Bayesian analysis of the dynamical influence of companion stars in warm and hot Jupiter exoplanet systems

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1

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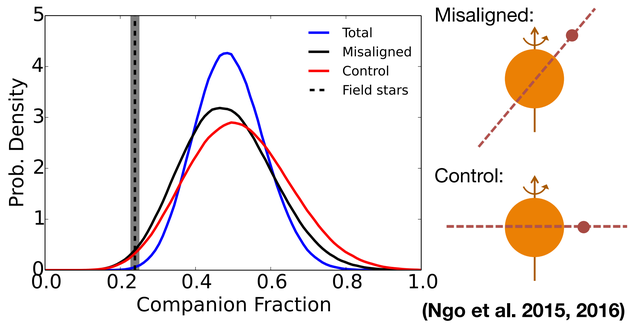
Our previous work ("Friends of hot Jupiters") found that companion stars do not influence migration of transiting hot Jupiters. But what about companion stars and RV-detected warm and hot Jupiters? #CASCA2018 (1/6)

23 May 2018



(Ngo et al. 2015, 2016)

2

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Here, we present an imaging survey of 144 stars hosting RV-detected warm & hot Jupiters with @keckobservatory/NIRC2 adaptive optics. We found 8 confirmed binary and 3 confirmed triple systems. #CASCA2018 (2/6)

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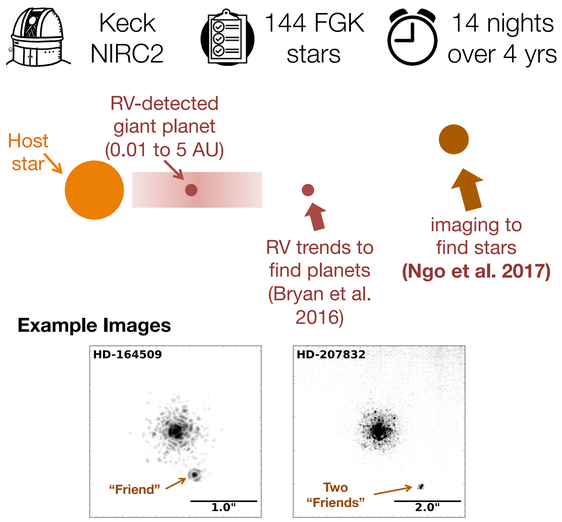

3

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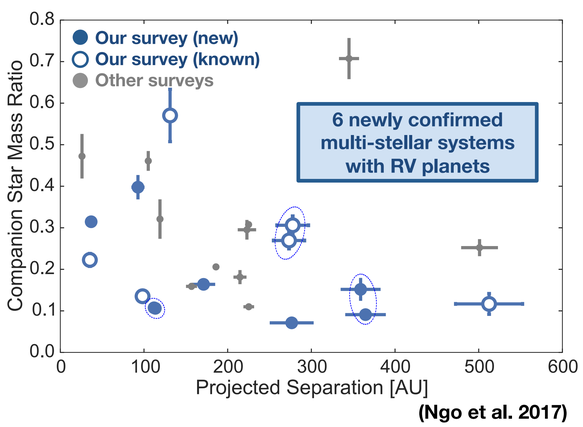
Due to RV planet surveys' bias against multiple stars, multi-stellar systems hosting RV-detected giant planets are rare. Our work identifies 6 new systems, bringing the total number of known systems with companions within 6" to 22. #CASCA2018 (3/6)

23 May 2018



(Ngo et al. 2017)

4

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Survey biases prevent a fair companion fraction comparison, so we look at distribution of the giant planet's mass, semimajor axis and eccentricity instead. Compare planets in single and multi-stellar systems, including multiple systems from literature. #CASCA2018 (4/6)

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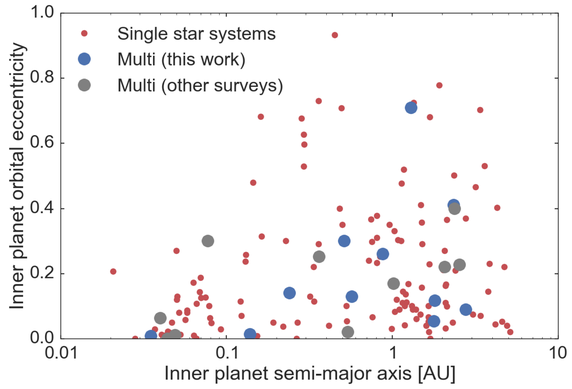

5

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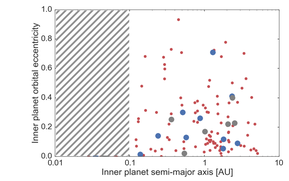
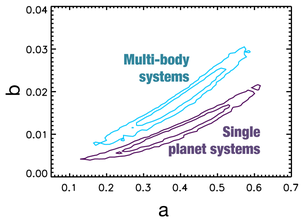
Excluding a<0.1 planets to avoid tidal circularization effects, a Bayesian odds ratio analysis finds no evidence for dynamical influence of companion stars. However, our group did find evidence for outer planets raising inner planet eccentricities (Bryan+ 2016) #CASCA2018 (5/6)

23 May 2018



Companion stars (Ngo et al. 2017):
No evidence for two populations

$$\frac{\text{prob(1pop)}}{\text{prob(2pop)}} = \frac{\exp \hat{\mathcal{L}}_1}{\exp \hat{\mathcal{L}}_2} \frac{\prod_x 2\pi\delta\theta_x/\Delta\theta_x}{\prod_y 2\pi\delta\theta_y/\Delta\theta_y} \sim 80$$



Companion planets (Bryan et al. 2016):
In multi-body systems, inner planet's eccentricity is excited (larger a, b)

$$P_\beta(e;\, a,\, b) = \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} e^{a-1}(1-e)^{b-1}$$

Eccentricity distribution from Kipping (2013)

6

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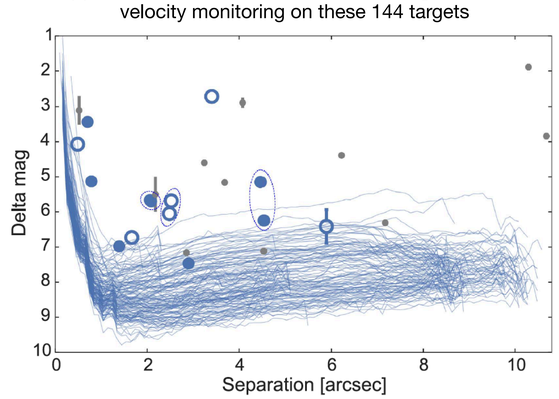
Bonus science: 1. We publish full contrast curves for all 144 stars, which will provide upper limits on any future RV search for companions in these systems; 2. Stellar orbit fits for all triple star systems in this work and "Friends" using OFTI (Blunt+ 2017) #CASCA2018 (6/6)

23 May 2018

Use our published detailed contrast curves to determine upper limits on future detections from long term radial velocity monitoring on these 144 targets



References

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