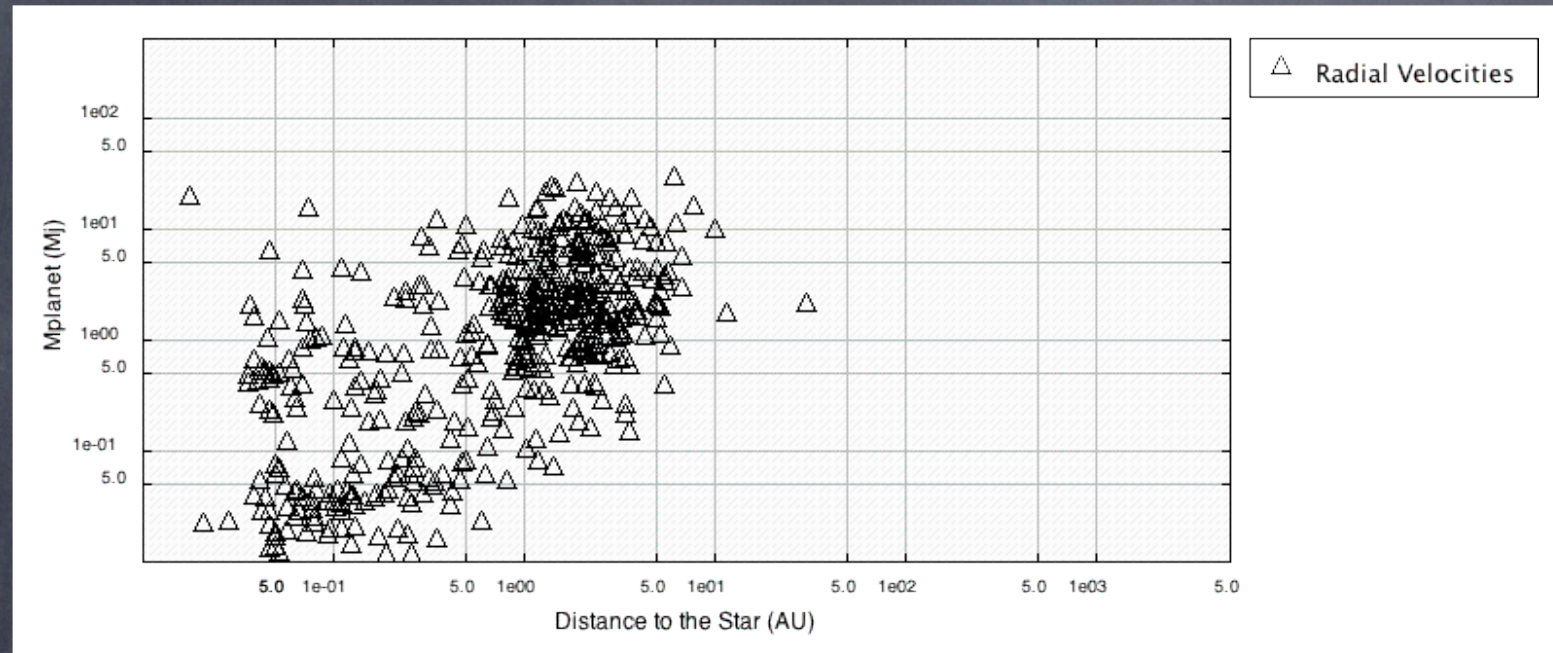


Radial Velocity: Indirect technique: Doppler shift (Targets: quiet stars; activity)



Orbital and Physical properties:

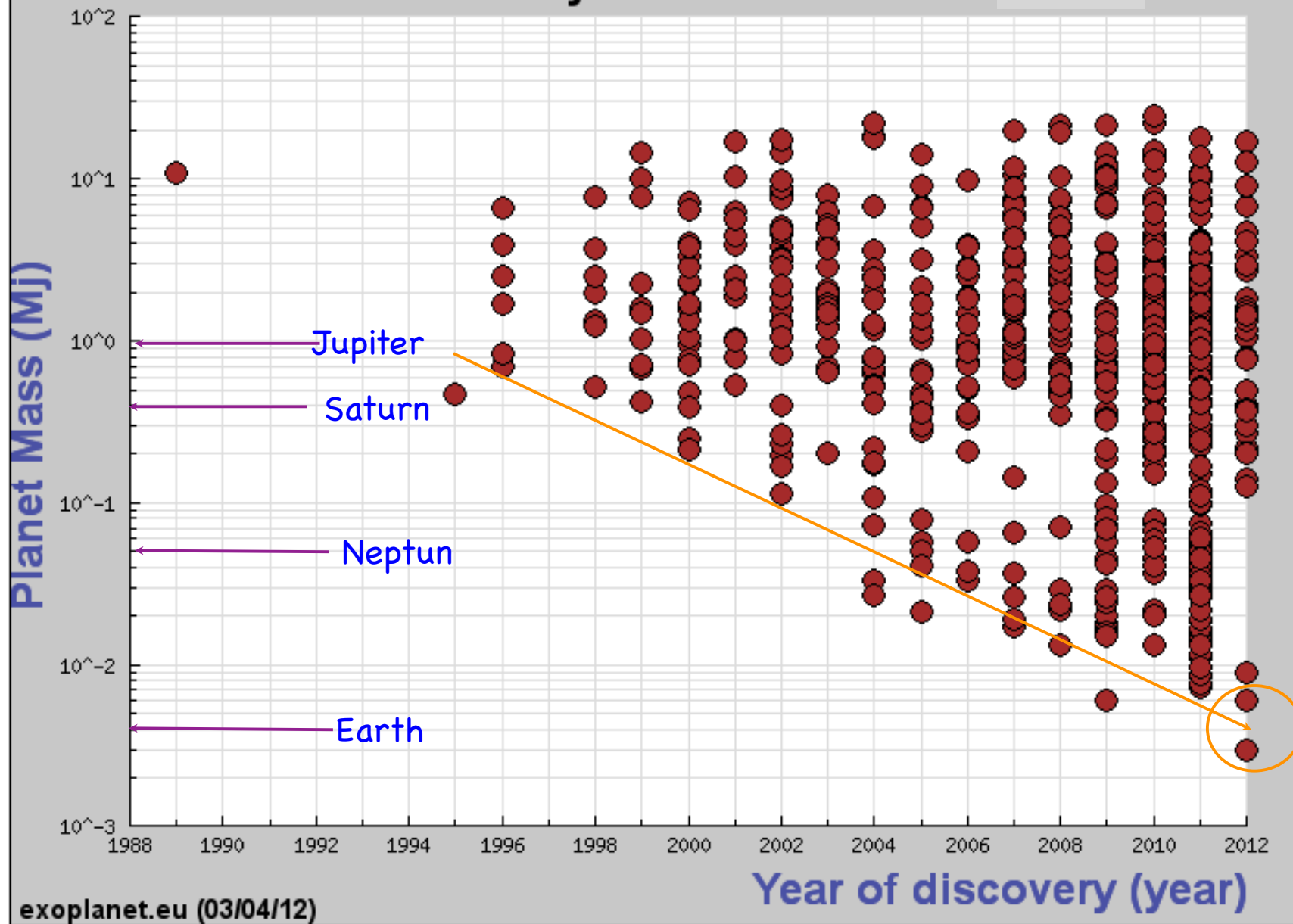
- > $M_p \sin(i)$, P , e , a , ω , T_0
- > Spin-Orbit Alignment
- > Architecture and Stability
- > exo-Earths and **Habitable Zone**

Dumusque et al. 12; Triaud et al. 11

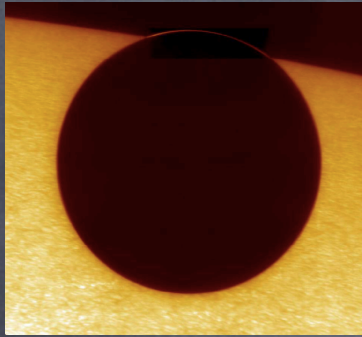
Statistics: more than 800 exoplanets

- > **Occurrence** down to Super-Earths
 - > Planetary host: Fe/H and binarity
- De Sousa et al. 11; Udry & Santos 07

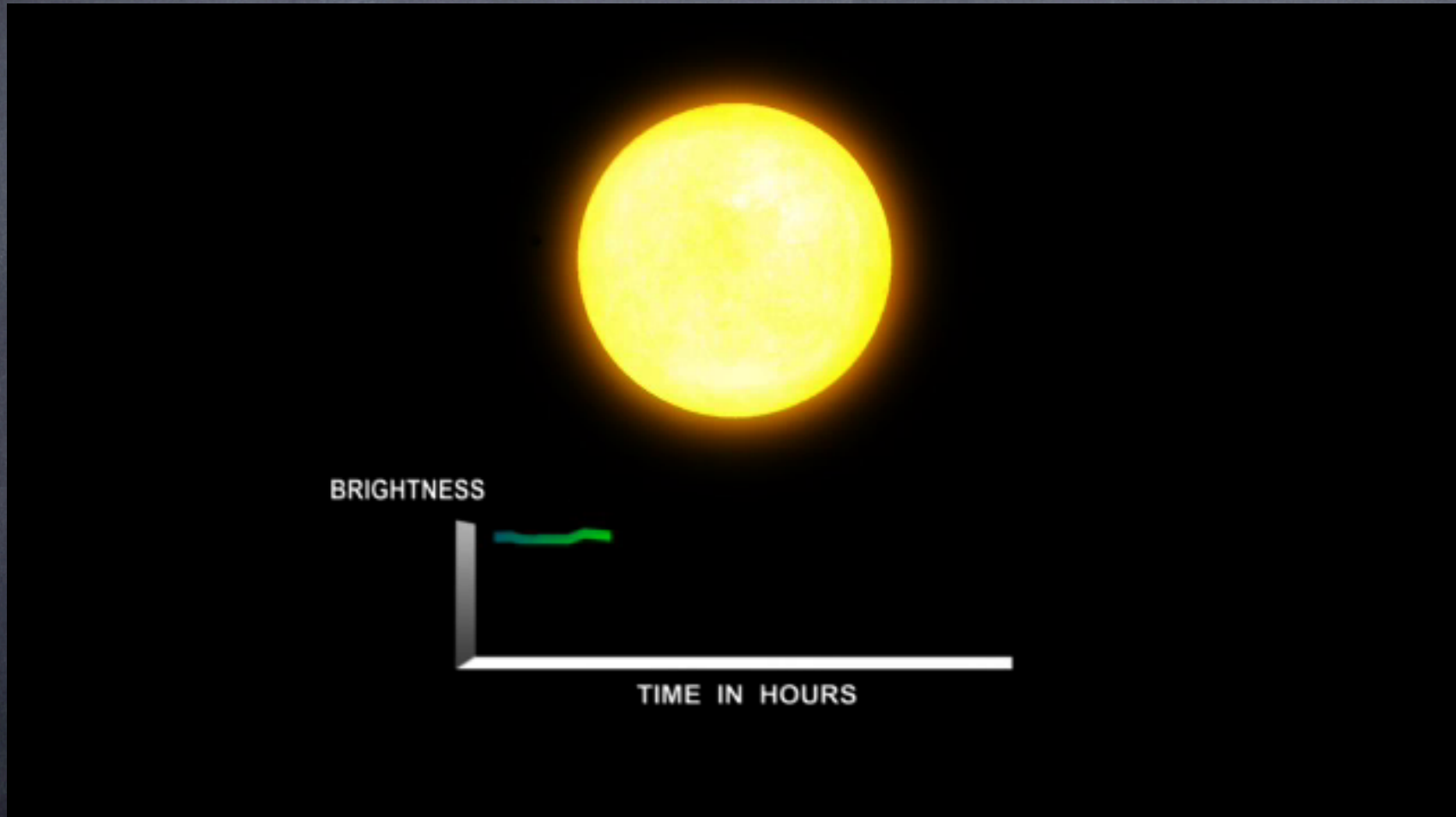
"Year of discovery" vs "Planet Mass"



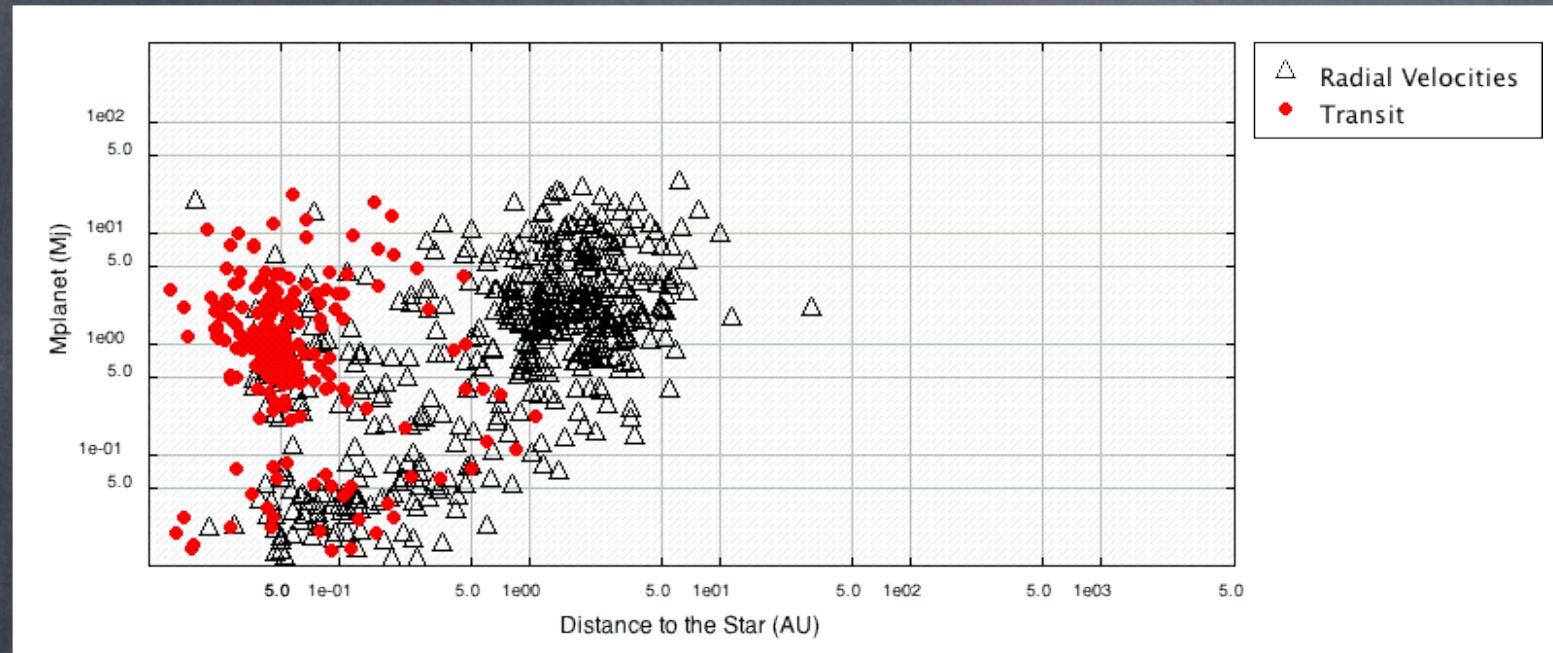
exoplanet.eu (03/04/12)



Transits



Transit (In)direct technique: 1^{ary}/2^{ary} eclipse.
(Targets: quiet stars; activity; crowded fields)



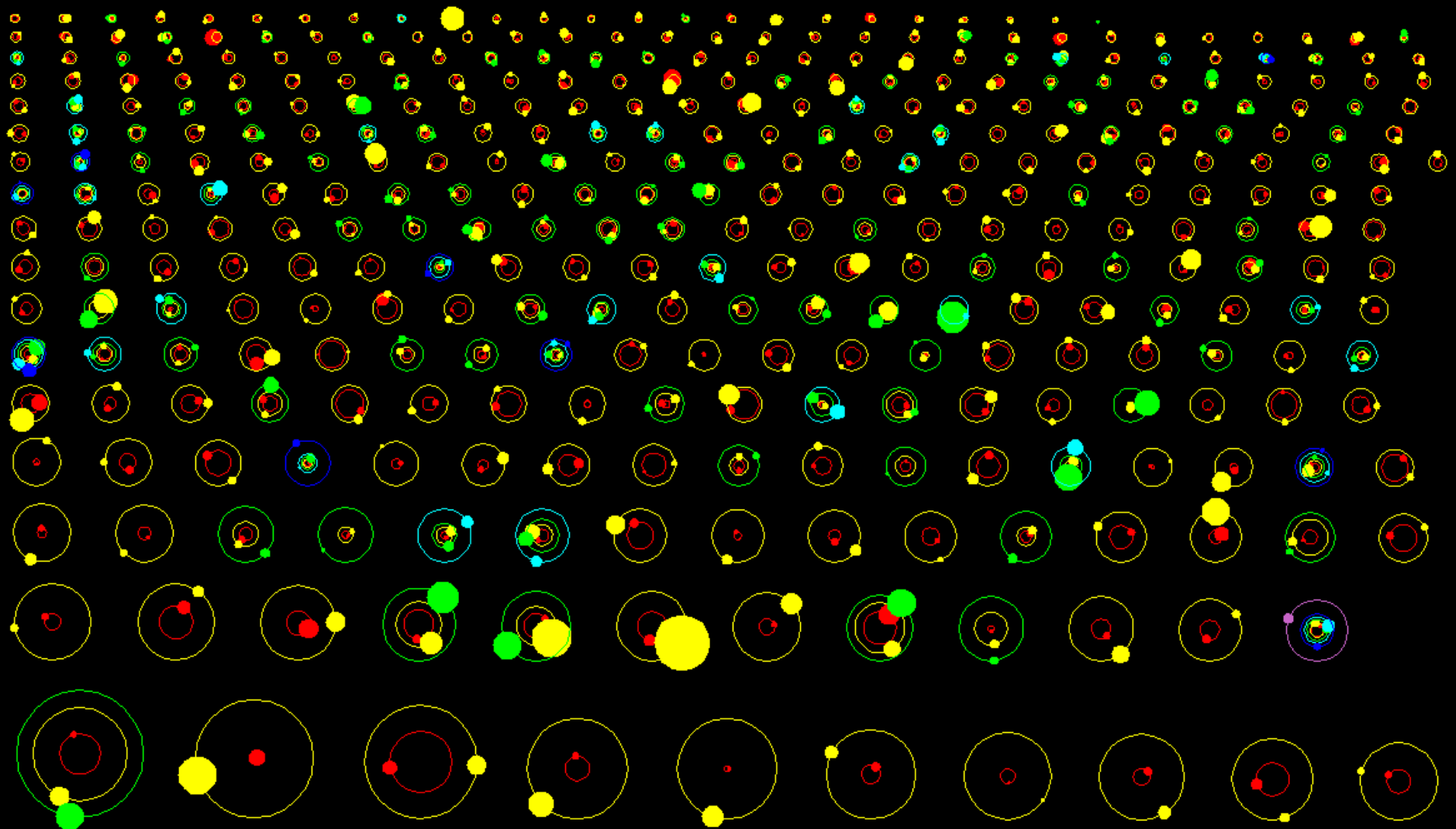
- . Orbital and Physical properties:
 - > R_*/R_p , M_p , P , a , i , T_o
 - > **Planetary Interiors**
 - > Multiple: Architecture and Stability

- > Circumbinary planets
Leger et al. 09; Doyle et al. 11; Balatha et al. 12

The Kepler Orrery II

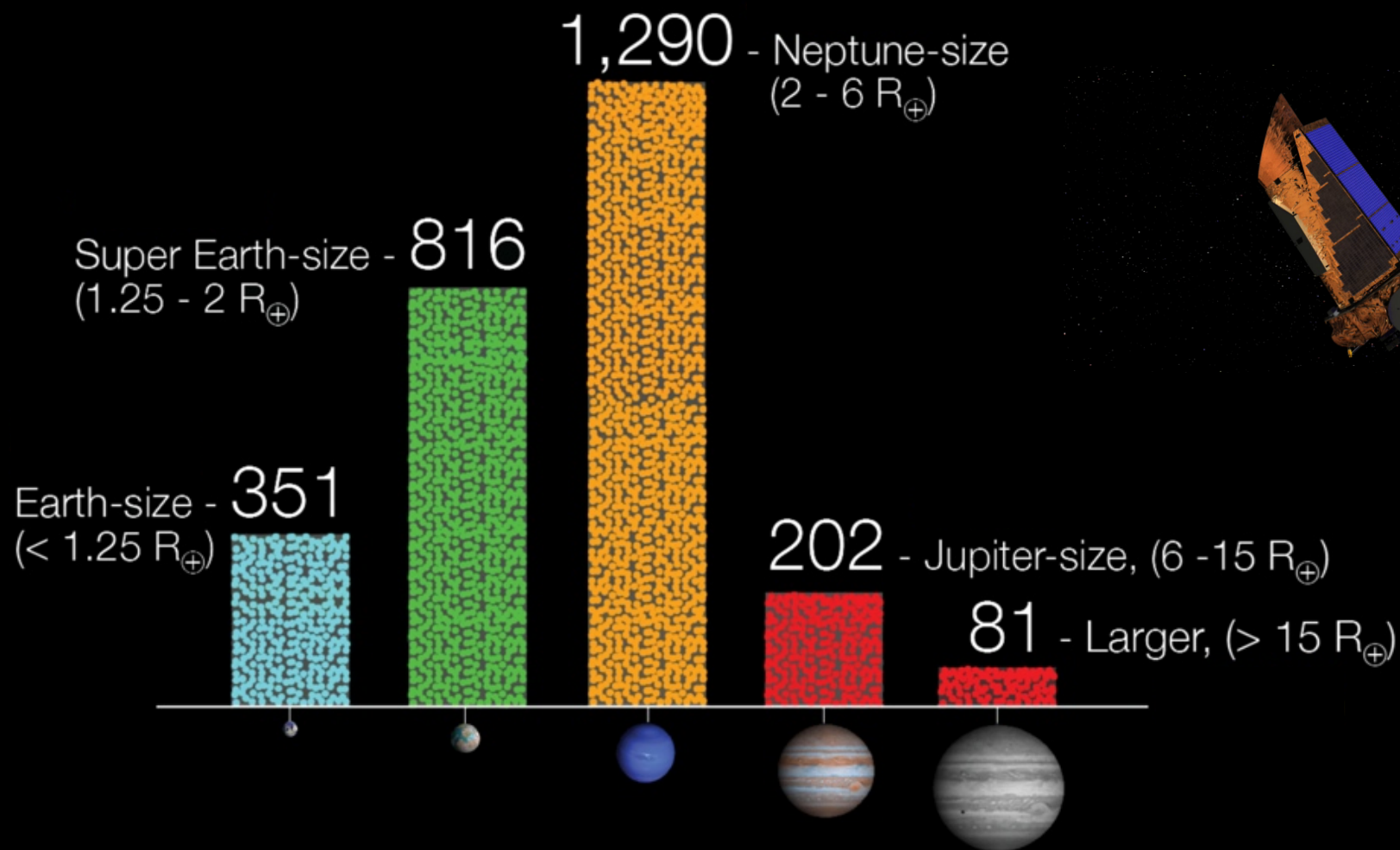
t[BJD] = 2454965

D. Fabrycky 2012



Sizes of Planet Candidates

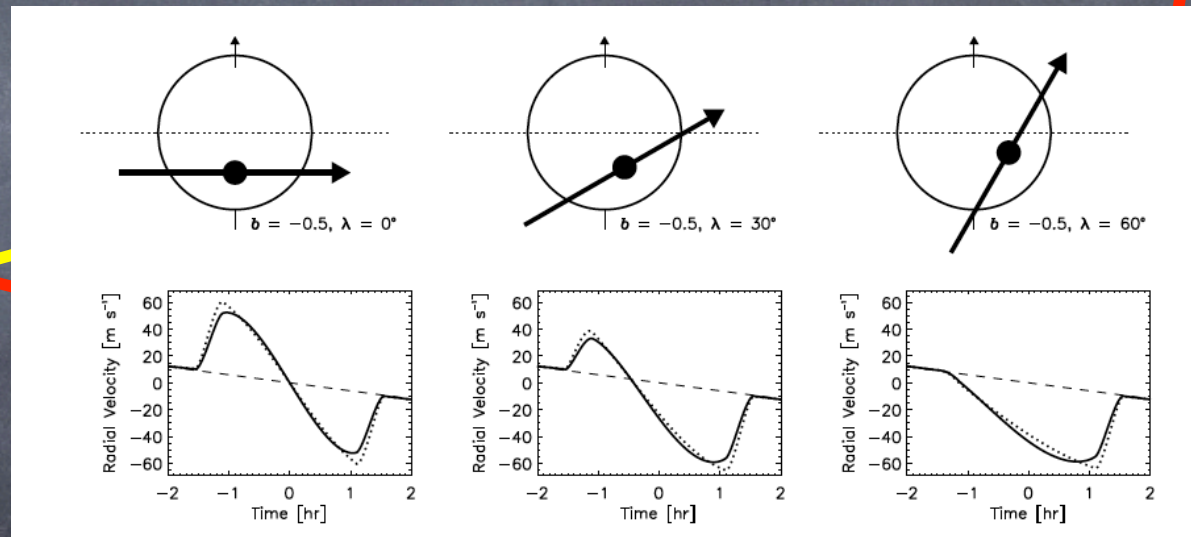
As of January 7, 2013



New Planet Characterization

Radial velocities:

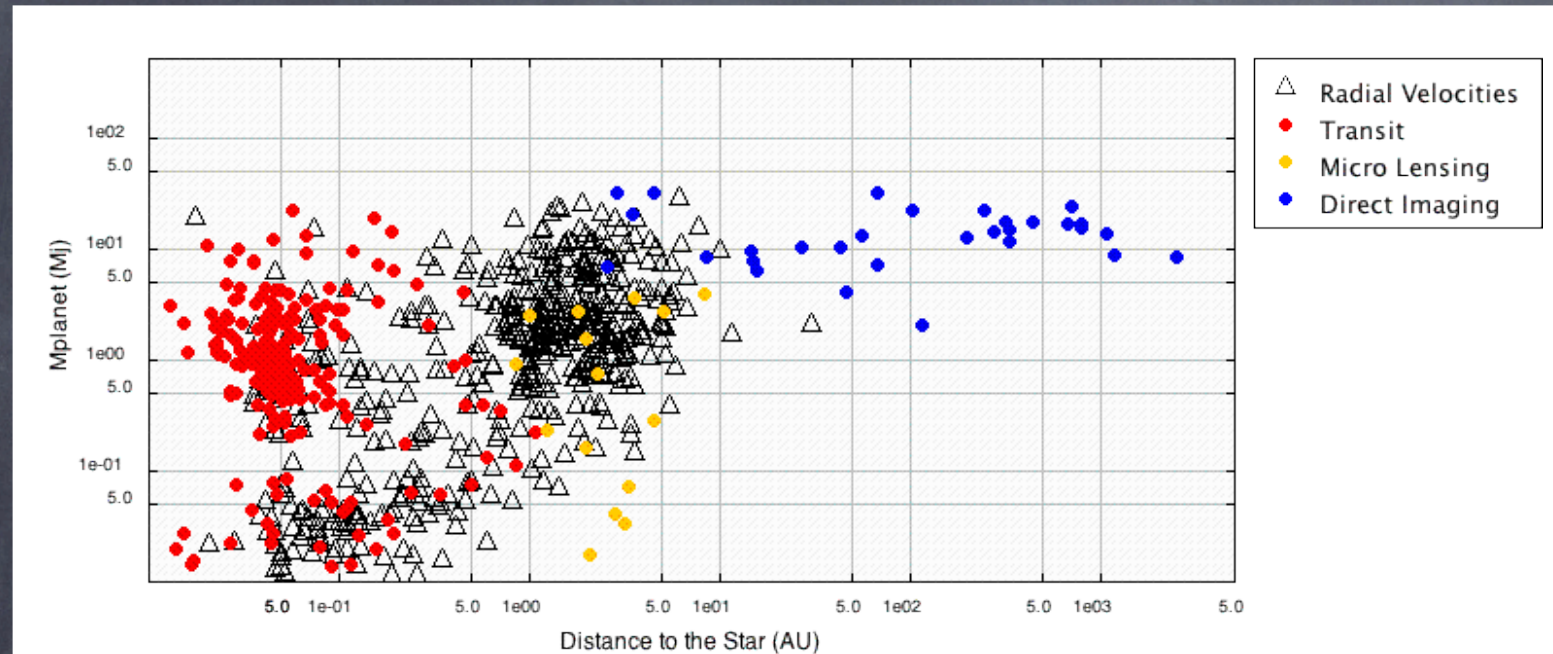
Orbital and Physical properties: $M_p \sin(i)$, P , e , a , ω , T_0



Transits:

Orbital and Physical properties: R_*/R_p , M_p , P , a , i , T_0

Direct Imaging: Direct technique: Planet's photons (Targets: young and nearby stars)



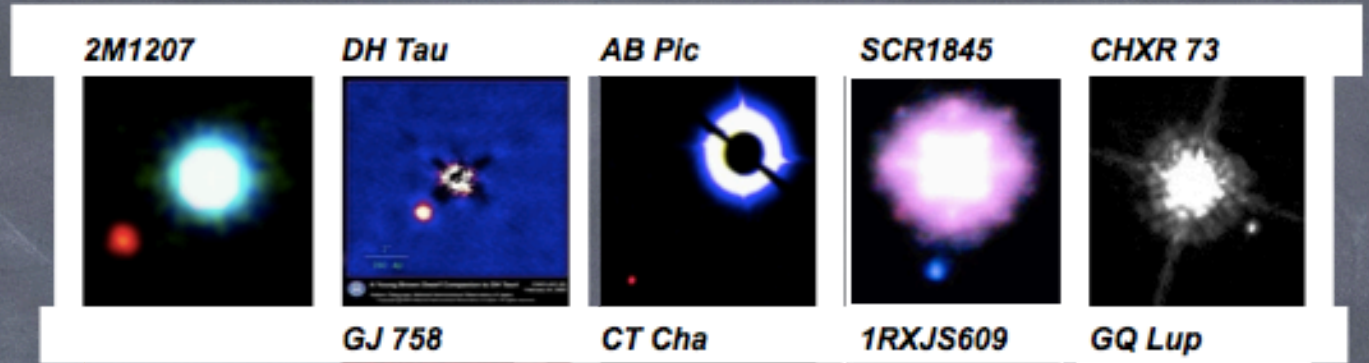
. Orbital And Physical properties:

- > L, a, e, i, ω, T_0
- > Giant planets at **wide orbits** (>10 AU)
- > Multiple: Architecture and Stability
- > Planet - disk connection

Chauvin et al. 05, 10; Lafrenière et al. 07

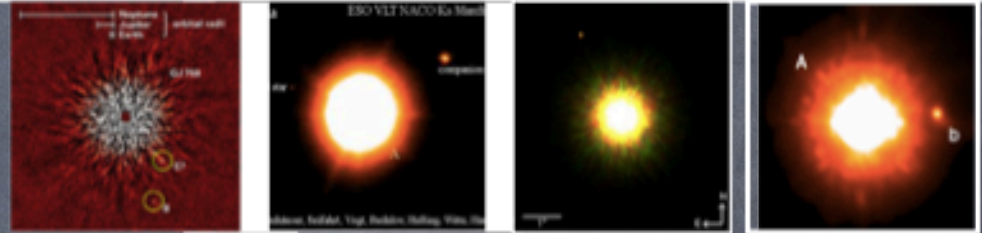
Soummer et al. 11; Vigan et al. 12

Family's Portrait



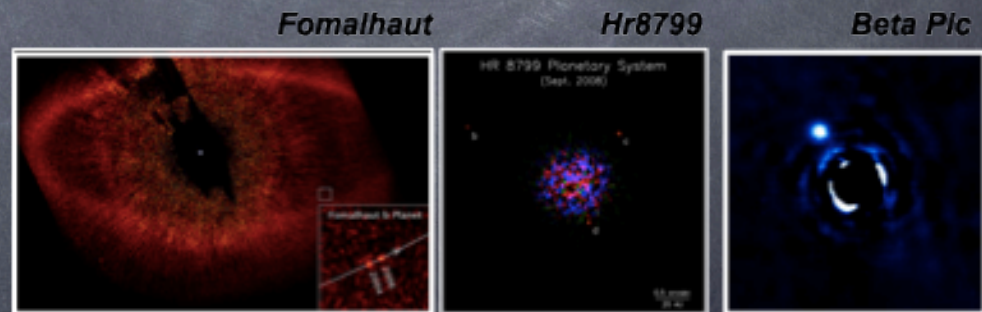
Wide orbit PMCs:

- Low mass KM stars
- $q = 0.02 - 0.2$ or $\Delta > 200$ AU



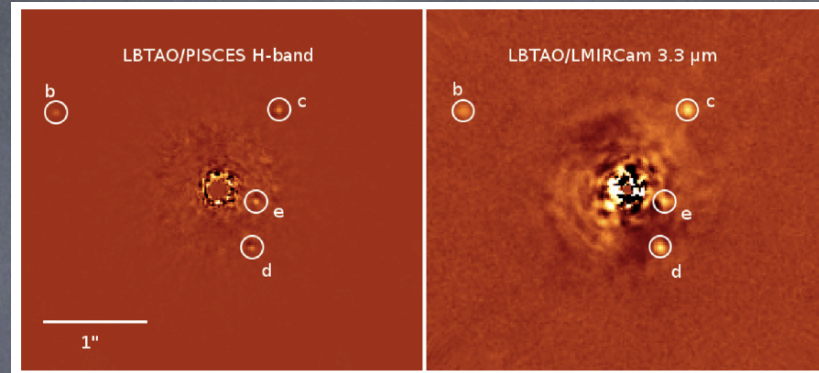
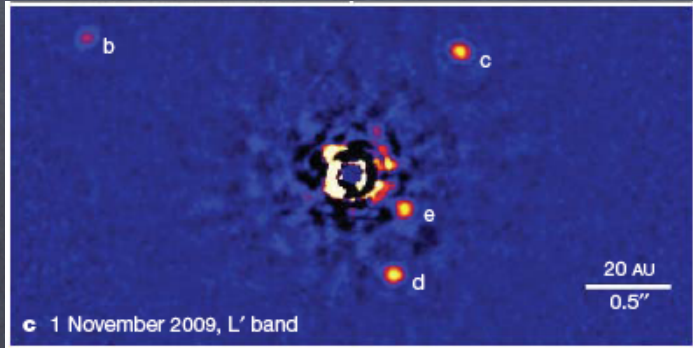
Closer PMCs:

- A4V-A5V massive primaries
- $q < 0.005$; $\Delta = 8 - 120$ AU
- CS Disk signatures

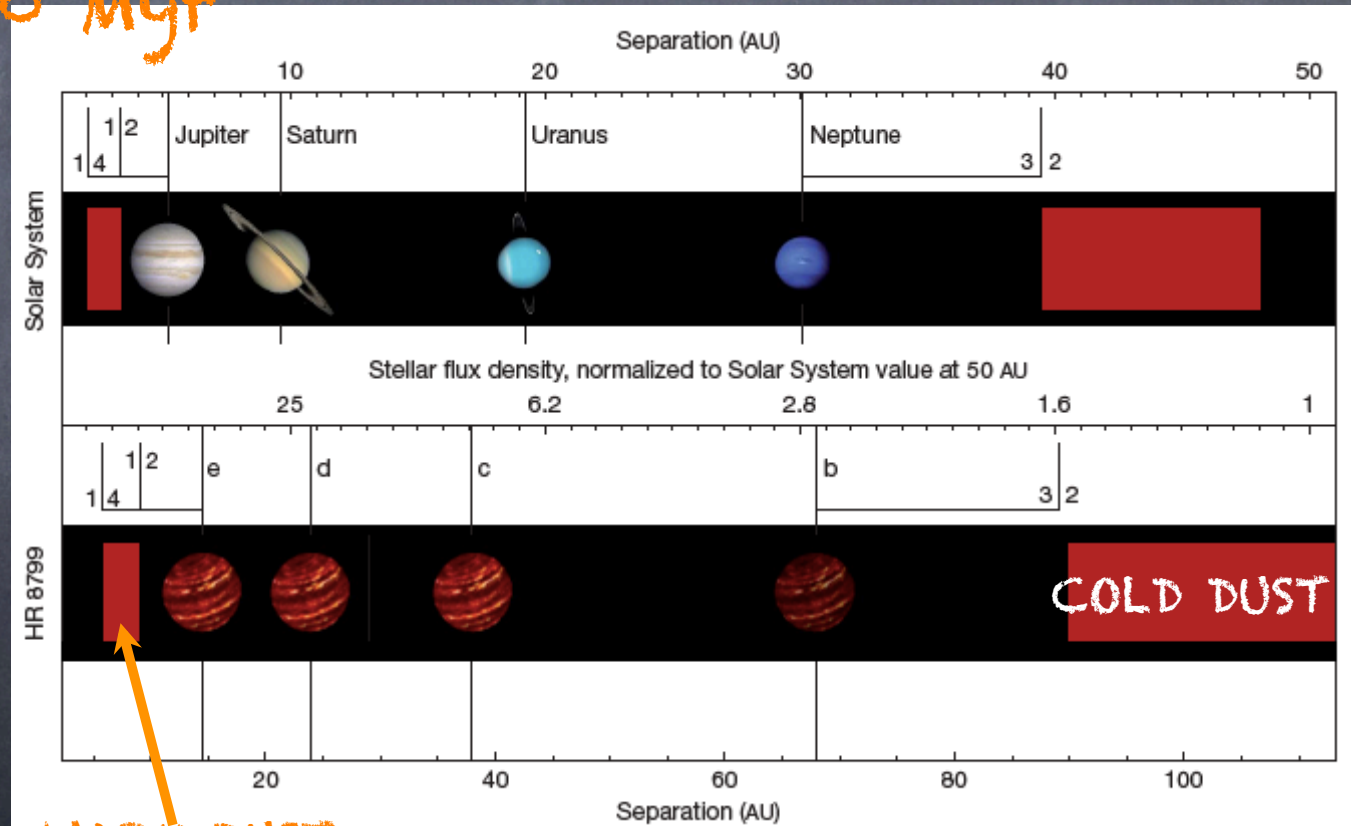


Ref: Chauvin et al. 04; Itoh et al. 05; Chauvin et al. 05; Biller et al. 05; Luhman et al. 06; Thalmann et al. 09; Lafrenière et al. 08; Neuhauser et al. 05; Schmidt et al. 09; Lagrange et al. 10; Kalas et al. 08; Marois et al. 08,10...

HR 8799 b, c, d, e



Age 30-60 Myr
 ASV
 $5 \leq M_p \leq 10 M_J$



WARM DUST

Color!

