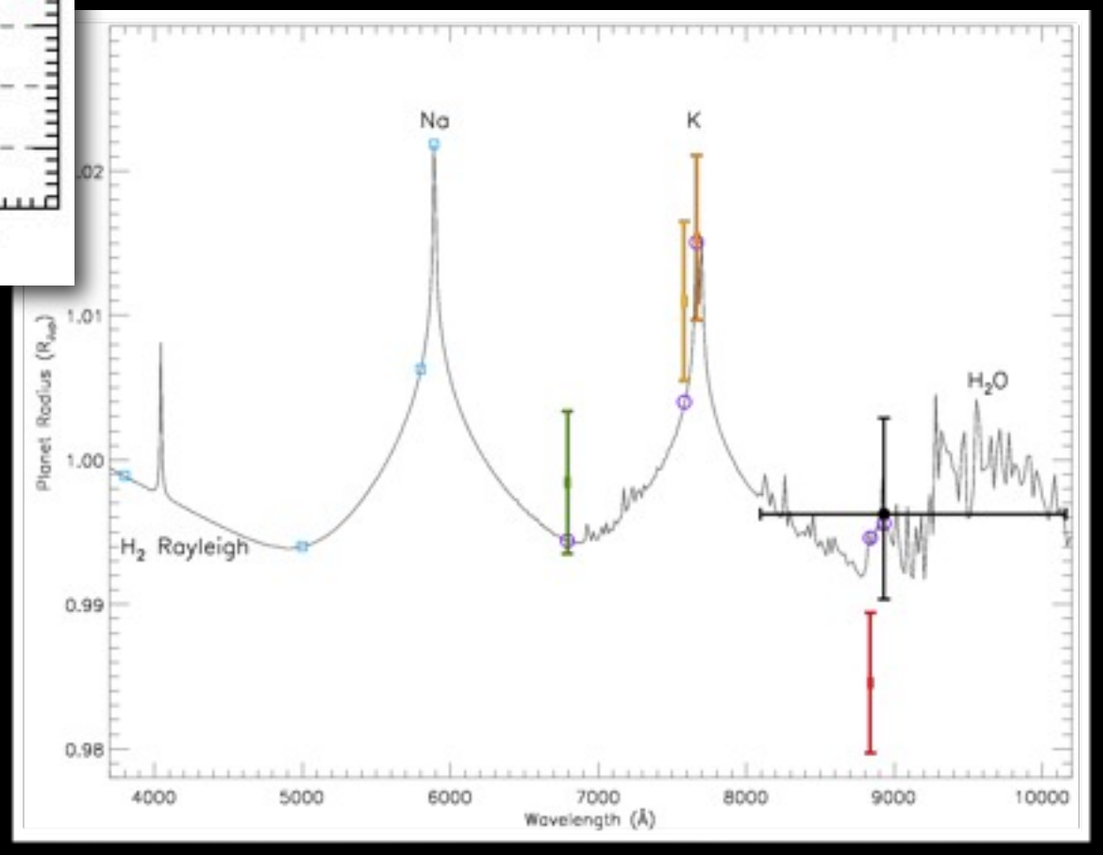


Potassium in XO-2b

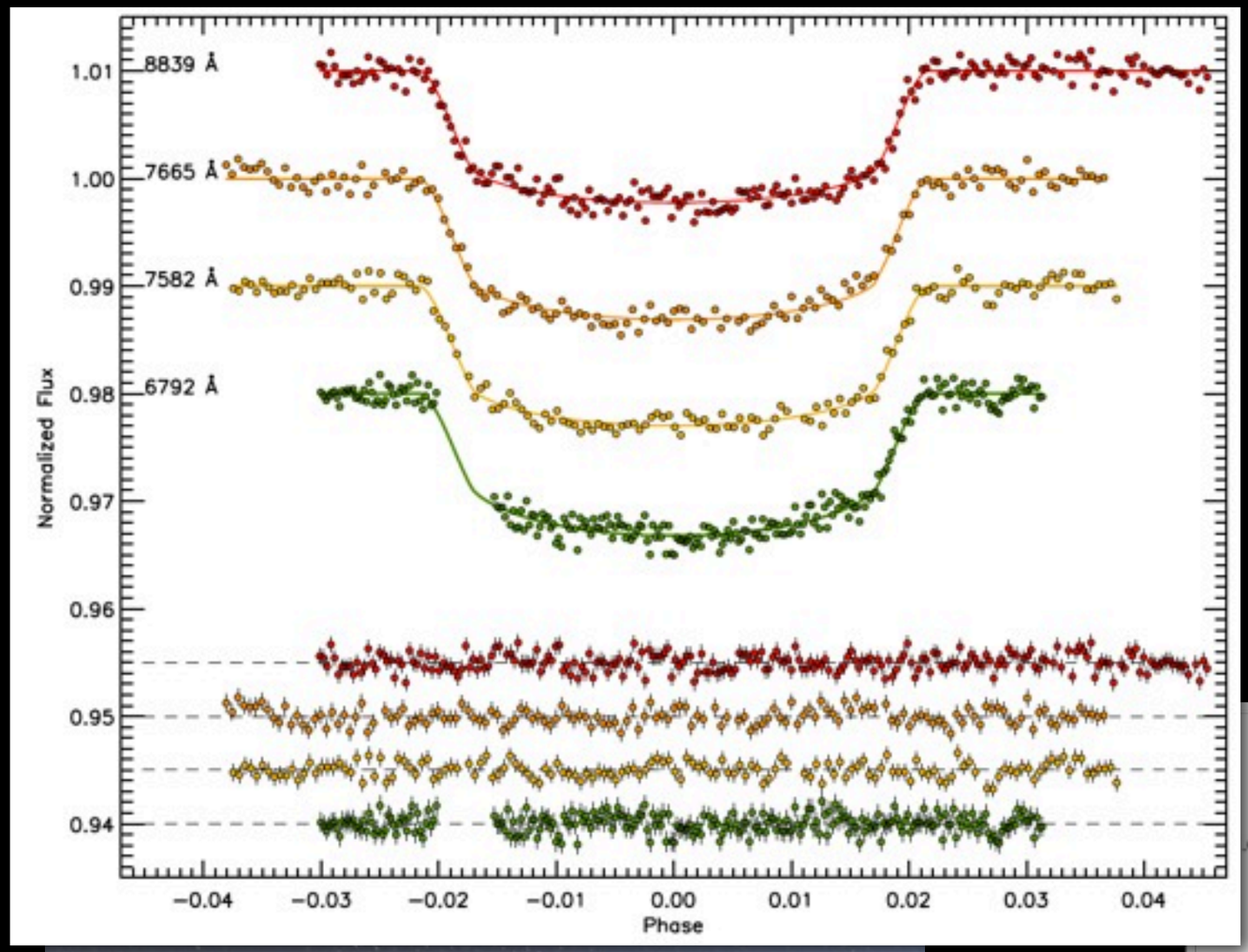


0.067% 12Å

Sing et al. 2011, A&A, 527, A73



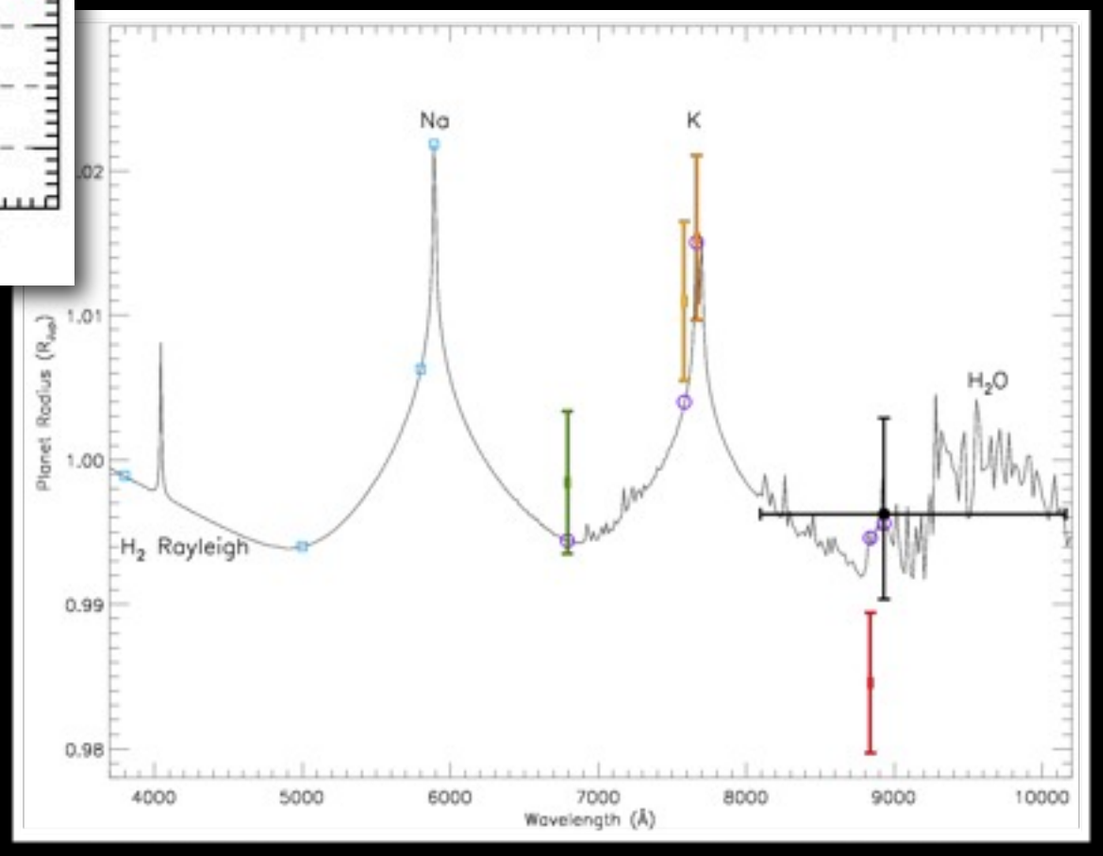
Potassium in XO-2b



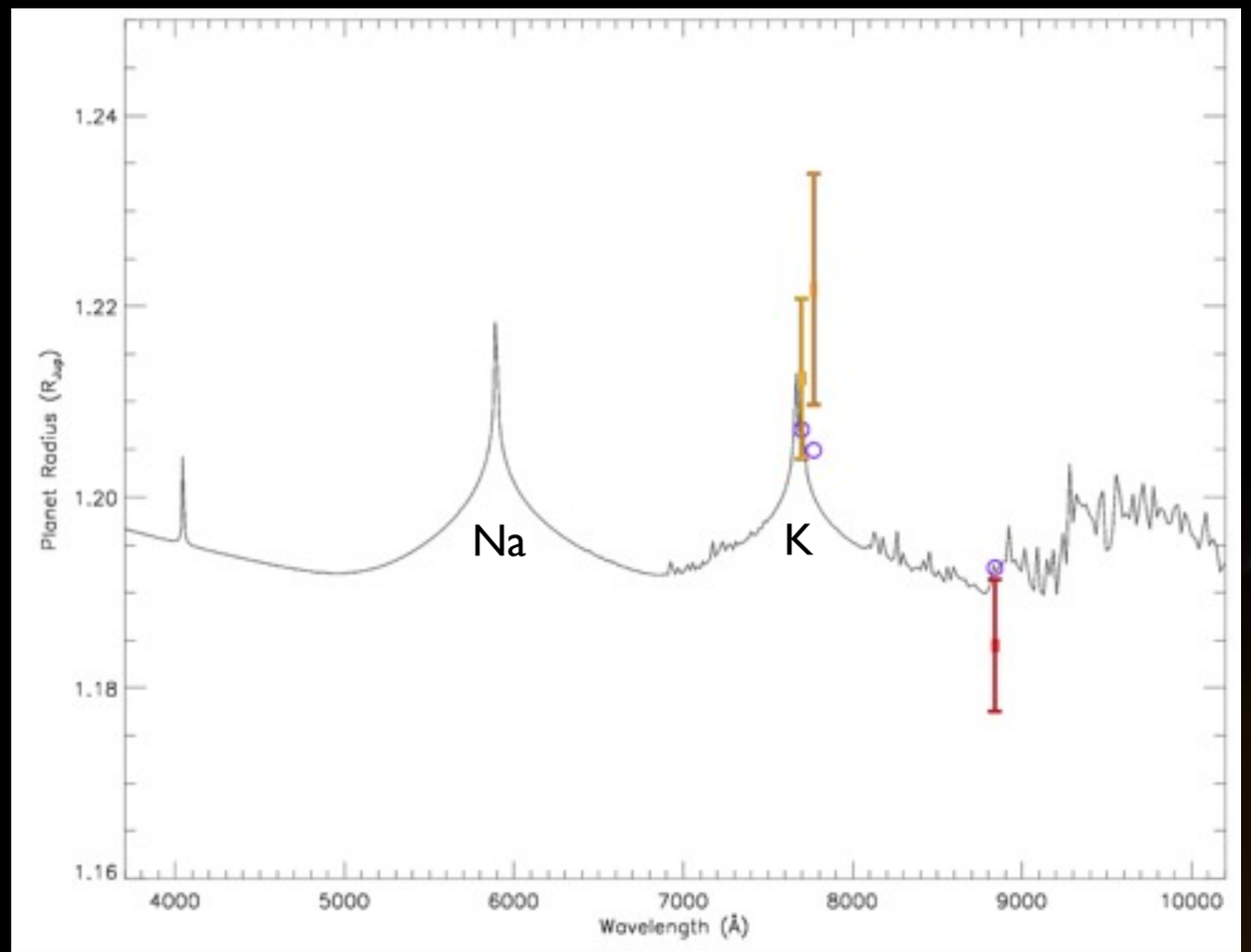
- Hot-Jupiters are Alkali-dominated optical (Na & K)
- Na/K producing low albedos

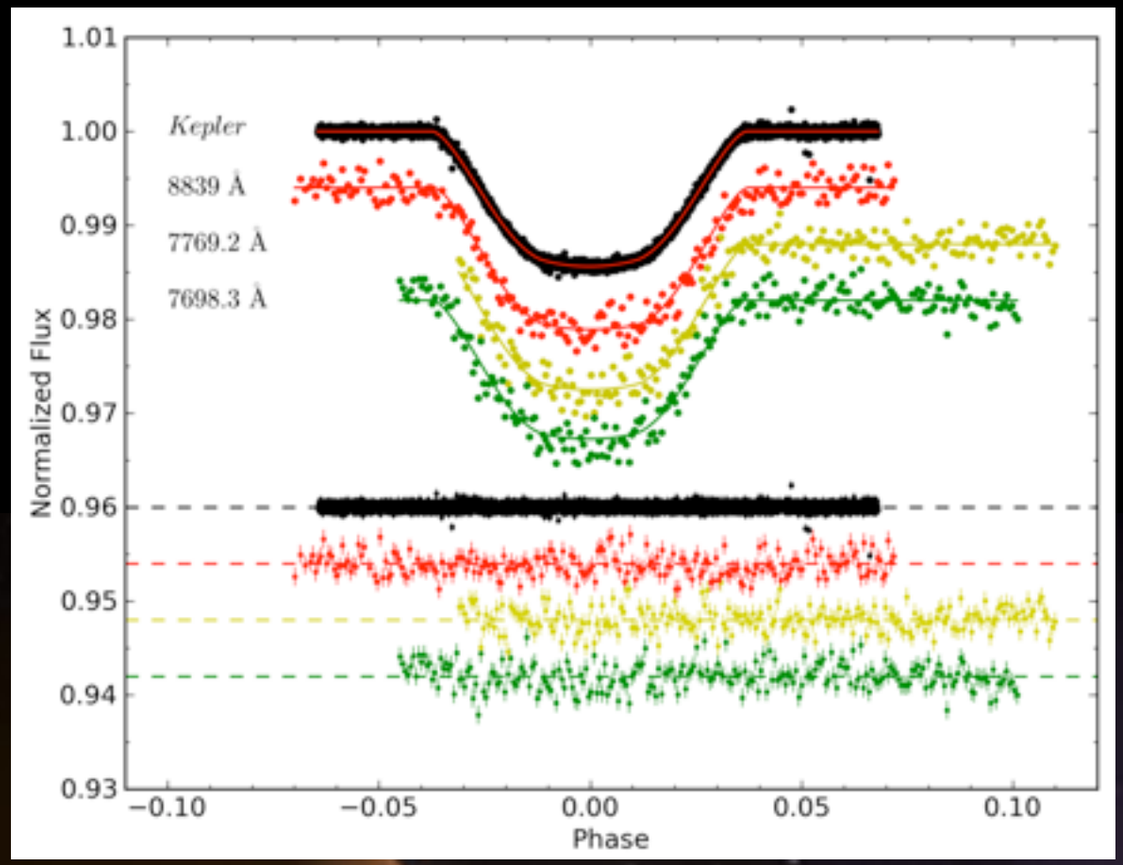
0.067% 12Å

Sing et al. 2011, A&A, 527, A73



TrES-2b

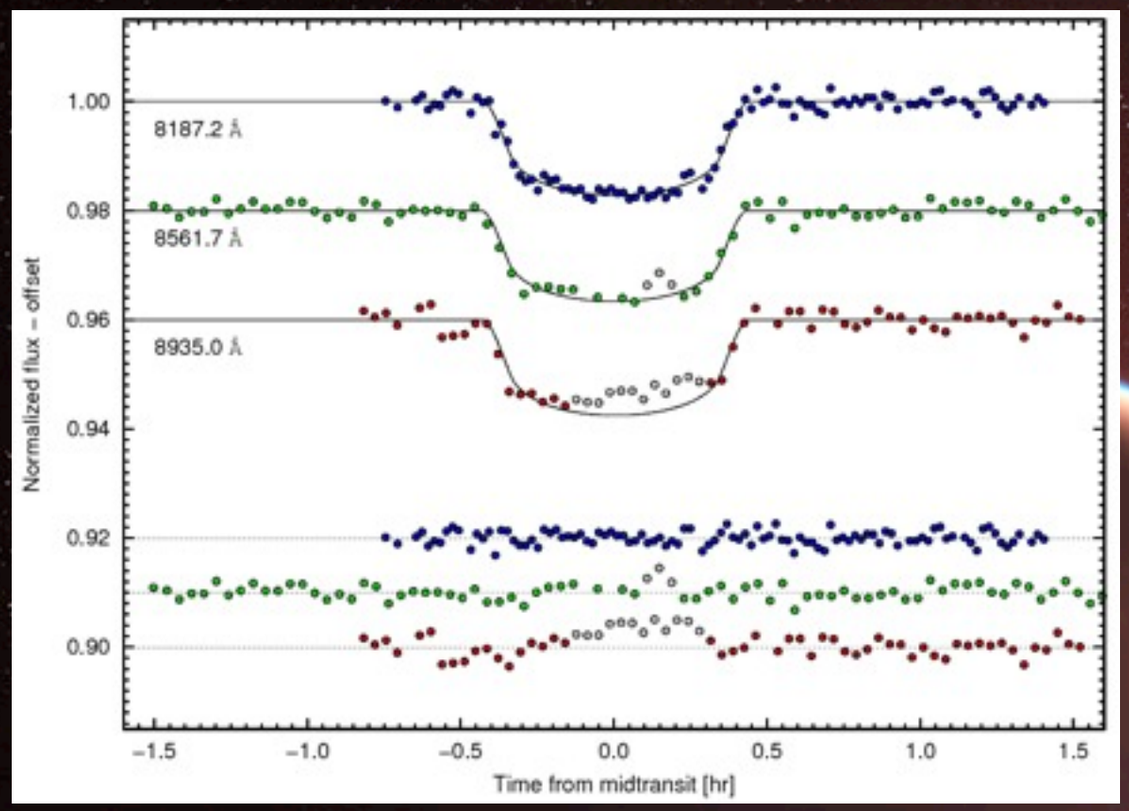




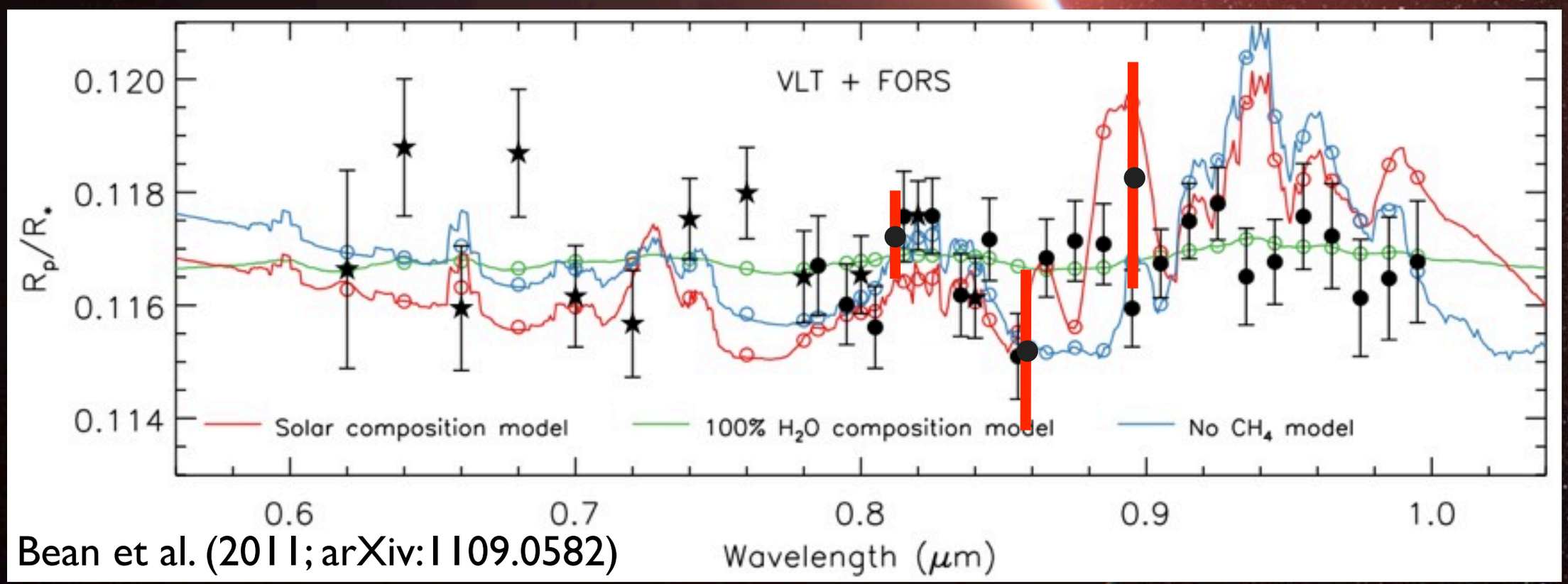
- Possible Potassium
- Known very low albedo

  (Kipping & Spiegel 2011)

GJ1214 The world is flat

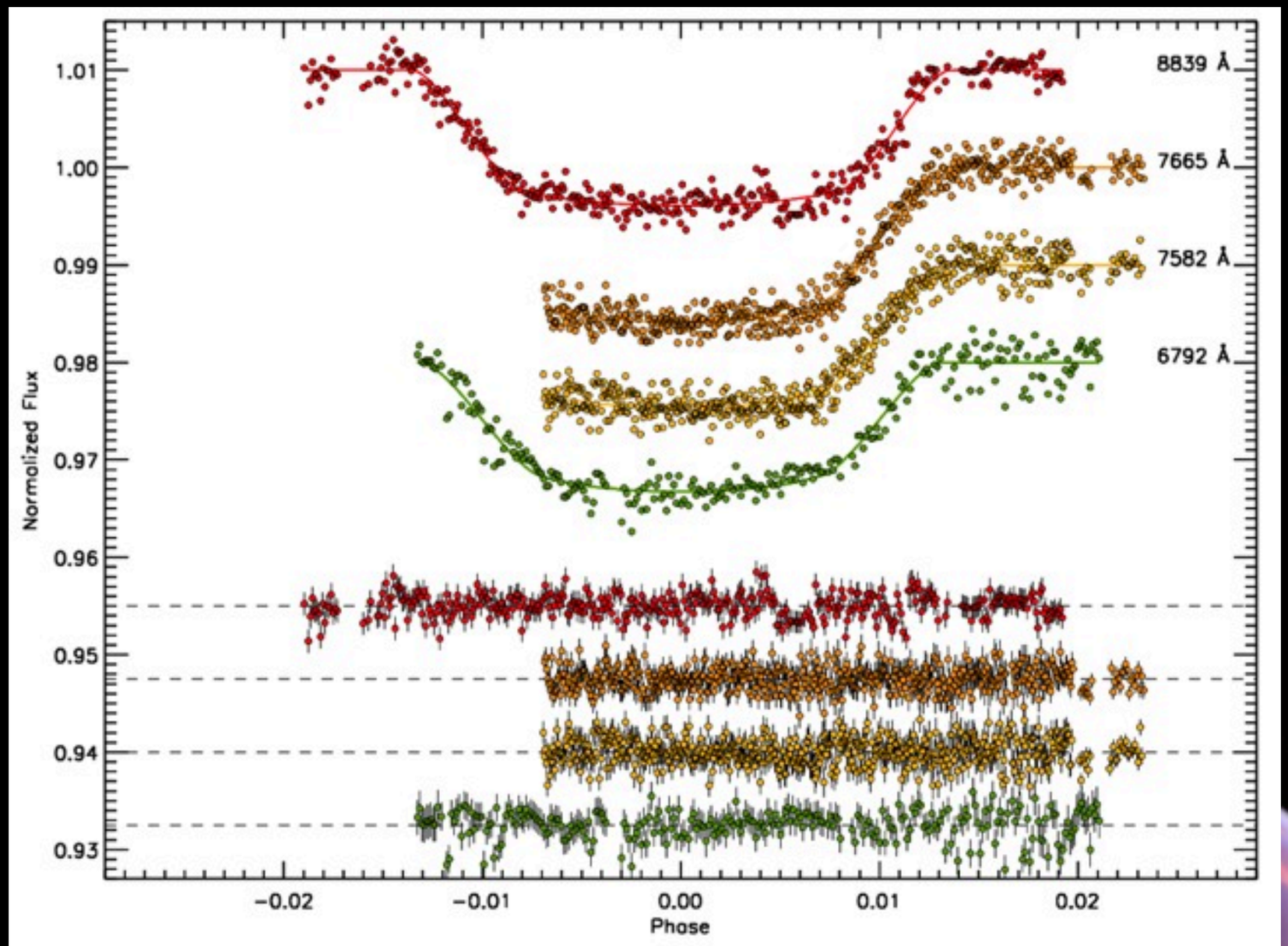


- Much Higher resolution
- Still flat
- Spots common



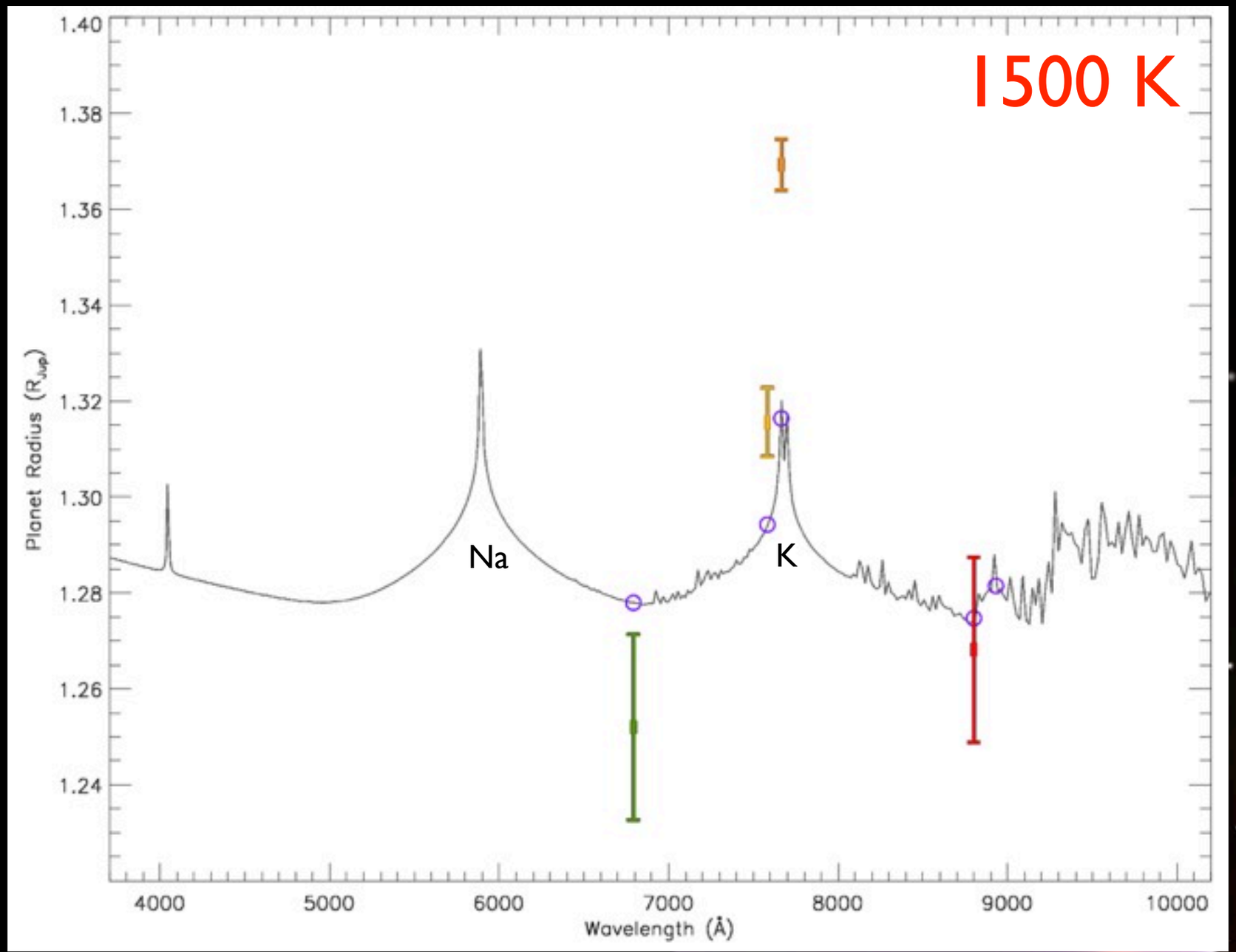
Bean et al. (2011; arXiv:1109.0582)

Hat-P-1b

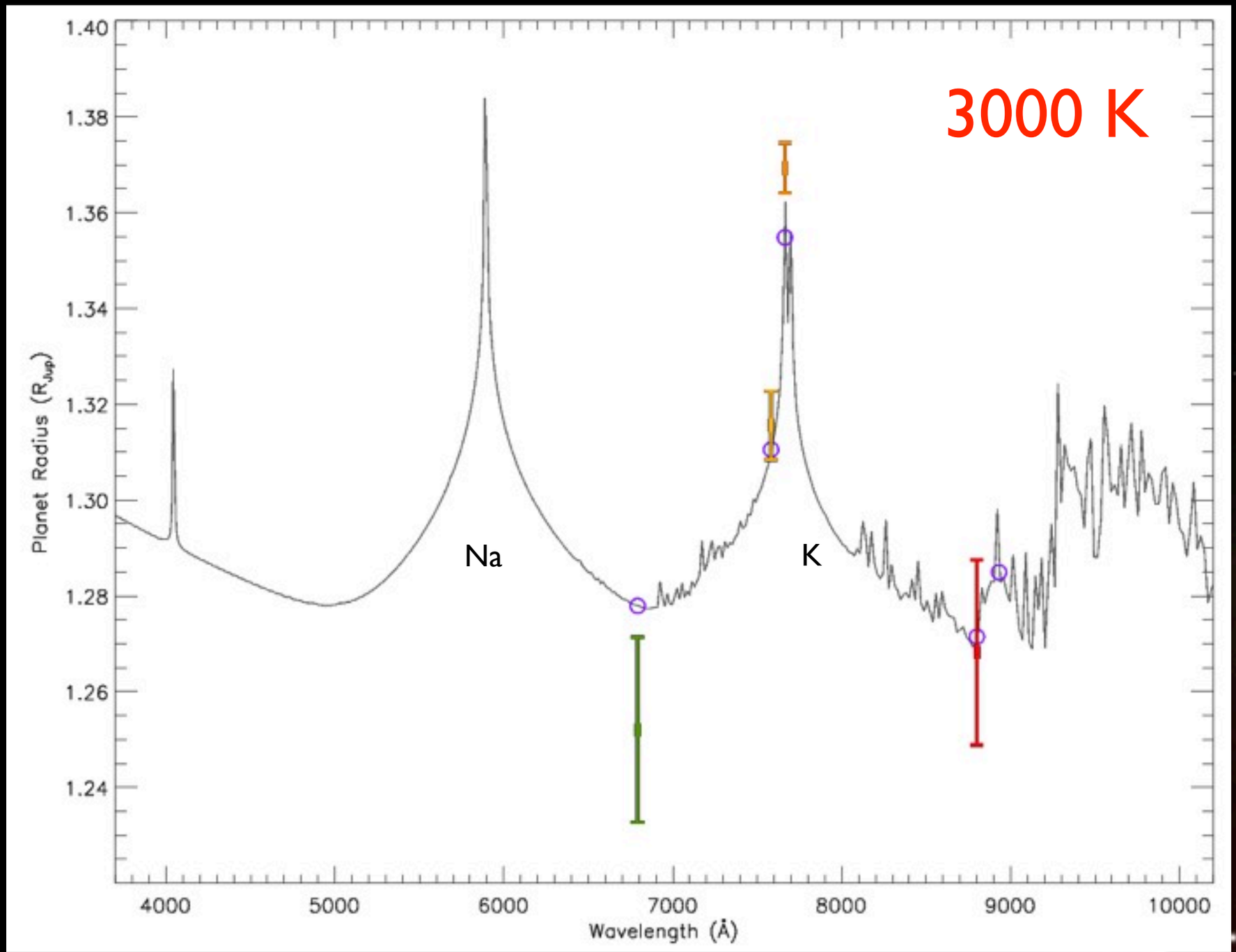


- near Photon limited

Hat-P-1b

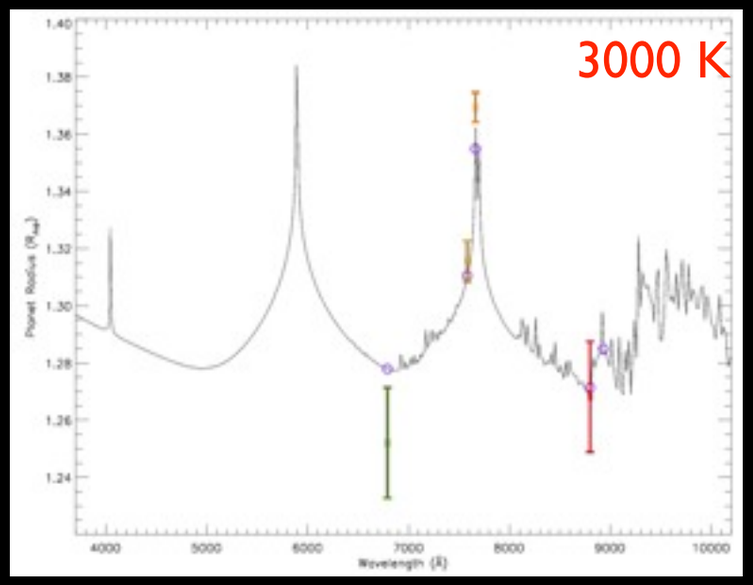

1500 K
Na
K
Planet Radius (R_{Jup})
1.40
1.38
1.36
1.34
1.32
1.30
1.28
1.26
1.24
4000
5000
6000
7000
8000
9000
10000
Wavelength (Å)

Hat-P-1b Thermosphere??

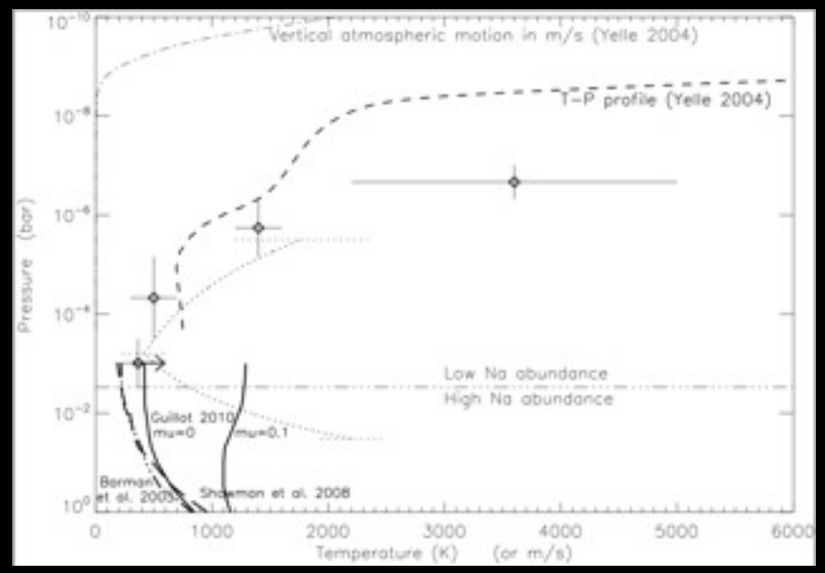


Thermospheres in Hot-Jupiters

Hat-P-1b ?

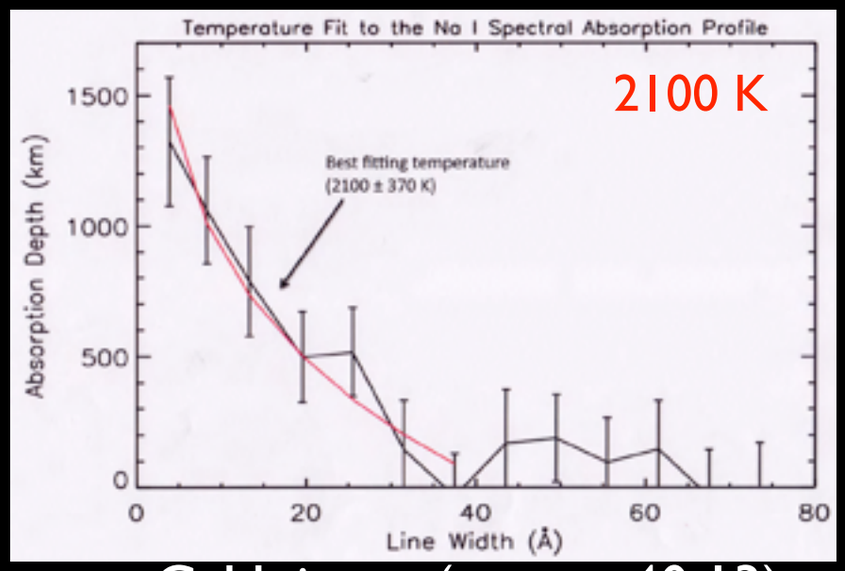


HD209458b



Vidal-Madjar et al. (2011)

HD189733b

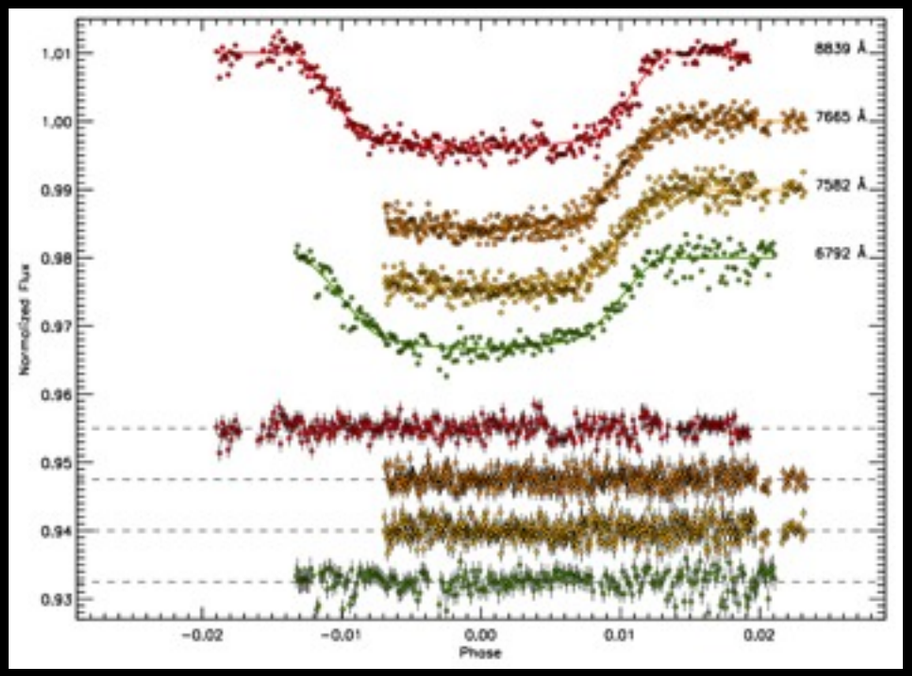


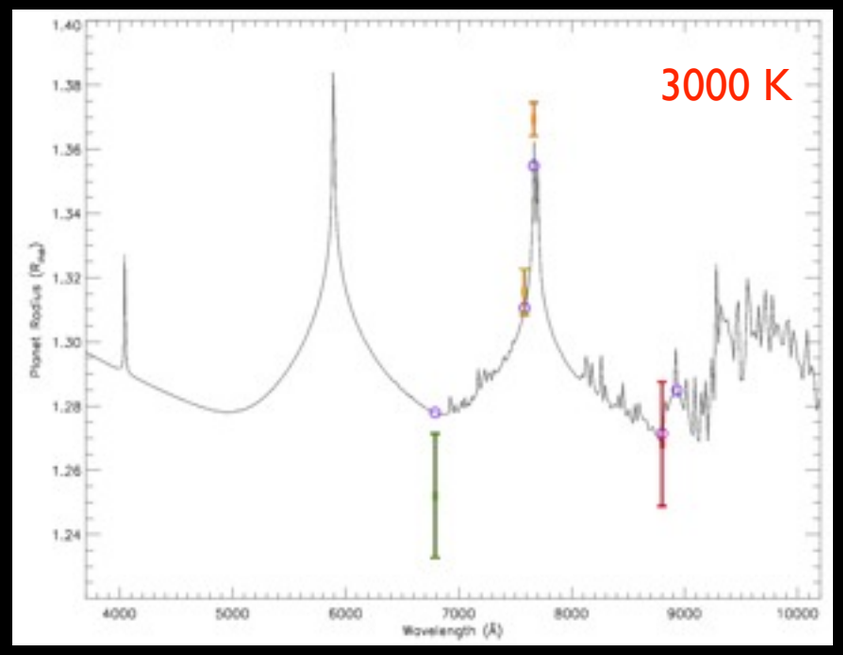
C. Huitson (poster 40.13)

Escaping Atmo: Vidal-Madjar et al. (2003) - Lecavelier et al. (2010)
Linsky et al. (2010)

- Thermosphere linked with atmospheric escape
- Should be common
- Detectable with Na, K, H line cores

Hat-P-1b





- Thermosphere result will be checked
- Second GTC potassium transit + Na
- Large HST Programme with STIS

Future

2012

Blue Filters (Na)

Longslit Transit Spectra

Completion of
Large ESO programme