Exoplanet Population Demographics for Yield Modeling

Shannon Dulz

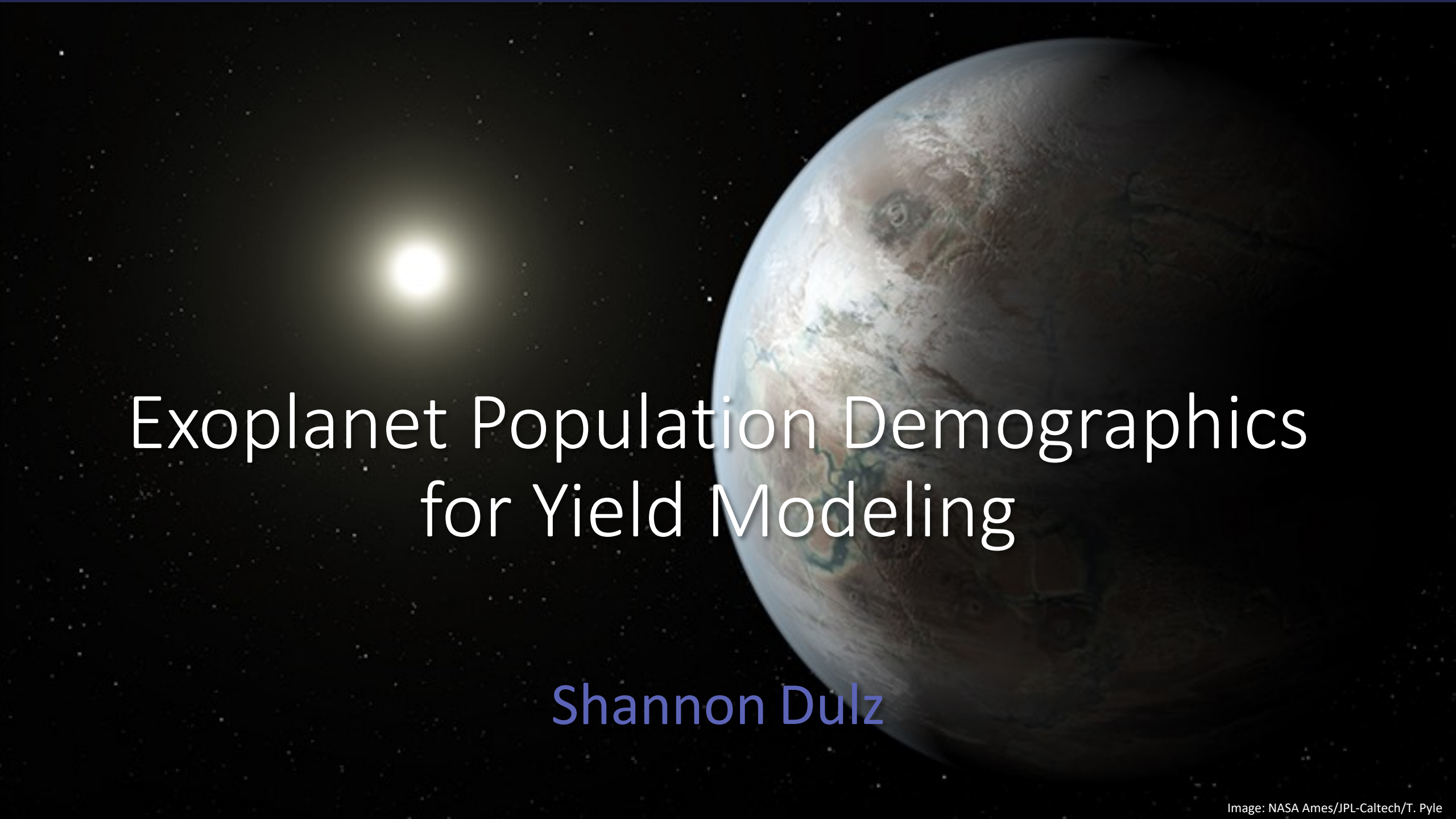
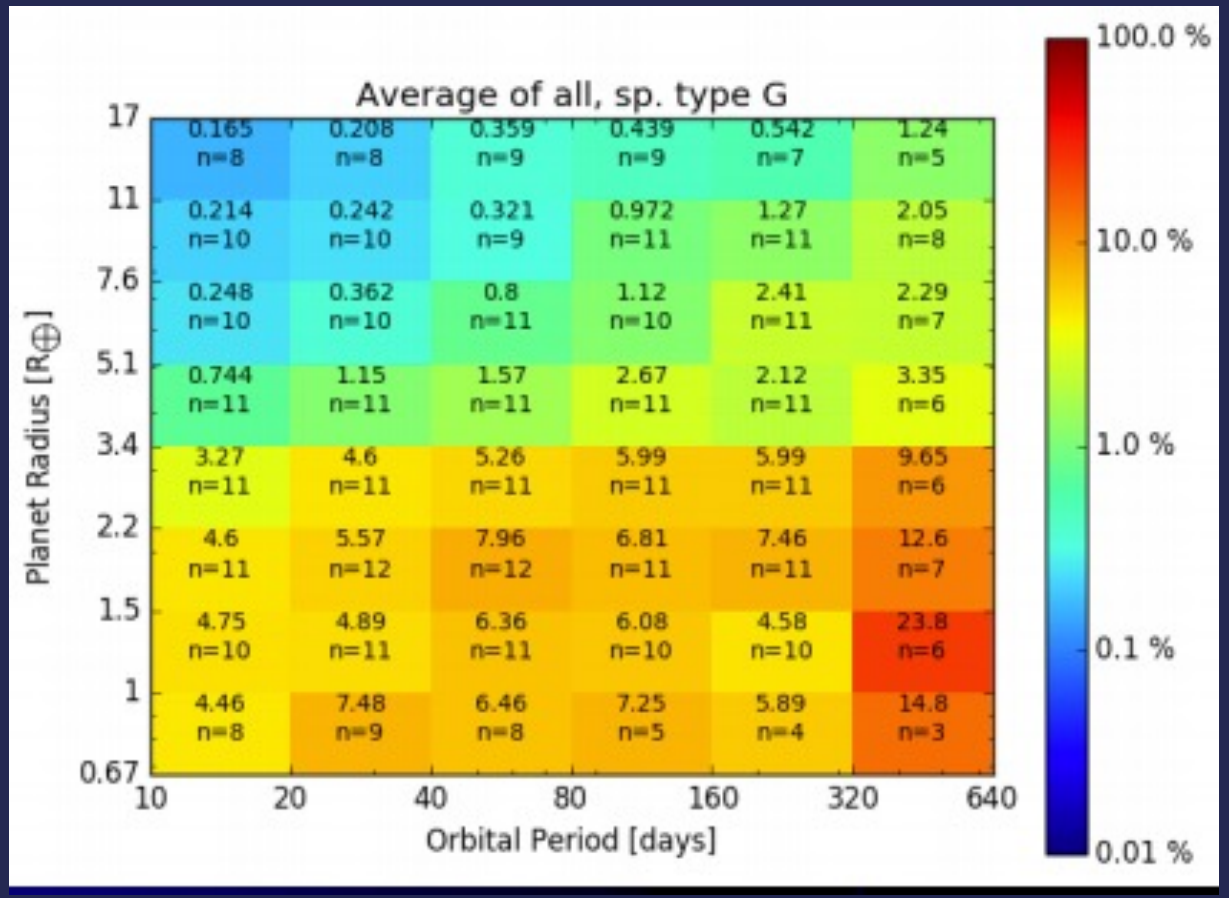
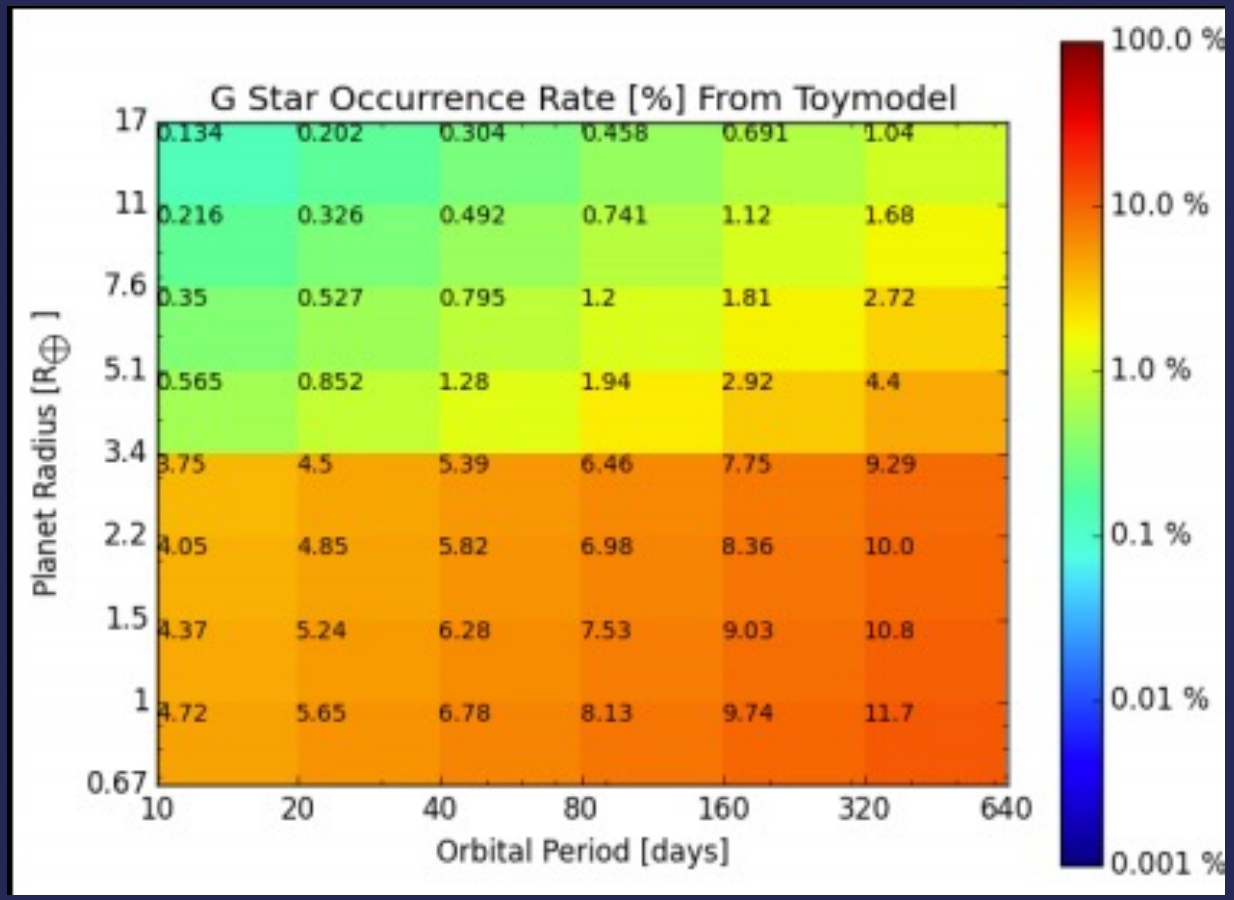


Image: NASA Ames/JPL-Caltech/T. Pyle

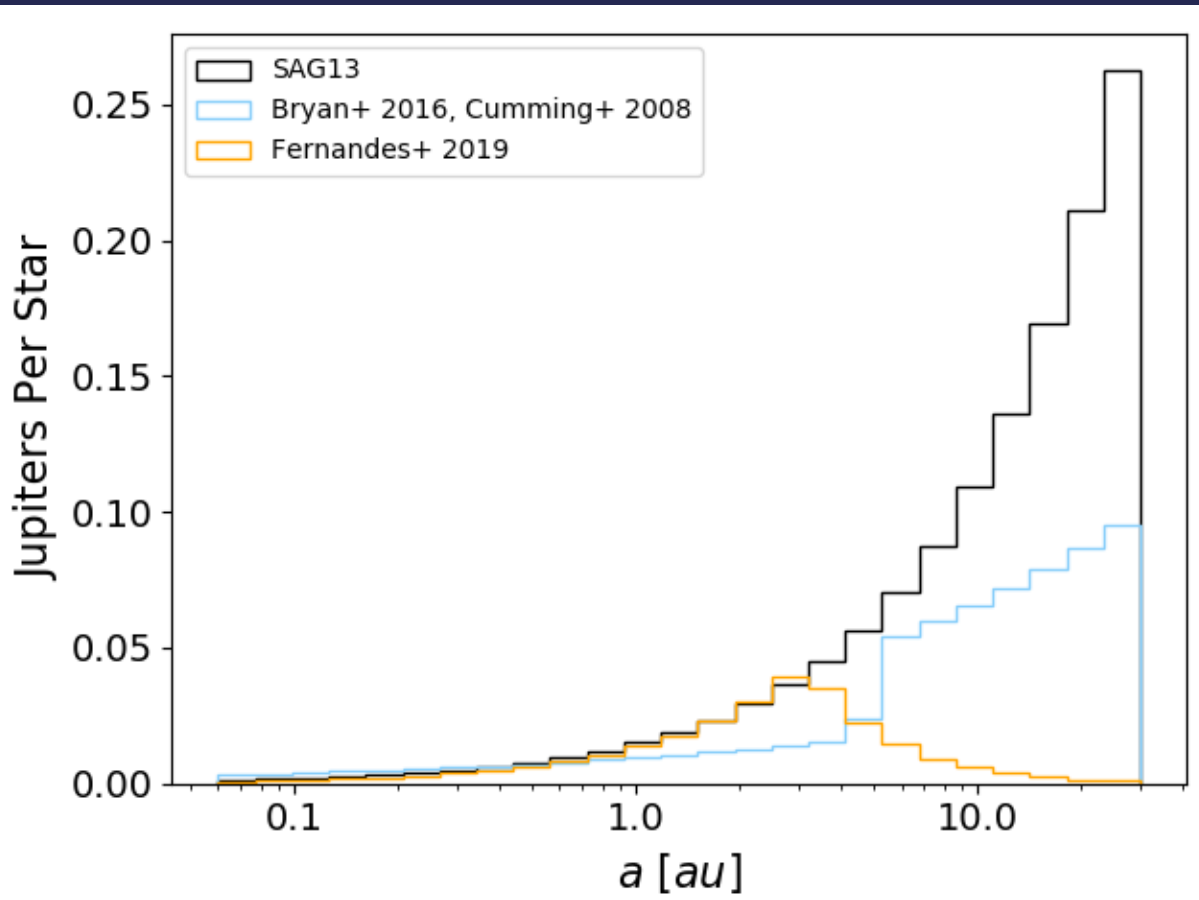
Known Demographics from Kepler

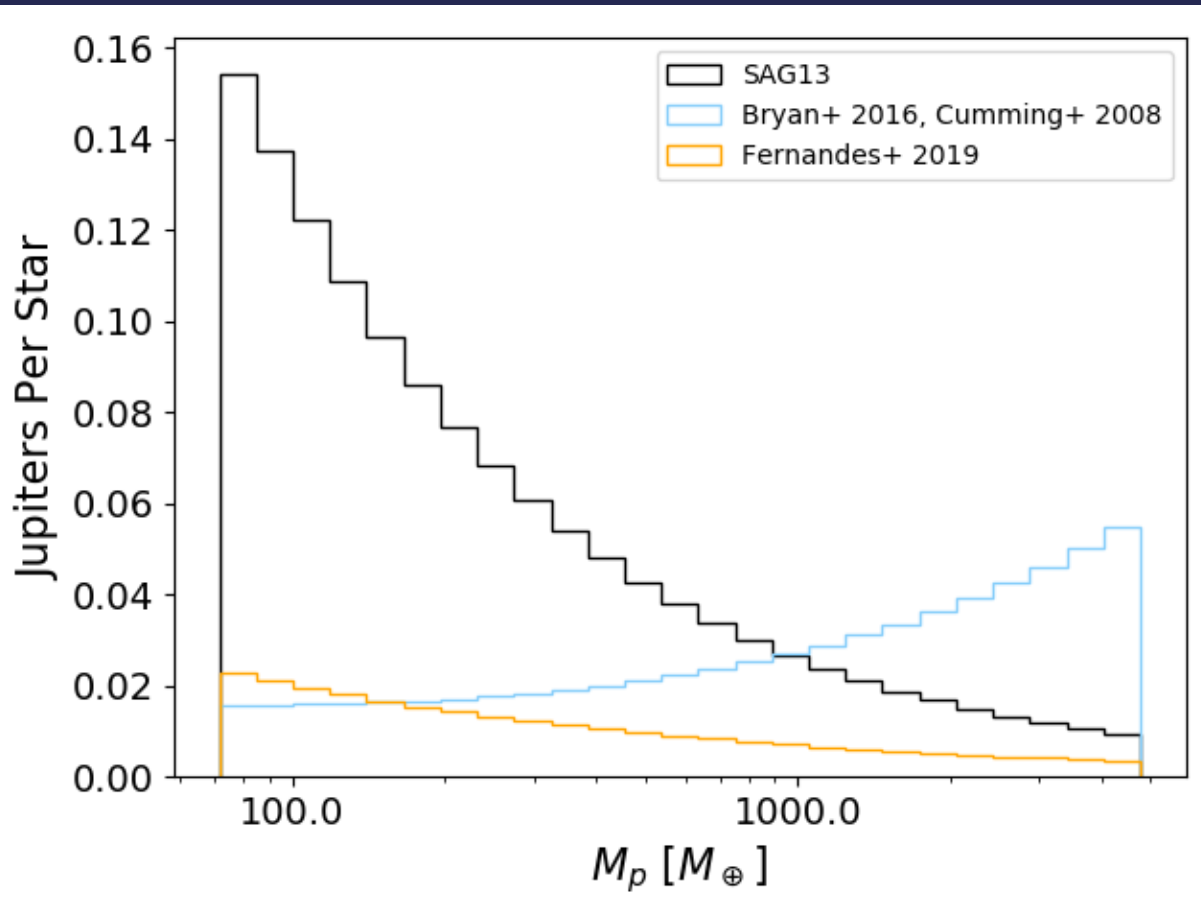




ExoPAG SAG13 Close-out Report
Belikov et al. 2017

RV Demographics of Jupiters





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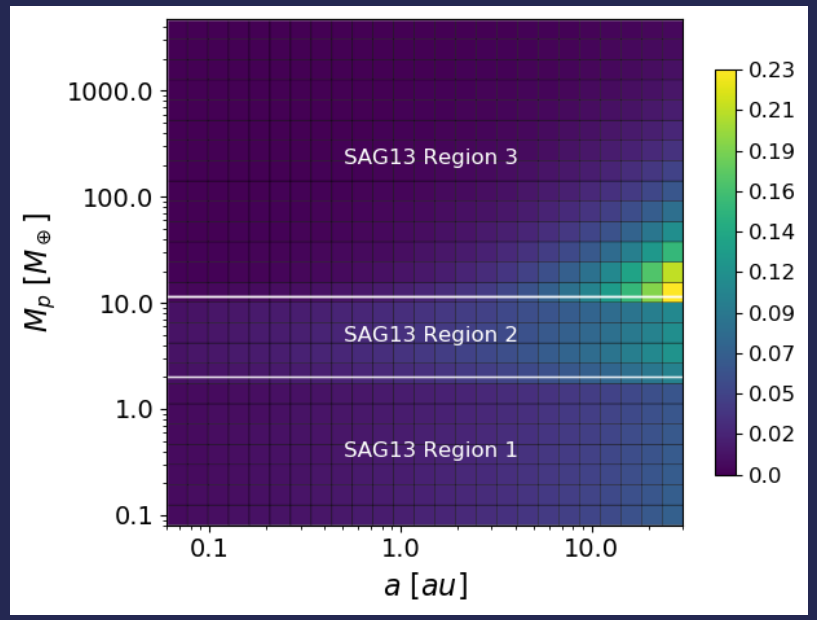
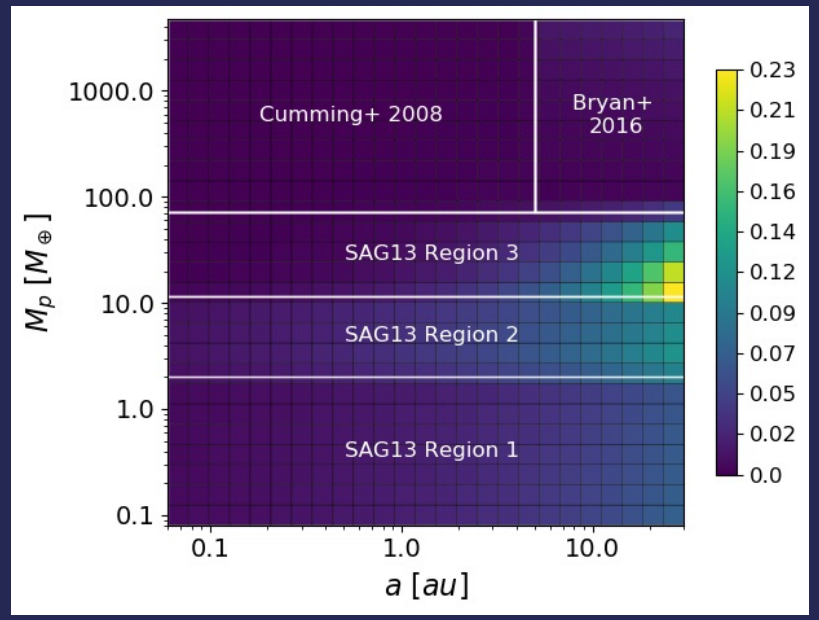
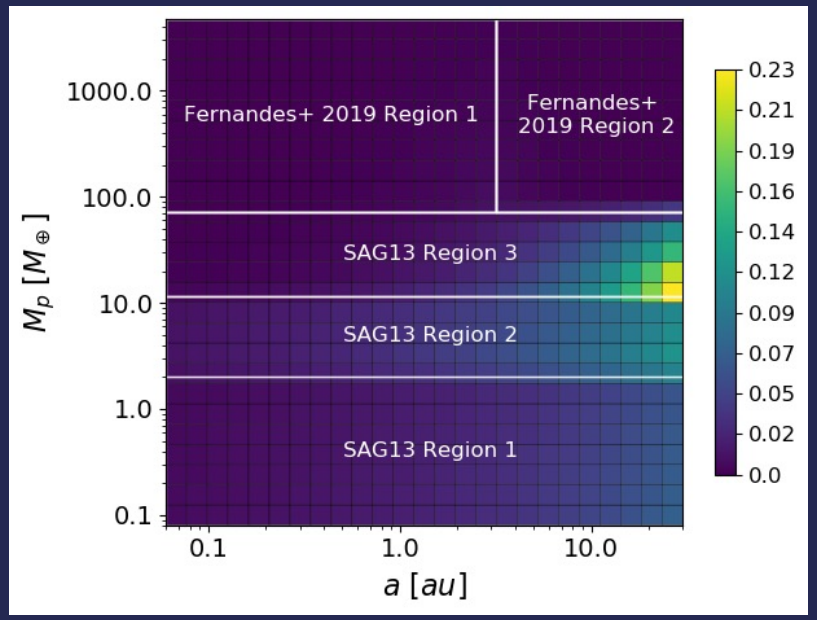
Input Demographics Sets







+ Optimistic and Pessimistic rates for each

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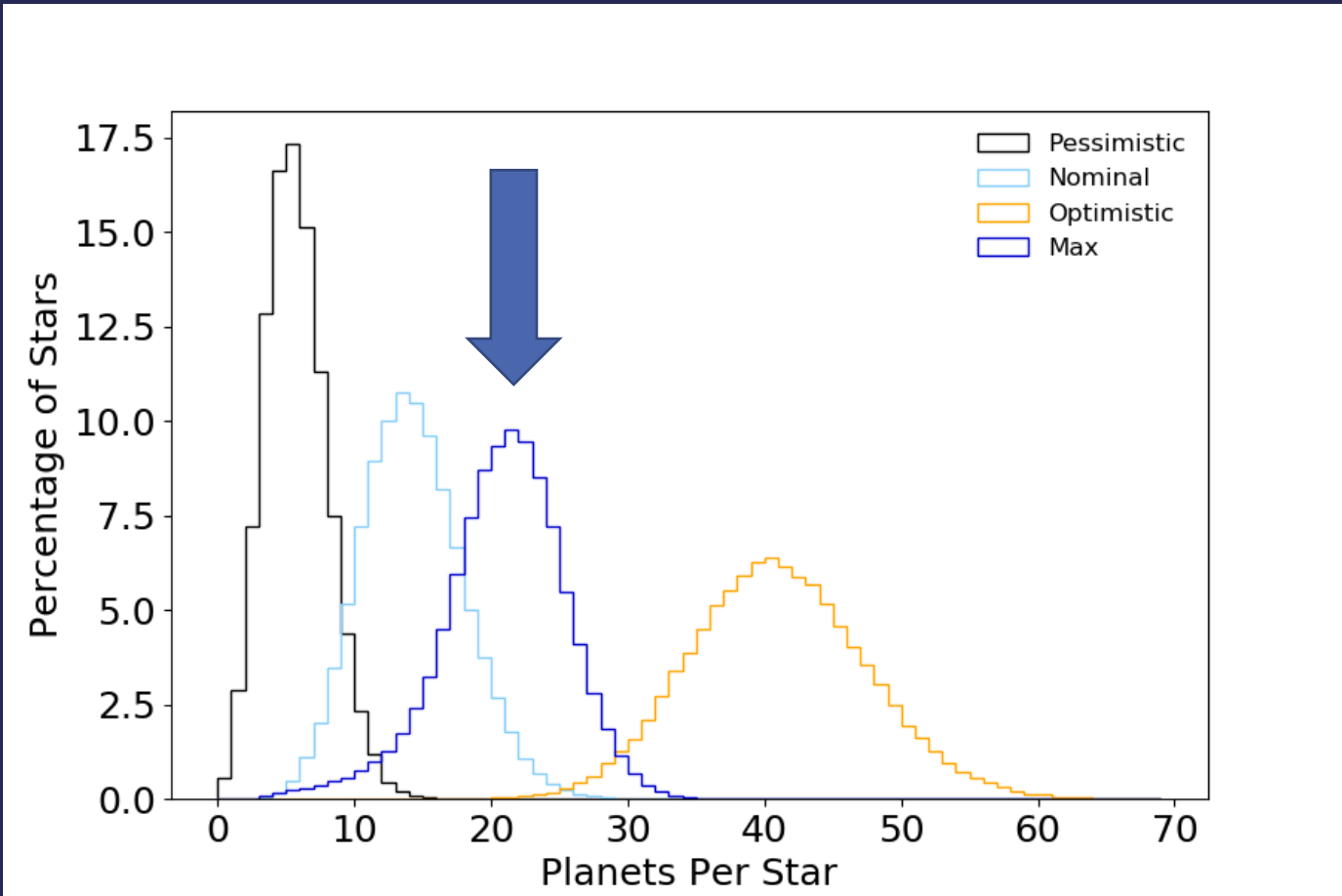
Problem: Unrealistic Number of Planets



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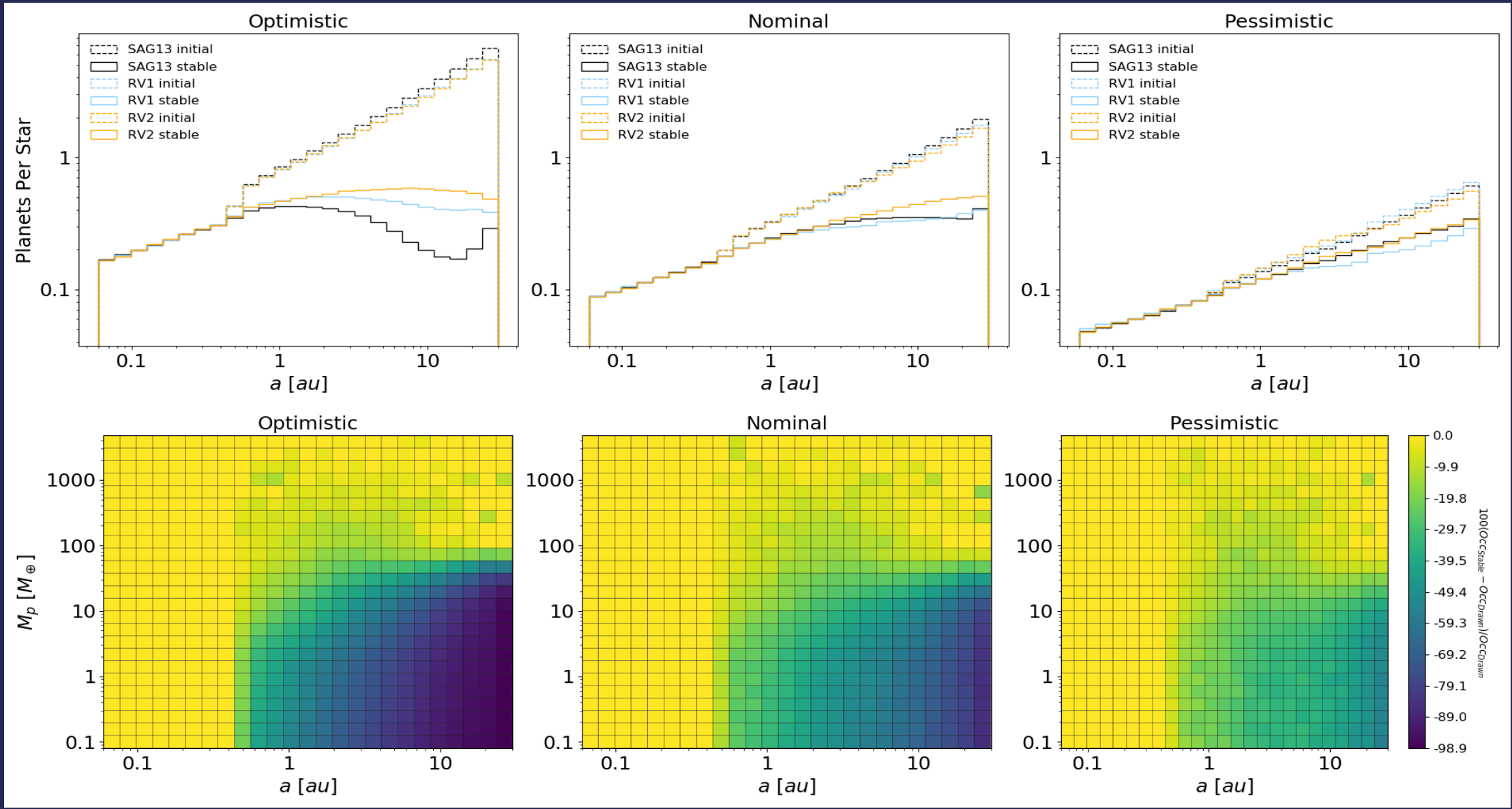
Solution: Require Stability

$$\Delta = 2\left(\frac{a_{outer} - a_{inner}}{a_{outer} + a_{inner}}\right)\left(\frac{3M_{Star}}{M_{p,outer} + M_{p,inner}}\right)^{1/3} > 9$$

Kane et al. 2016
Gladman 1993
Smith & Lissauer 2009

Stability Checks Remove Cold Earths



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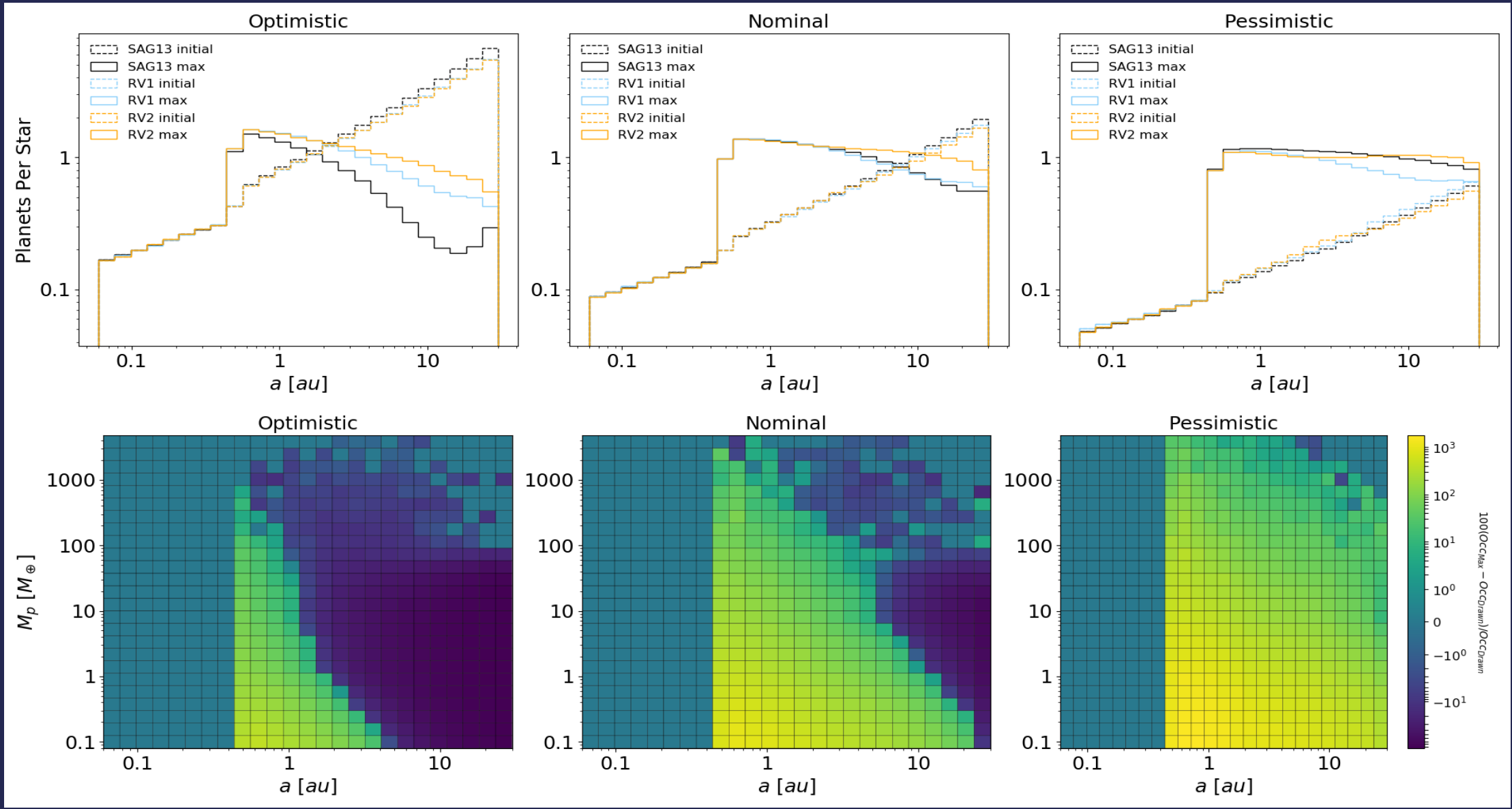
Maximally Packed Systems



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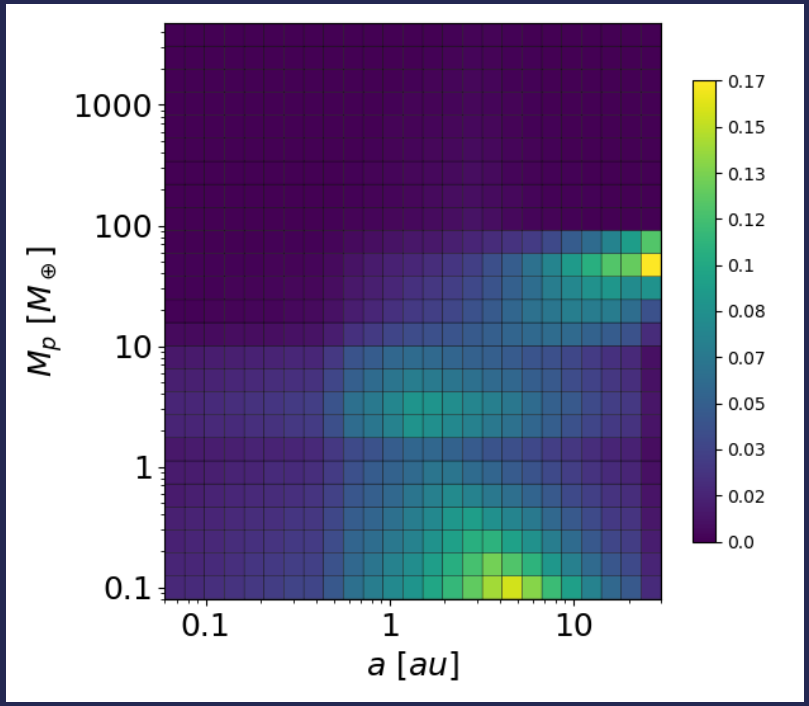
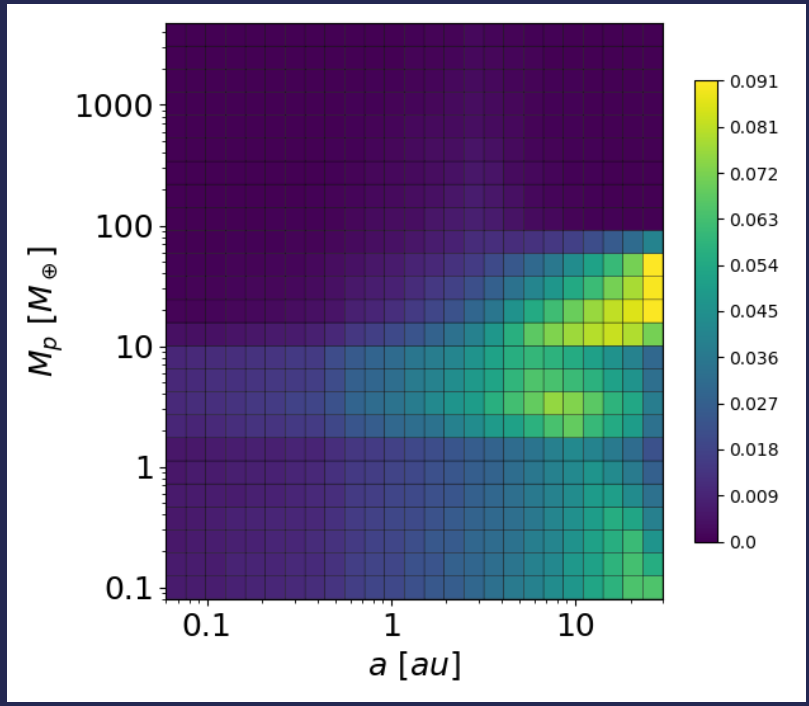
Upper Bound on Cold Occurrence Rates

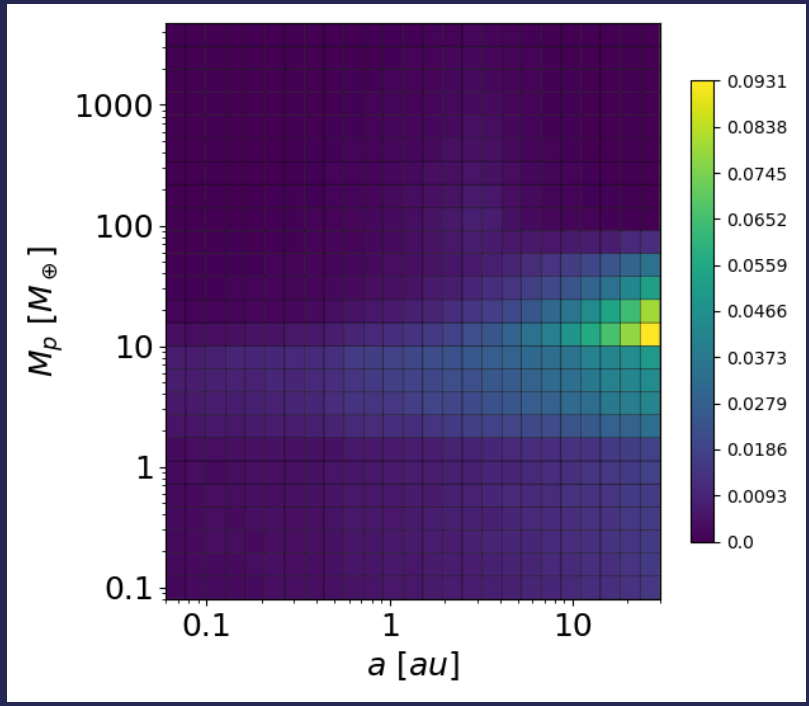
Optimistic



Nominal



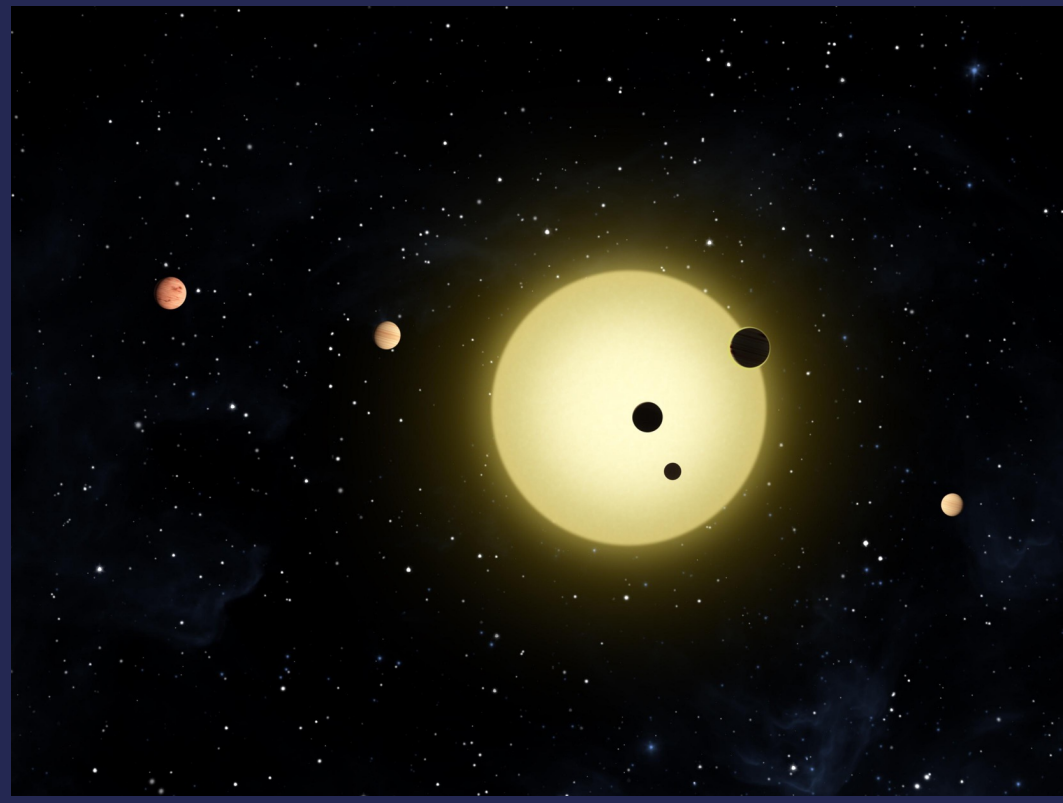
Pessimistic



Dulz et al. 2020

Dulz et al. 2020 Conclusions

- Stability can be used to extrapolate occurrence rates into unconstrained regions
- Maximum packing can place an upper limit on cold occurrence rates



NASA/Tim Pyle