Dynamical **instabilities** sculpt **missing exoplanet pairs** at **close separations**

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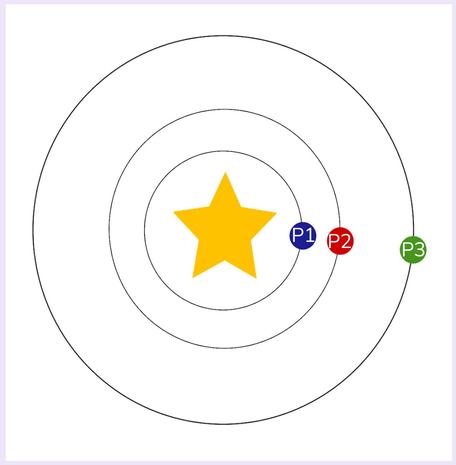
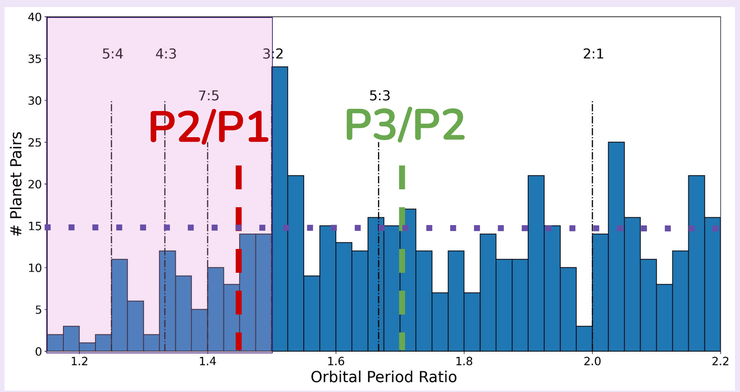
Exoplanet Period Ratios



Period 1 = 7 days Period 2 = 10 days Period 3 = 17 days

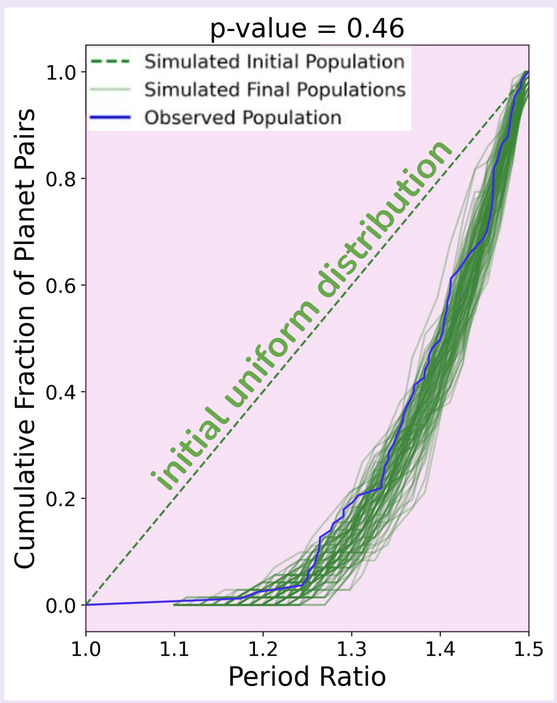
Period Ratio Distribution



Low period ratio ← → **High period ratio**

- Distribution is uniform at wide separations, as expected from chaotic giant impact phase (Tremaine 2015)

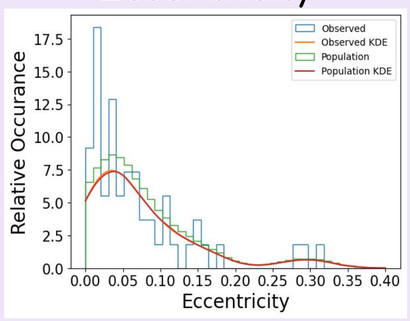
Was the distribution also uniform at close separations, and subsequently carved out by dynamical instabilities?



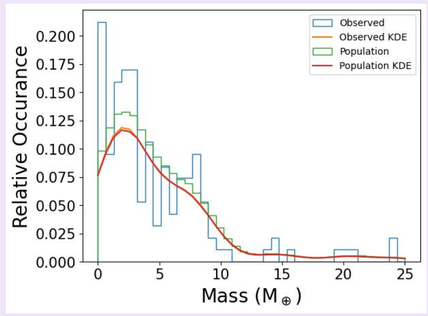
Dynamical instabilities can explain observed falloff at close separations (~50% chance drawn from the same distribution)

What factors affect stability?

Eccentricity



Mass



Separation Dispersion

Generating a Planetary Sample

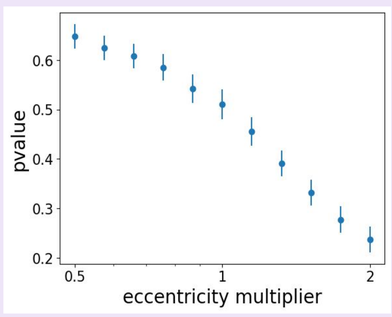
- Generated 3-planet system with inner period ratio drawn uniformly [1,1.5]
- Sampled from observed dispersion distribution to sample outer period
- Drew masses and eccentricities independently from observed distribution

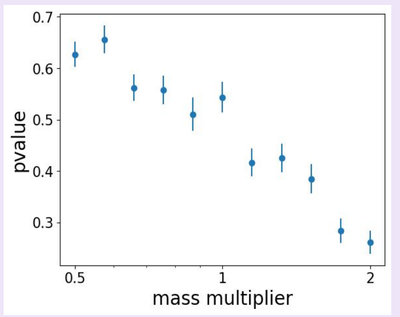
Filtering for Stability

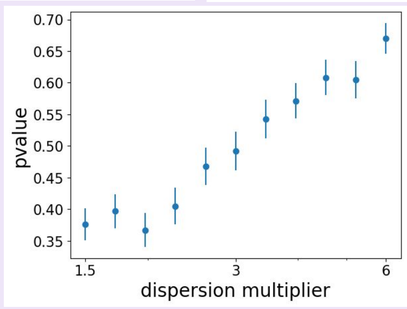
- Use the machine learning model Stability of Planetary Orbital Configurations Klassifier (SPOCK) (Tamayo et al., 2020)
  - ➢ How do we filter out unstable systems?

Robustness to Assumed Population Parameters

- Varied population parameters by factors of 1/2 - 2
- Results remain consistent with observations (~20-70% chance of being drawn from same distribution)







Citations
Tremaine, 2014, ApJ, 807, 157
Tamayo et al., 2020, PNAS, 117, 18194-18205
Kang et al., in prep