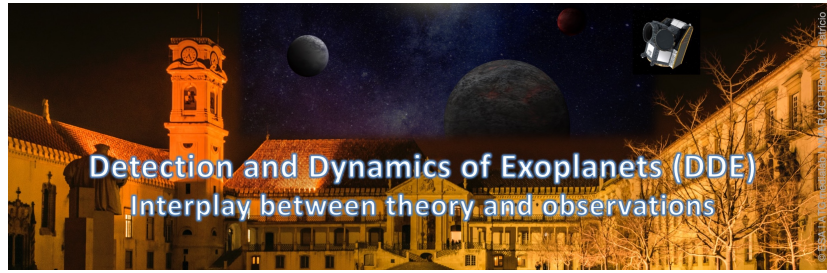


Detection and Dynamics of Exoplanets (DDE): Interplay between theory and observations



Contribution ID: 23

Type: **not specified**

Tidal destruction of ultra-short-period planets around Sun-like stars

Thursday, July 10, 2025 3:15 PM (15 minutes)

Chemical evidence indicates that an appreciable fraction of Sun-like stars have engulfed rocky planets during their main-sequence lifetimes. We investigate whether the tidal evolution and destruction of ultra-short-period planets (USPs) can explain this phenomenon. We develop a simple parameterized model for the formation and engulfment of USPs in a population of MS stars. With this model, it is possible to reproduce both the observed occurrence rate of USPs and the frequency of planet-engulfing Sun-like stars for a reasonable range of USP formation rates and tidal decay lifetimes. Our results support a theory of USP formation through gradual inward migration over many Gyr and suggest that engulfment occurs ~ 0.1 -1 Gyr after formation. This lifetime is set by tidal dissipation in the USP itself instead of the host star, due to the perturbing influence of external companions. If USP engulfment is the main source of pollution among Sun-like stars, we predict a correlation between pollution and compact multi-planet systems; some 5-10% of polluted stars should have a transiting planet of mass >5 Earth masses and period ~ 4 -12 days. We also predict an anti-correlation between pollution and USP occurrence.

Presenter: O'CONNOR, Christopher (CIERA, Northwestern University)

Session Classification: Star-planet interactions and exoplanets' characterization