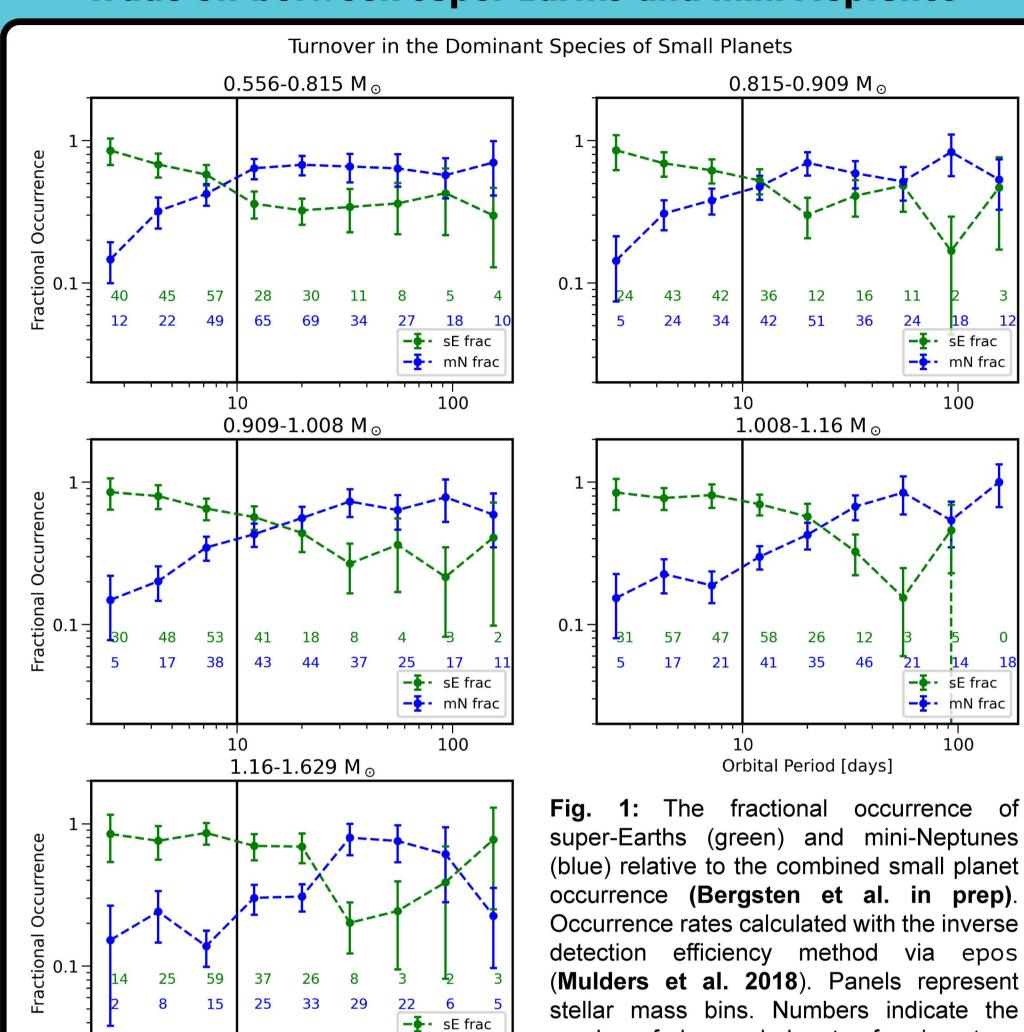
Demographics of Small Kepler Planets and their Dependence on Stellar Mass

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Trade-off between super-Earths and mini-Neptunes



Stellar Mass Dependence of Small Planet Turnover

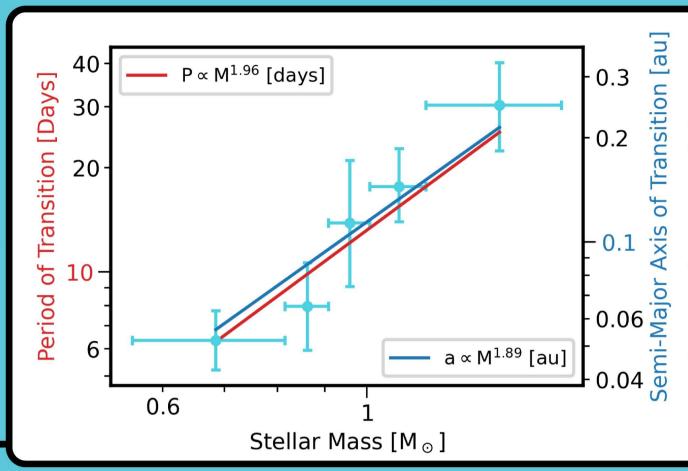
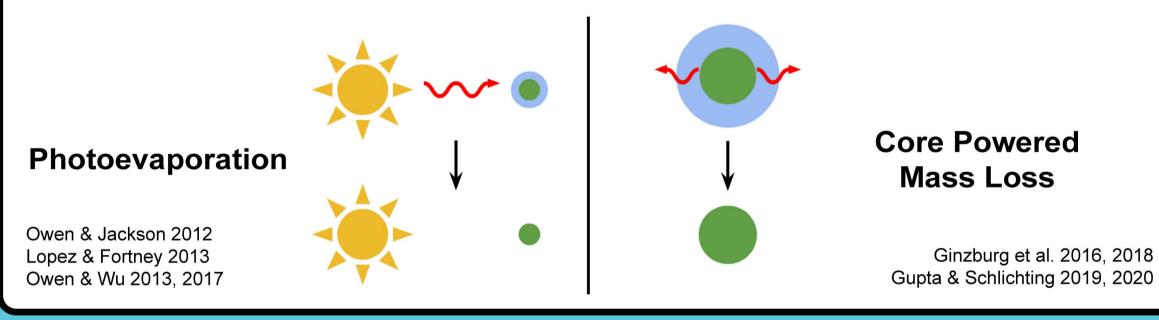


Fig. 2: The best fit values for the location where the small planet population transitions from being mostly comprised of super-Earths to being dominated by mini-Neptunes. Values are fit independently for each stellar mass bin. The location in orbital period is on the left y-axis (red), and the corresponding orbital separation on the right (blue). We include two log-log fits indicating the exponential dependence of either location on stellar mass.

Connection to Evolution of Small Planets and Atmospheric Loss

- The abundance of short-period super-Earths may be due to contamination by stripped cores. TESS could study this by observing young planet populations of various ages.
- The pronounced dependence on stellar mass may help constrain the dominant mechanism for atmospheric mass loss driving the radius valley seen in small planets (Fulton et al. 2017).



Implications and Validations with TESS

−- mN frac

100

Orbital Period [days]

- With TESS observing planetary systems in the solar neighborhood, we hope to see how these distributions compare with demographics of nearby populations.
- The search for planets around nearby M-dwarfs (excluded in this work) may help constrain transitions in the small planet population at low stellar masses.
- Ongoing work to find and characterize early exoplanets in young clusters can also study this feature, and probe how small planets and their atmospheres evolve with time.
- Our predictions for Kepler Habitable Zone occurrence suggest that habitable, terrestrial planets may be increasingly common around low-mass stars. Ongoing searches for similar planets with TESS will provide valuable comparisons between the two missions.

super-Earths in the Habitable Zone

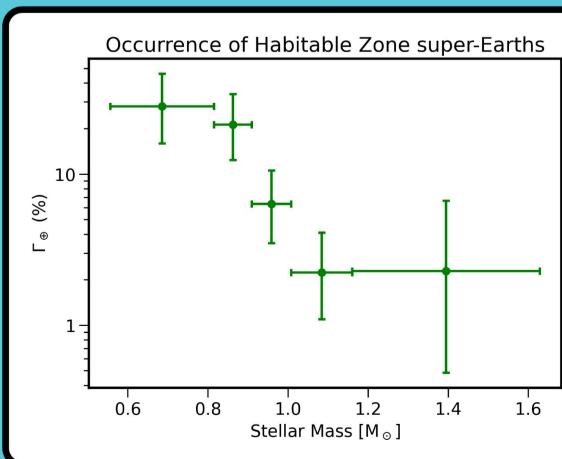


Fig. 3: The occurrence of super-Earth sized planets in the habitable zones (HZs) of stars of varying mass. Distribution functions fit to the populations in Fig. 1 are extrapolated and interpolated across the corresponding HZs, assuming a flat fraction of super-Earths at large periods. HZ period ranges are calculated using the methods of Kopparapu et al. (2013) based on average properties of each stellar mass bin. The occurrence is normalized by the size of the HZ in period (years) and radius (R_{\odot}) to provide Γ_{\odot} based on convention by the ExoPAG Study Analysis Group 13.



100

100

number of observed planets of a given type

within a period bin. Black line at 10 days is

included to show variation across mass bins.





