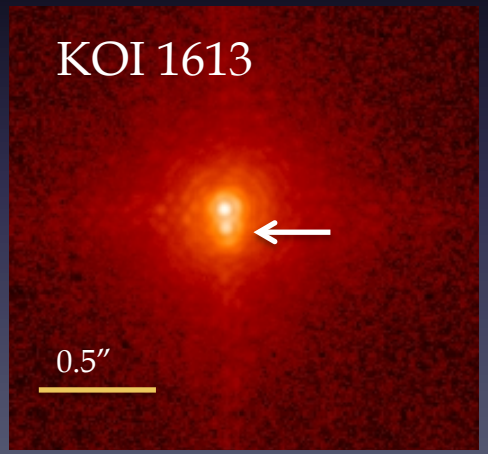
Close Companions to *Kepler* Objects of Interest

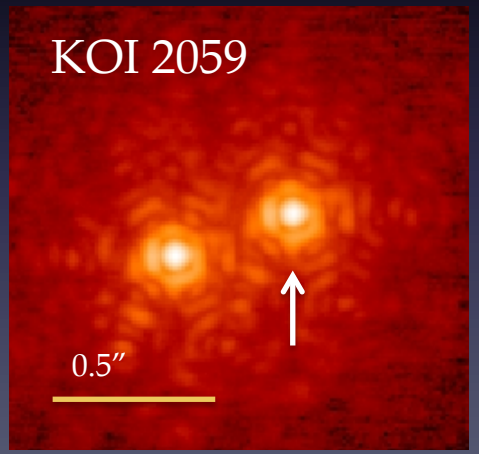


Lea Hirsch

UC Berkeley

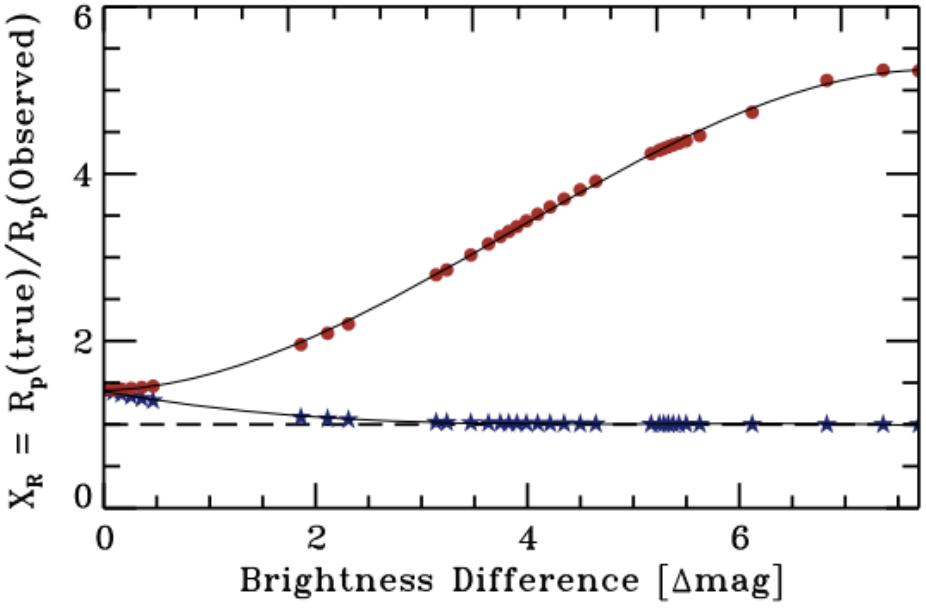
Kepler/K2 Conference

June 19, 2017



Effects of Close Companions

Primary is the Planet Host
Secondary is the Planet Host



$$X_R = \frac{R_p\ (true)}{R_p\ (single)} = \left(\frac{R_t}{R_1}\right)\sqrt{\frac{F_{total}}{F_t}}$$

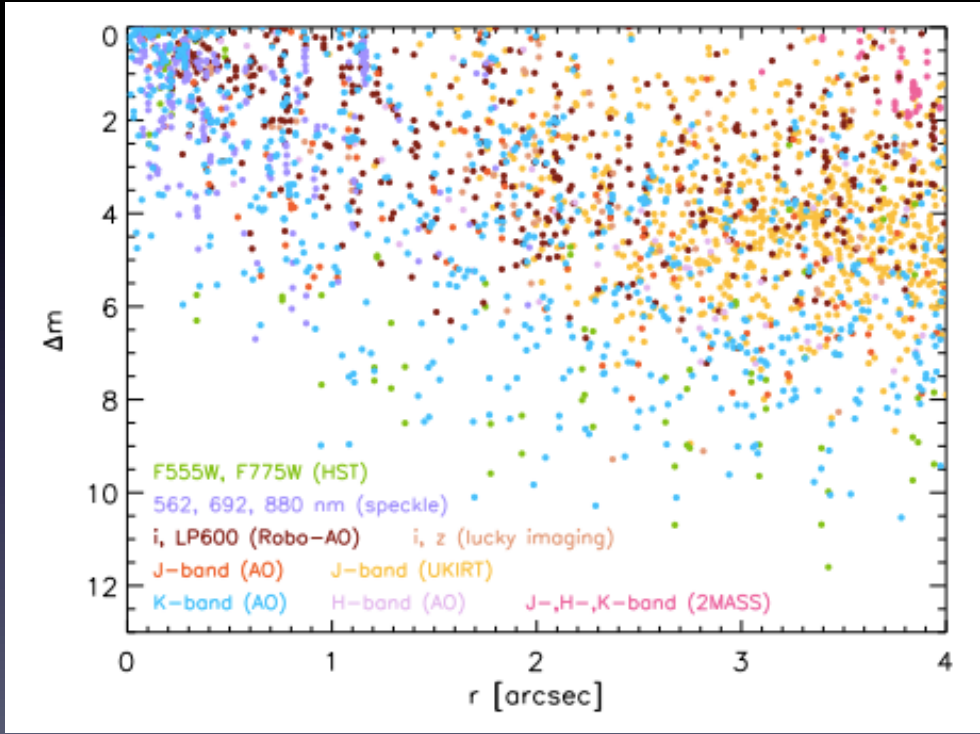
- Mass-radius Relation
- Rocky / non-rocky transition radius
- Occurrence rates vs. planet radius

Ciardi et al. 2015

High Resolution Imaging Follow-Up

Furlan et al. 2017:

Howell et al. (2011); Lillo-Box et al. (2012, 2014); Adams et al. (2012, 2013); Horch et al. (2012, 2014); Dressing et al. (2014); Law et al. (2014); Everett et al. (2015); Gilliland et al. (2015); Cartier et al. (2015); Wang et al. (2015a,b); Kraus et al. (2016); Baranec et al. (2016); Baranec et al. (2016); Ziegler et al. (2016); etc…



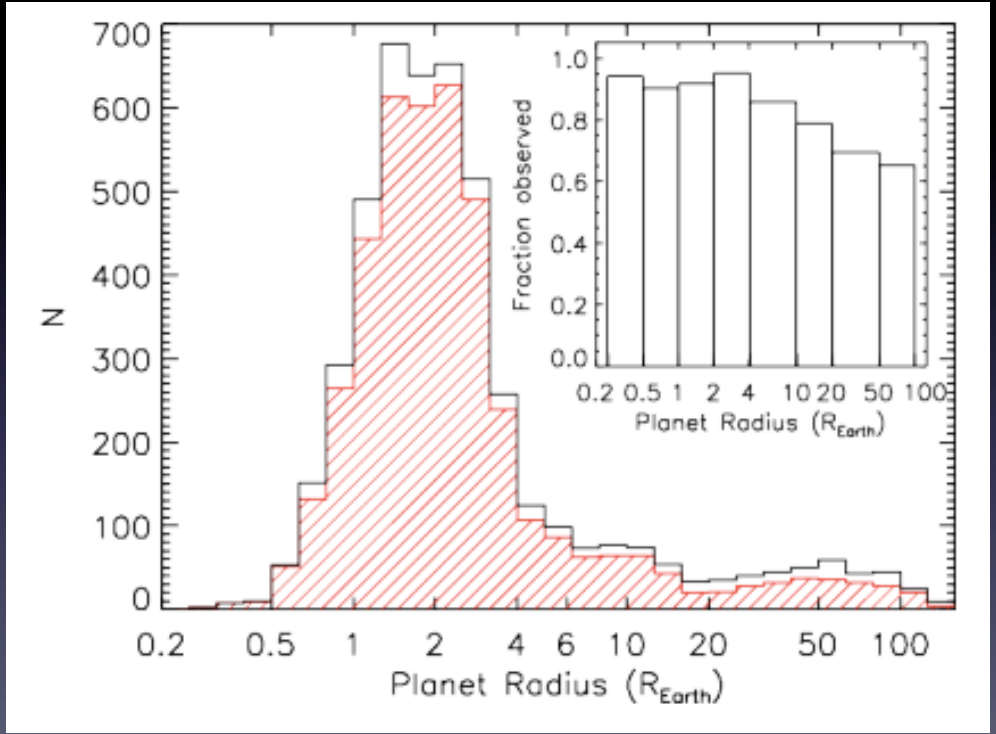
High Resolution Imaging Follow-Up

Furlan et al. 2017:

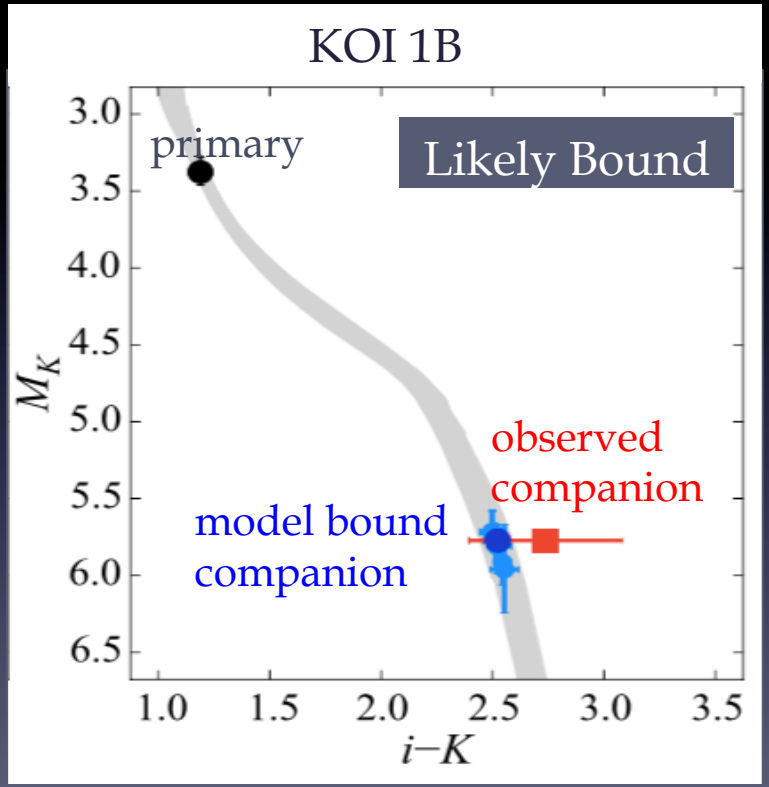
3183 host stars imaged

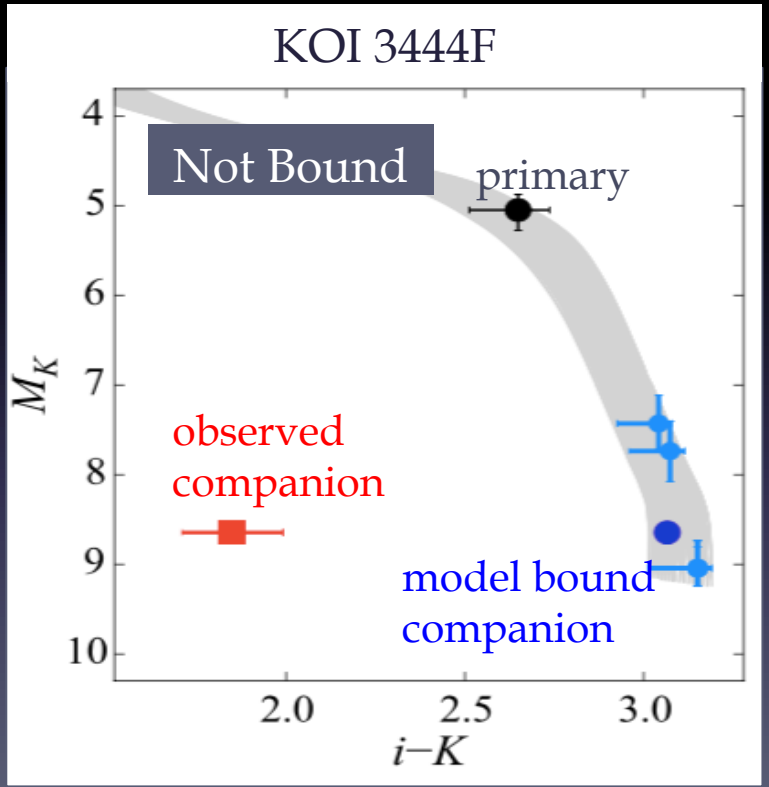
(83% host stars, 90% planets)

- 93% of planets with R < $4R_{Earth}$
- 76% of planets with R > $4R_{Earth}$



165 KOIs with companions within 2″ imaged in ≥ 2 filters (Hirsch et al. 2017)

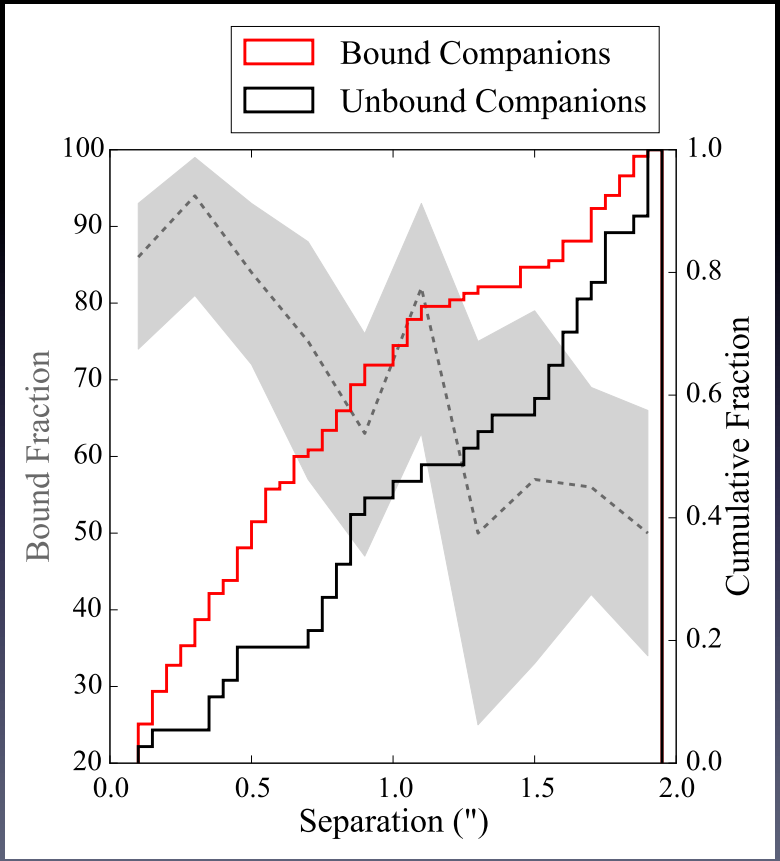


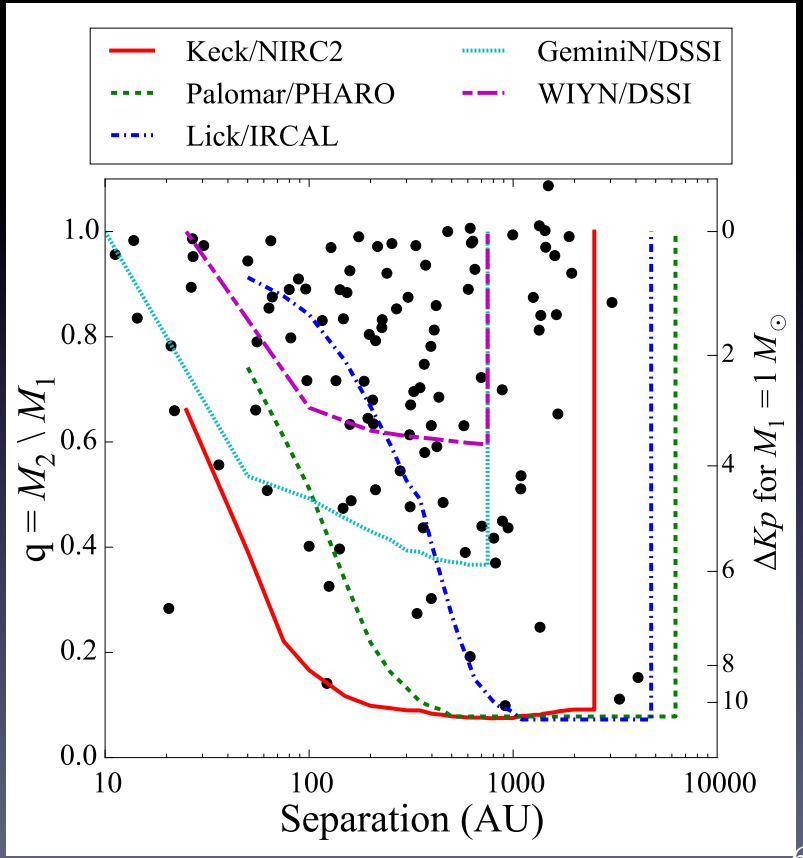


Hirsch et al. 2017

Hirsch et al. 2017

Bound Companion Properties



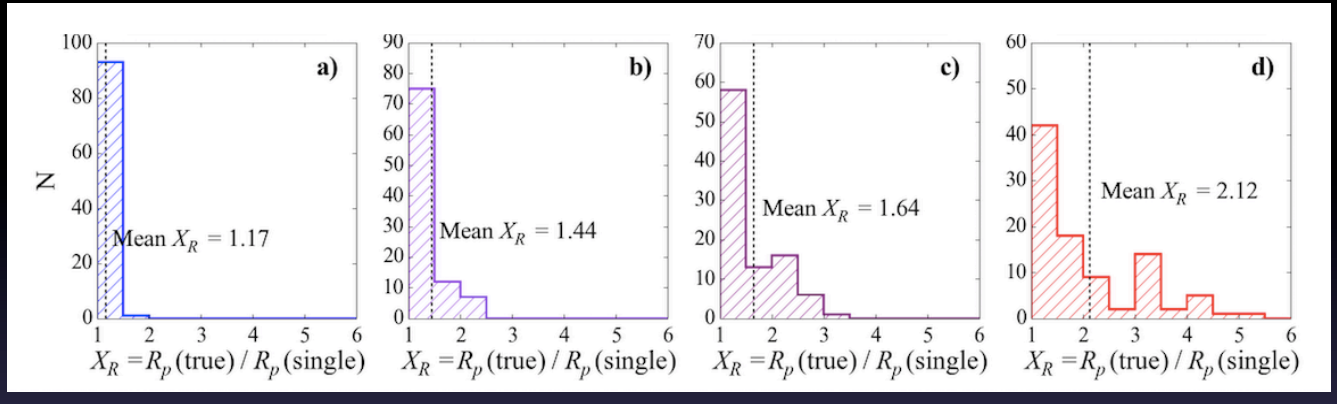


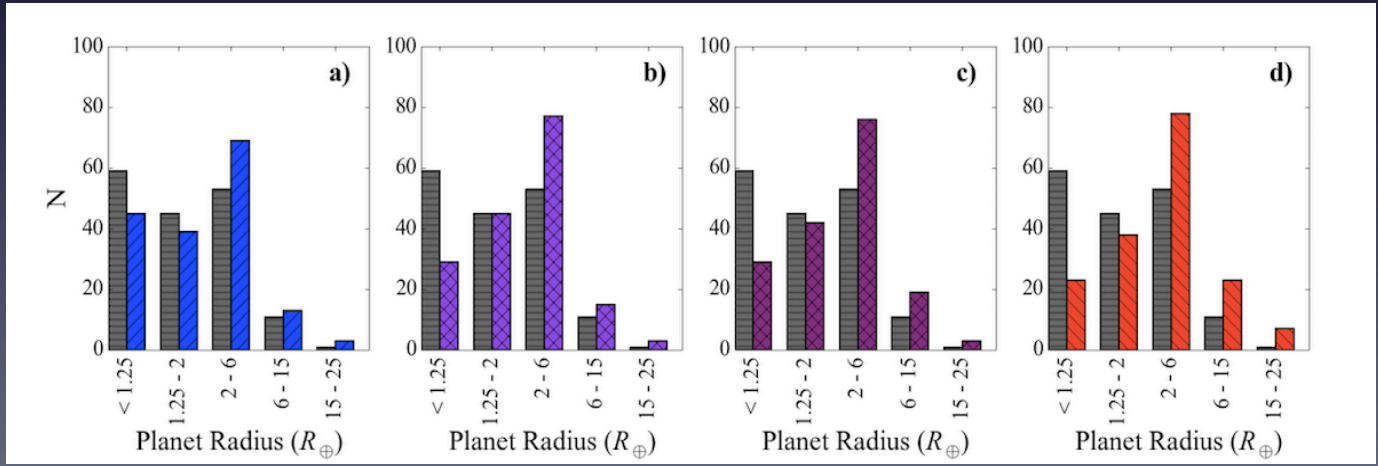
Hirsch et al. 2017

Results for Bound Systems

a) All planets orbit primary star

b) Planet host weighted by planet occurrence

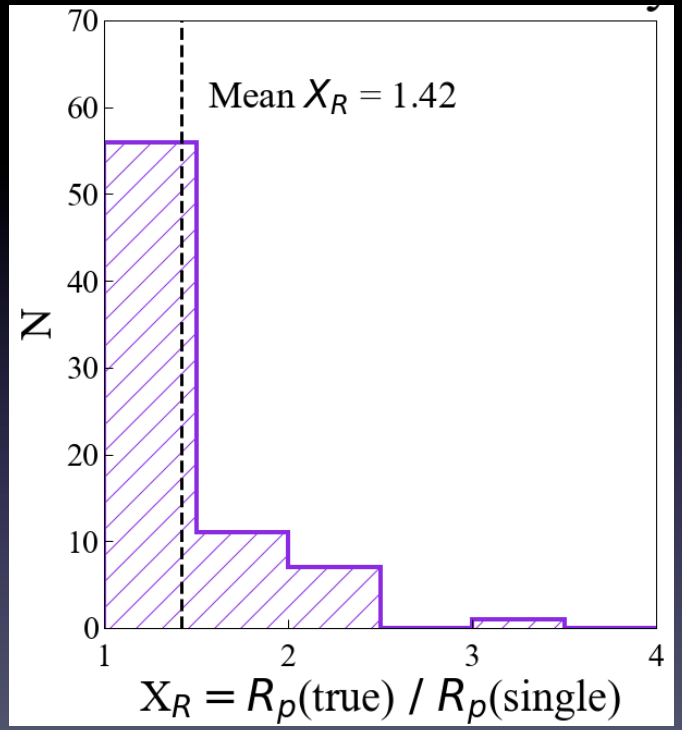




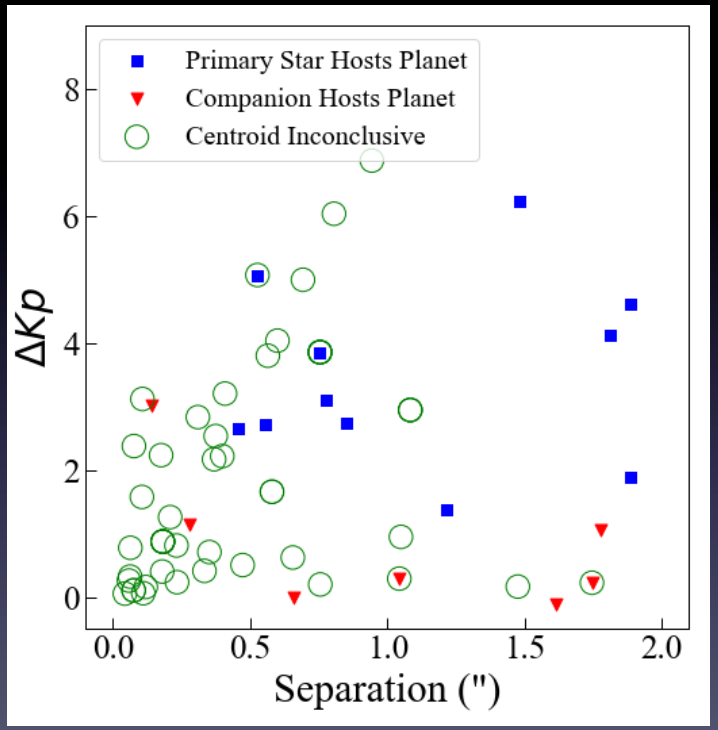
c) Planets equally likely to orbit primary or secondary

d) All planets orbit secondary star

Centroid Analysis



- 14 definitively around primary
- 7 around secondary
- 50 inconclusive



Centroid results from Bryson & Morton 2017: Astrophysical Positional Probabilities

Conclusions

- Accounting for stellar multiplicity is very important for transit surveys studying occurrence rates
- We need a better understanding of planet formation in binary systems, especially the relative likelihood of each star to host planets.