

Giant Planet Companions to T Tauri Stars

Christopher Crockett
Lowell Observatory

Naved Mahmud (Rice University)

Lisa Prato (Lowell Observatory)

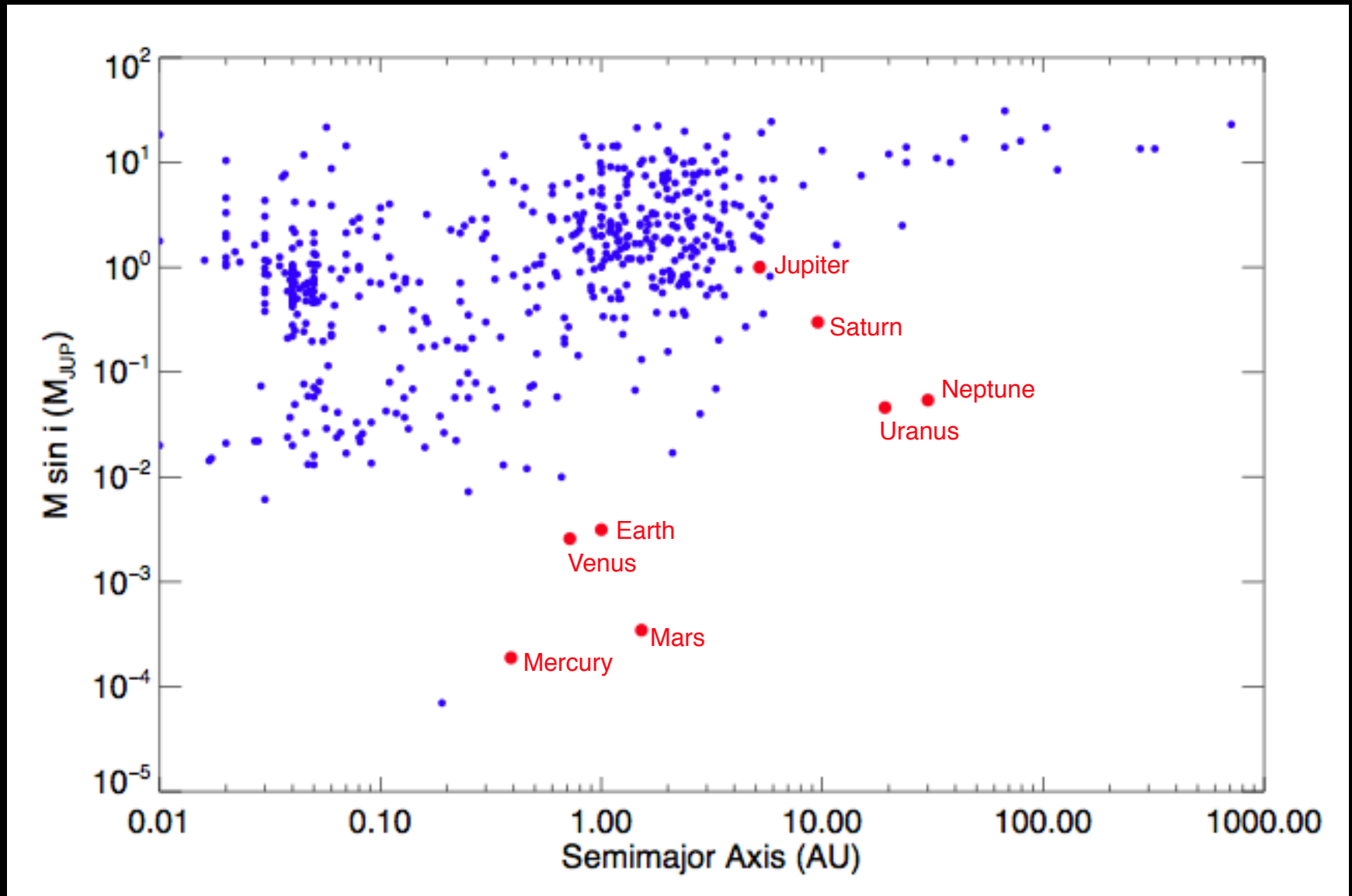
Christopher Johns-Krull (Rice University)

Daniel T. Jaffe (University of Texas, Austin)

Patrick Hartigan (Rice University)

Charles Beichman (NExScI)

Over 500 known exoplanets



T Tauri stars as planet hosts

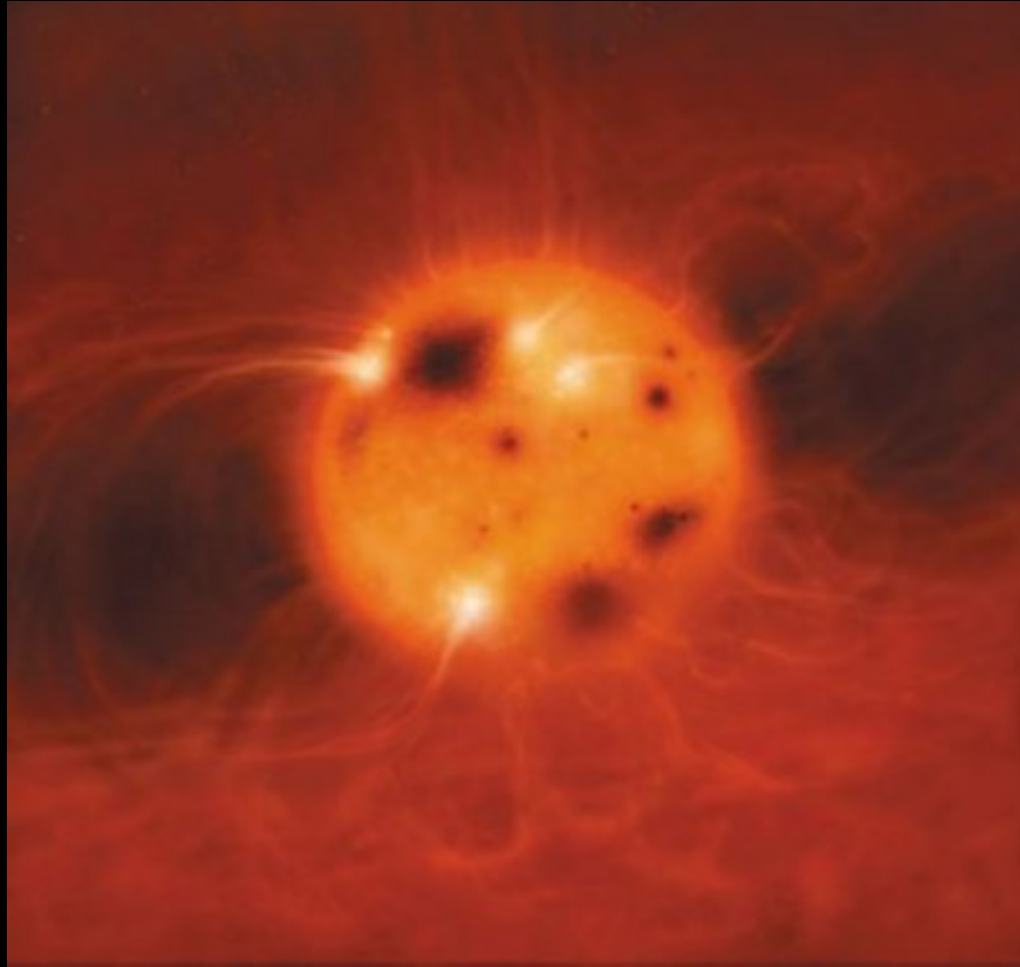
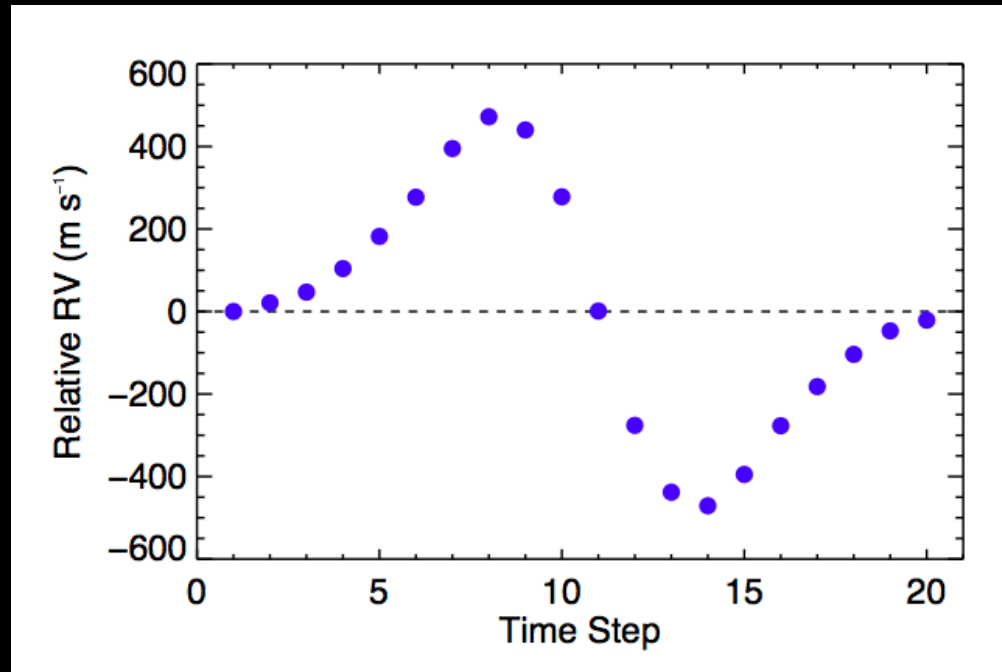
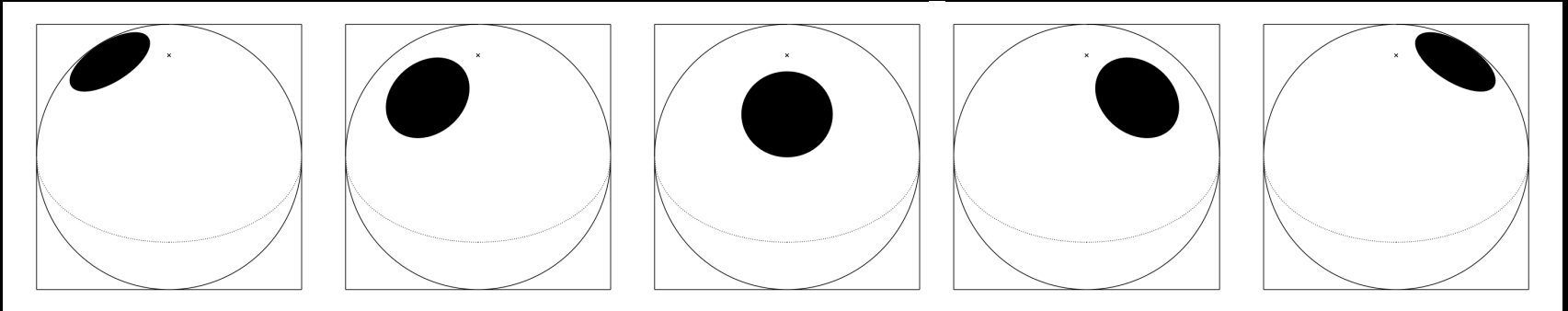
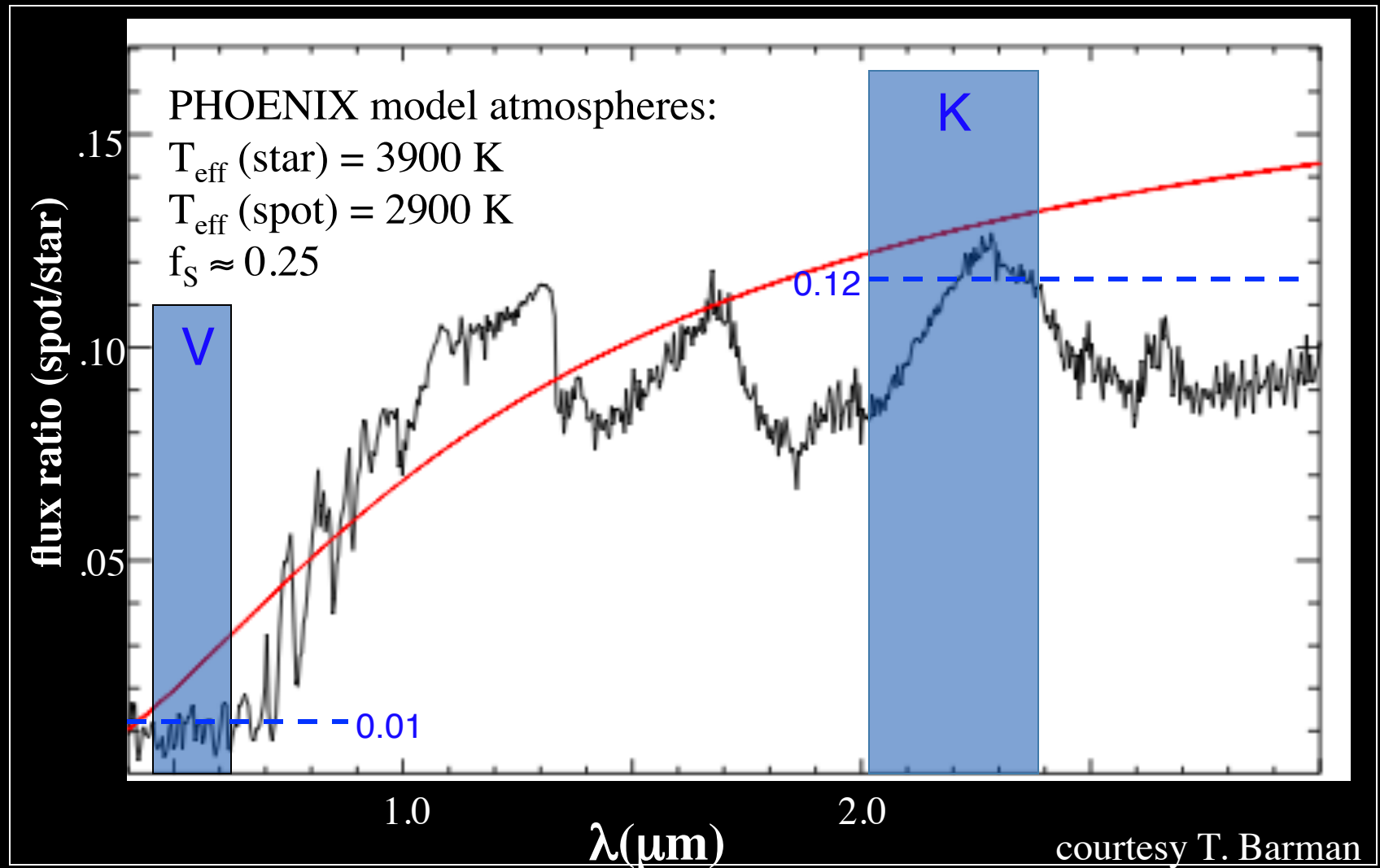


Image Credit: M.A. Garlick

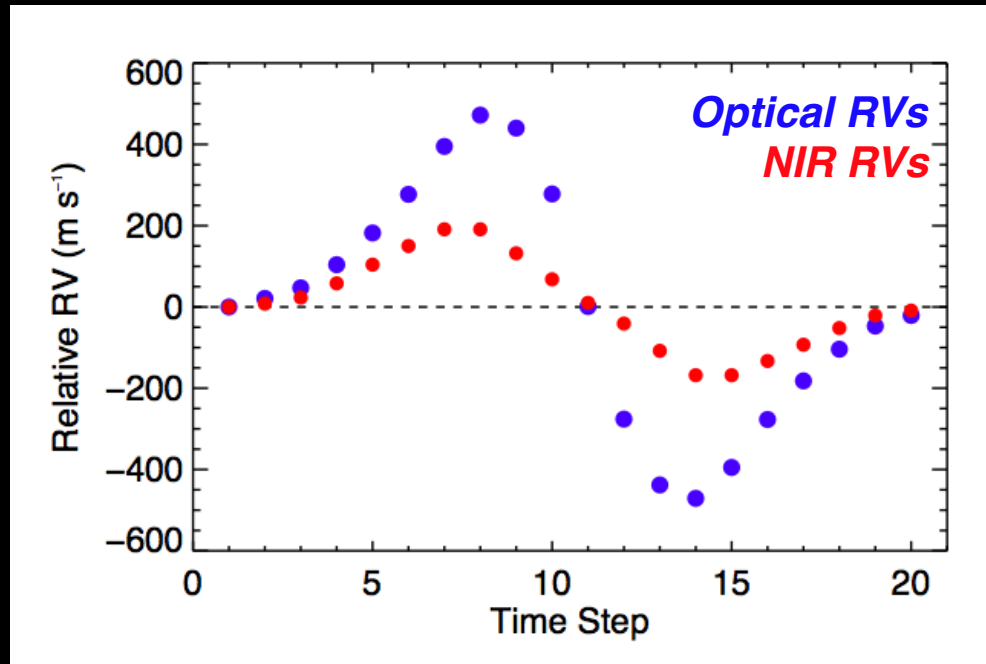
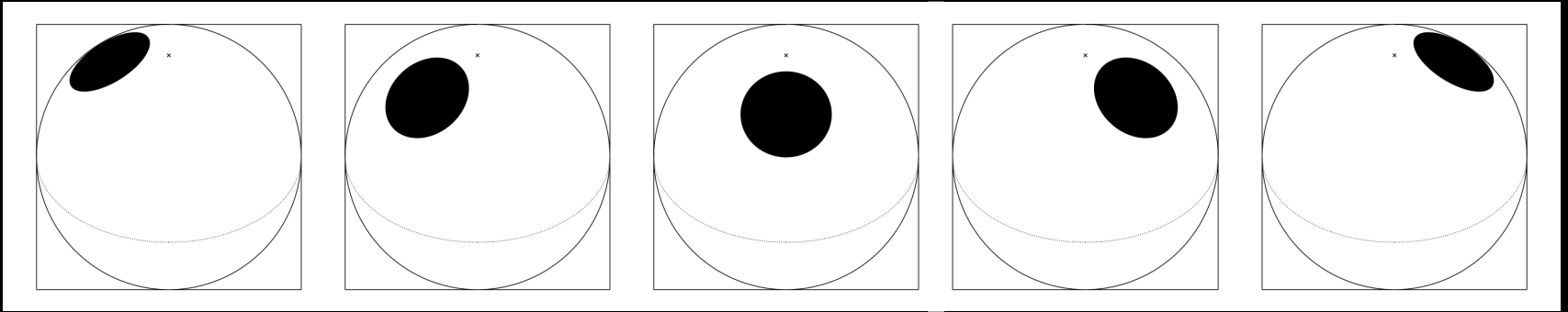
Spots can resemble planets



Spots have wavelength-dependent contrast

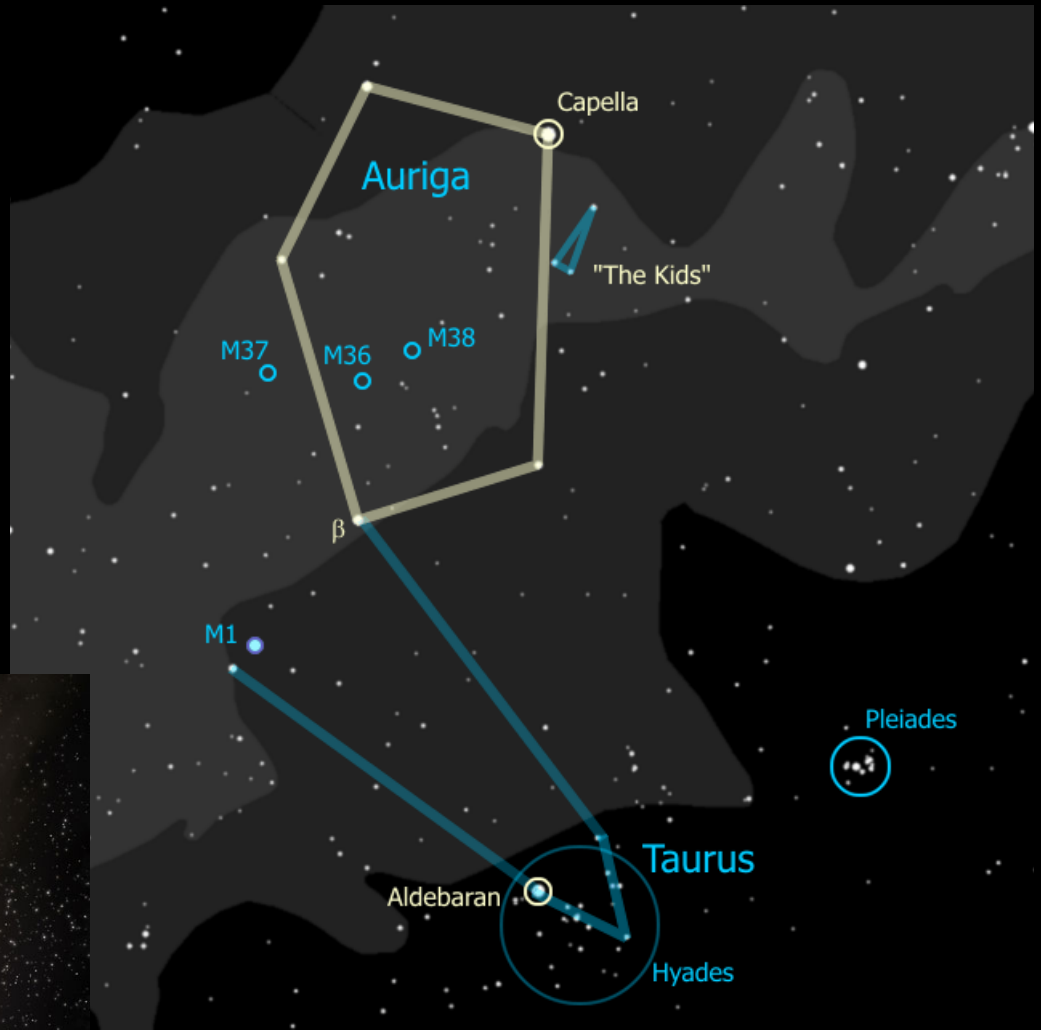


RVs from spots are wavelength dependant



An RV survey of Taurus-Auriga

- ~150 T Tauri stars
- 1-3 Myr old
- ~140 pc



Optical observations



- McDonald Observatory (Ft. Davis, TX)
 - 2.7-m telescope
 - Coudé echelle spectrometer
 - $R \sim 60,000$ (5 km/s)
 - $\lambda_C \sim 6300 \text{ \AA}$
 - 2.1-m telescope
 - cassegrain echelle spectrometer
 - 0.8-m telescope
 - photometry

- Kitt Peak National Observatory (Tucson, AZ)
 - 4-m telescope
 - cassegrain echelle spectrometer
 - $R \sim 60,000$ (5 km/s)
 - $\lambda_C \sim 6300 \text{ \AA}$

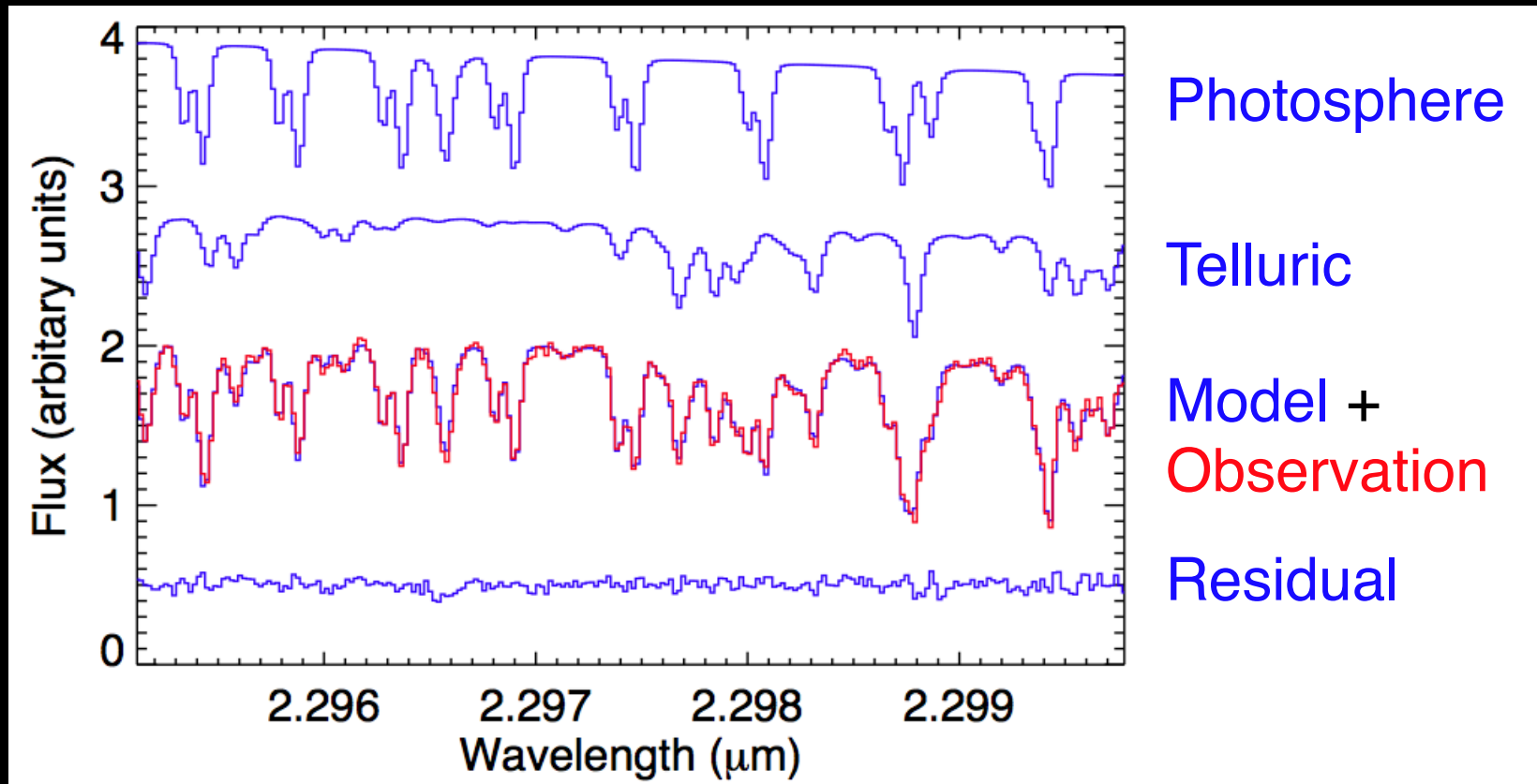


NIR observations



- NASA Infrared Telescope Facility (IRTF)
 - 3-m telescope
 - CSHELL (Cass-mounted echelle)
 - $R \sim 46,000$ (6.5 km/s)
 - K-band ($\lambda_C \sim 2.3 \mu\text{m}$)

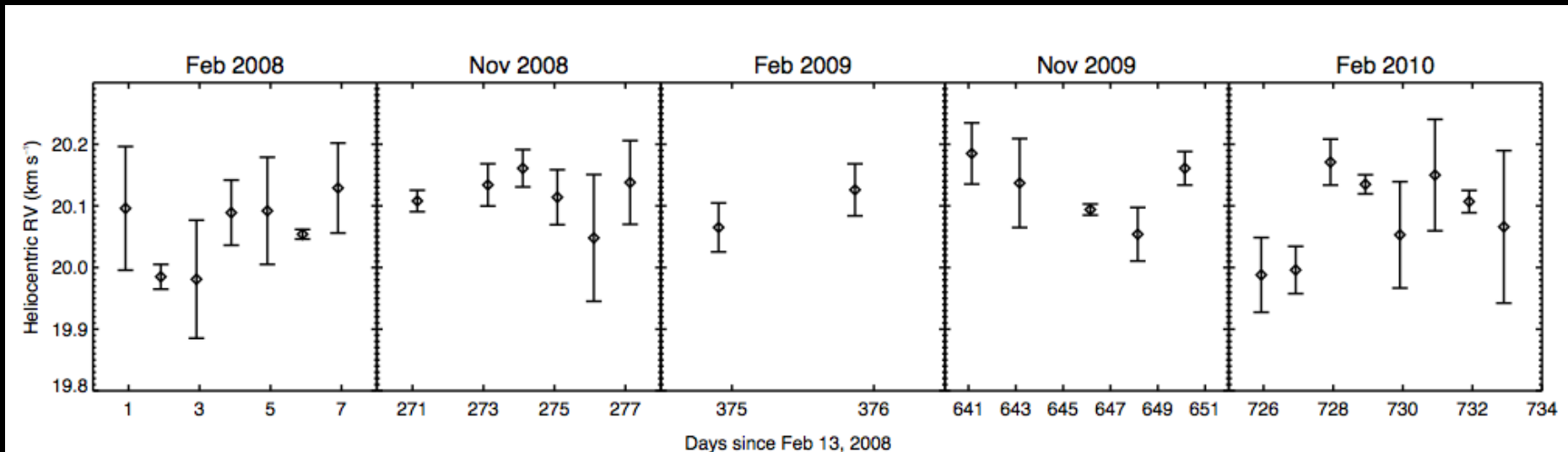
Using the atmosphere as a gas cell



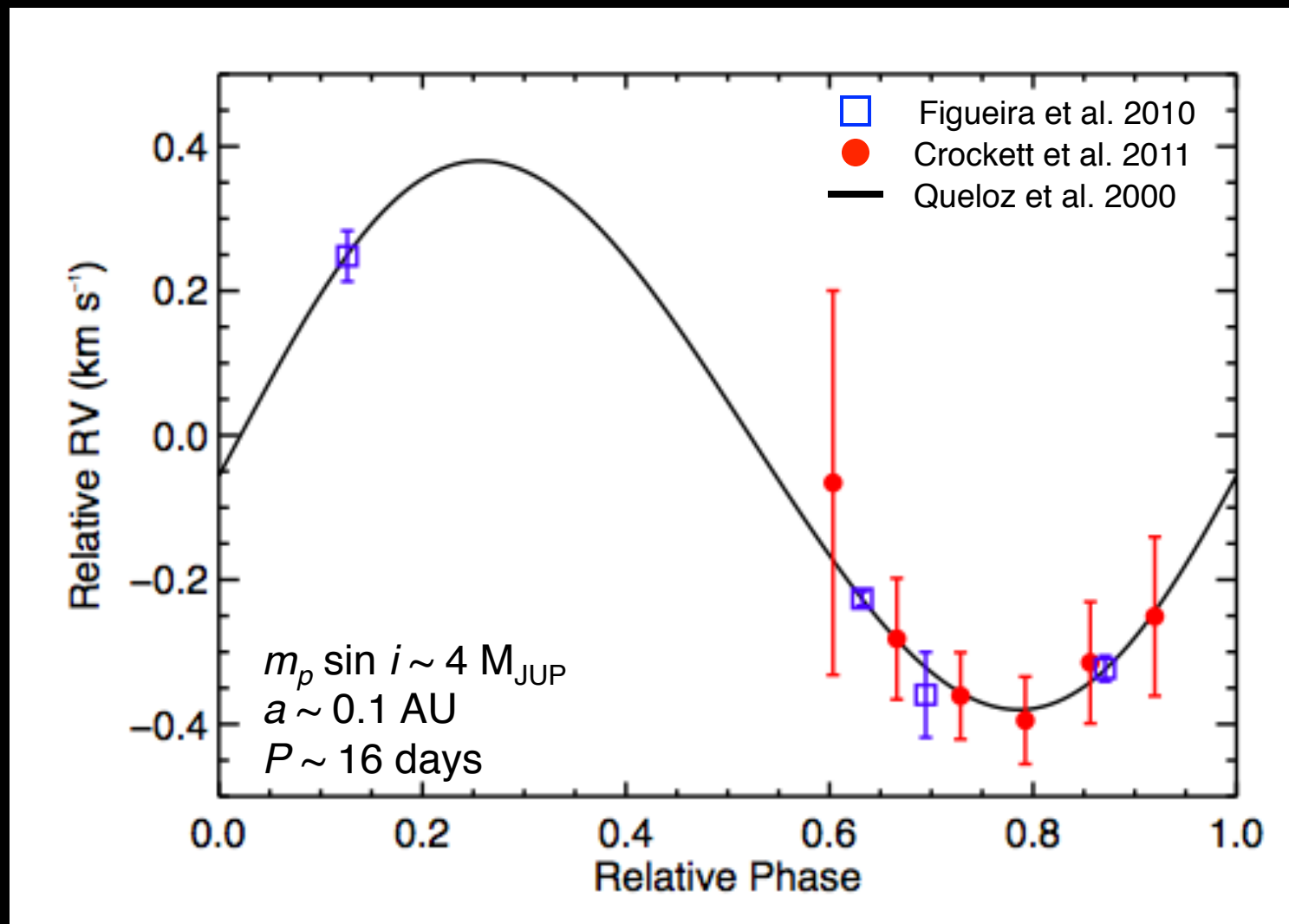
See also:
Blake et al. 2010
Figuera et al. 2010

60 m s⁻¹ precision with CSHELL

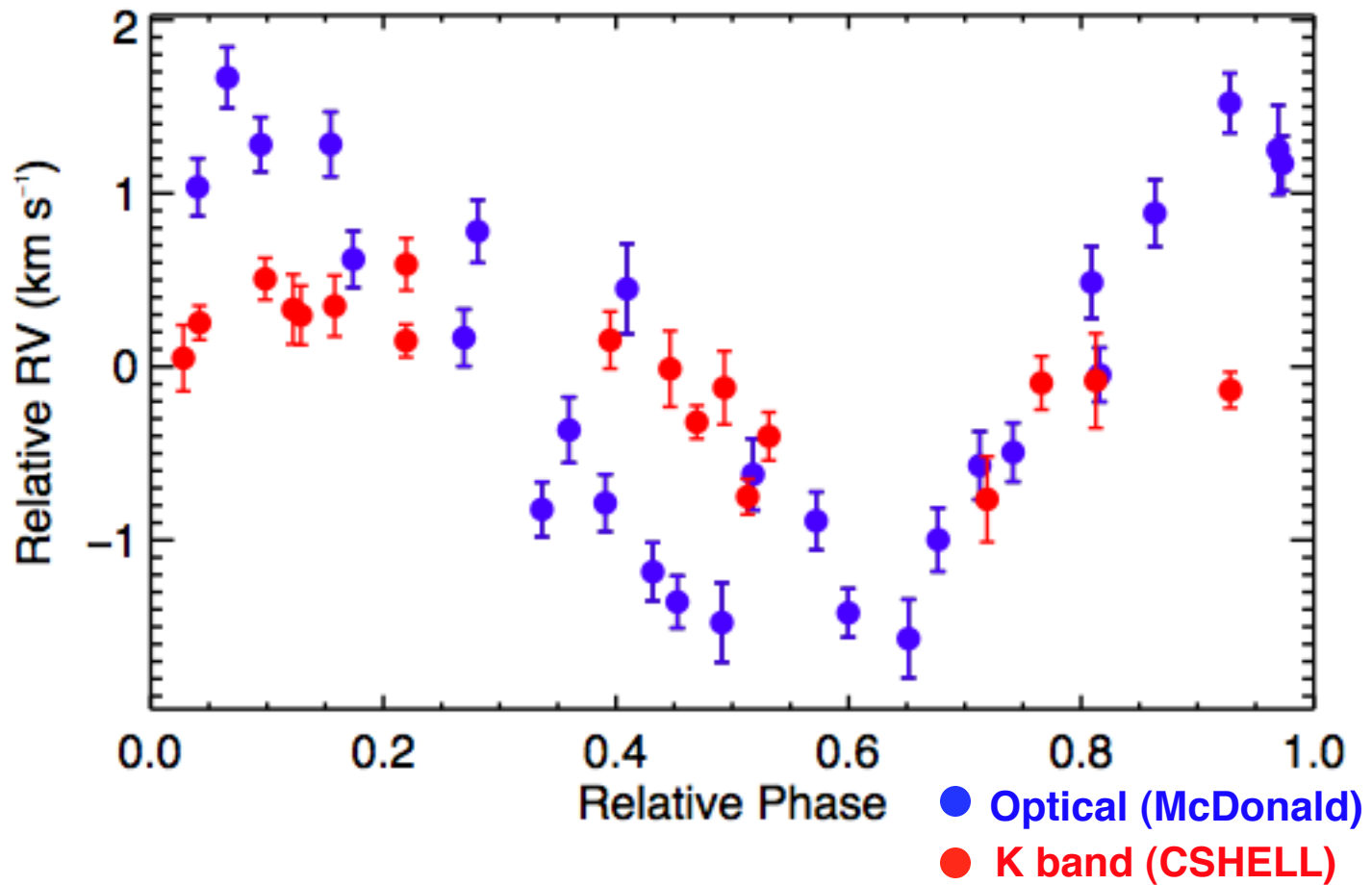
RV Standard GJ 281 (M0)



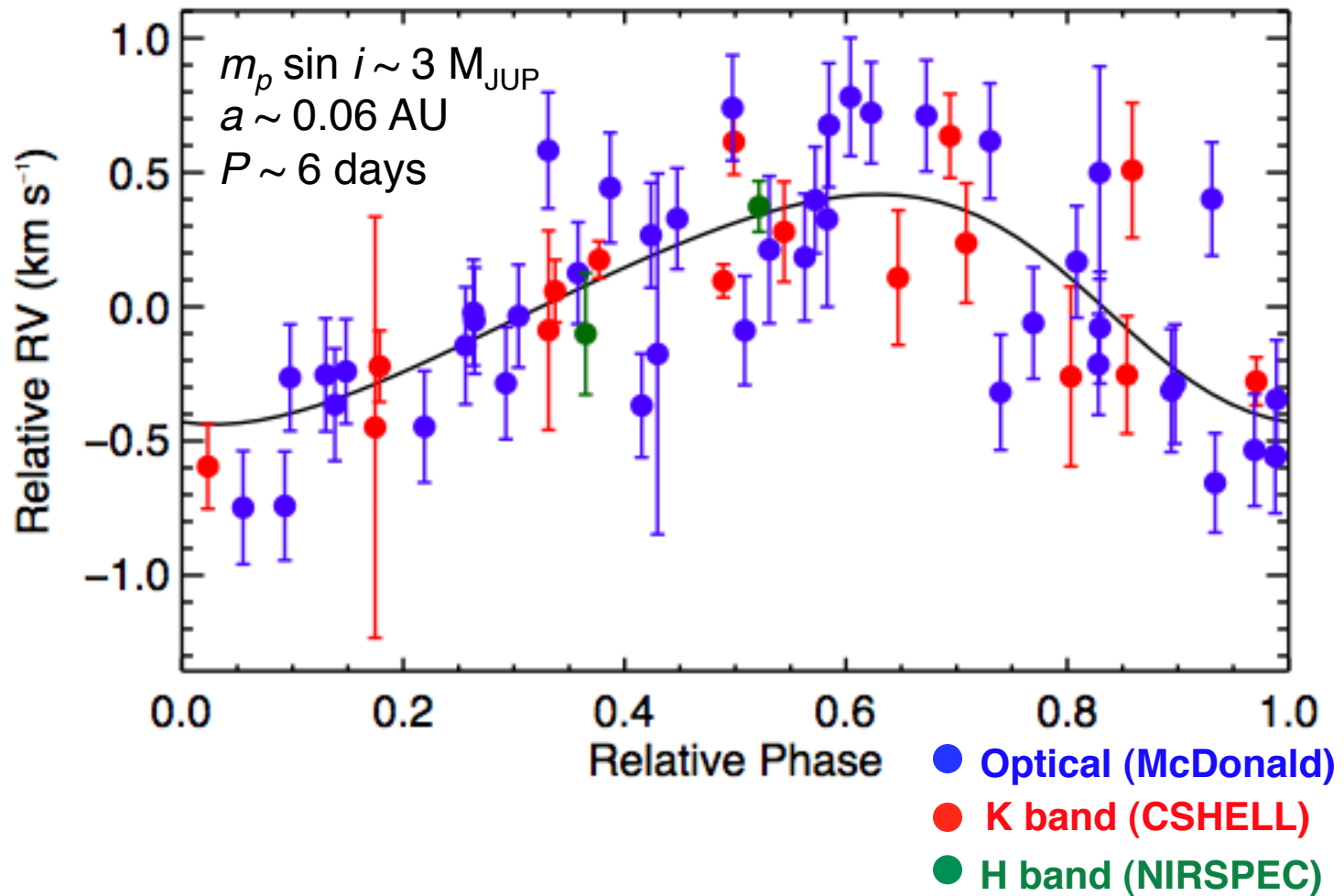
Recovered known exoplanet Gl 86 b



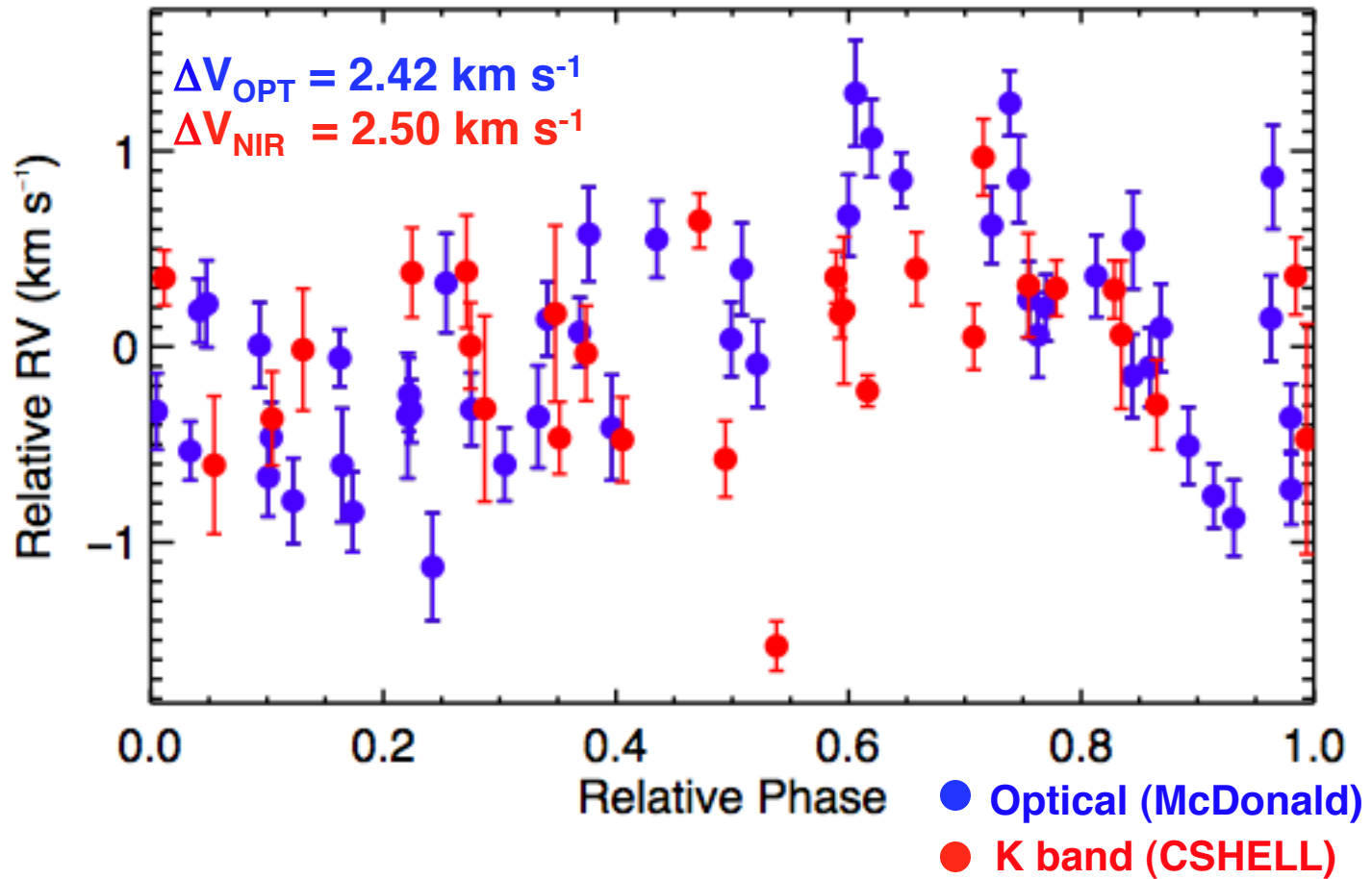
Hubble 4: a spotted star



Target of interest #1



Target of interest #2



Take home message

- T Tauris constrain formation timescale
- Young stars exhibit large RV noise
- Multiwavelength observations essential
- A possible 1 Myr old, $3 M_{\text{JUP}}$, 0.06 AU planet

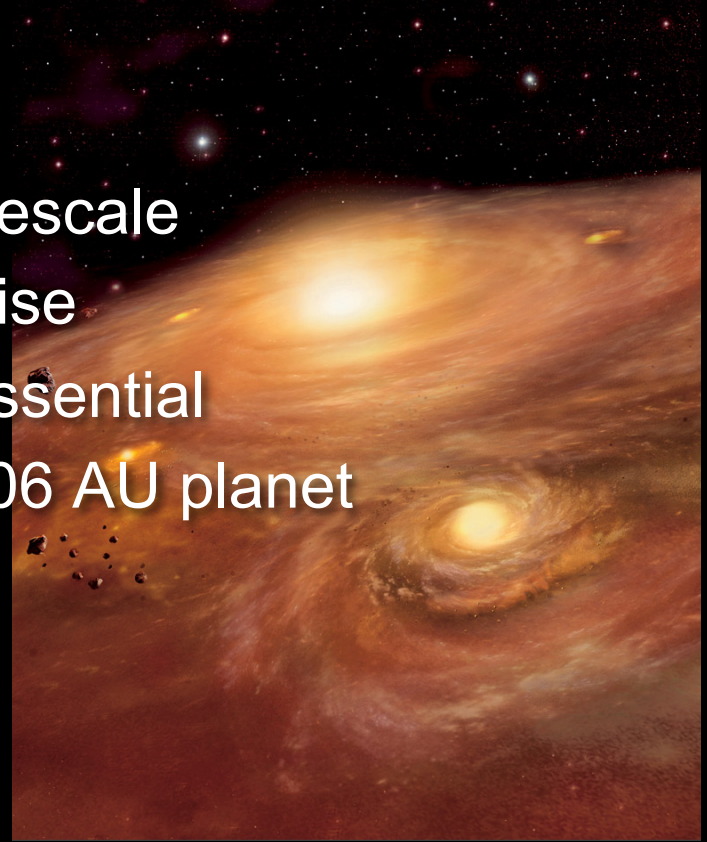


Image Credit: Moonrunner Design

See poster: Missions.14

Mahmud et al. *Brown Dwarfs and Giant Planets Around Young Stars*