
EAPS Planetary Lunch Colloquium Series (PICS)

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Tidal Decay and Roche-Lobe Overflow of Short-Period Gaseous Exoplanets

Discoveries of 100+ Earth-sized planet candidates with short orbital periods, some only a few hours, have challenged theoretical expectations. The proximity of hot Jupiters to Roche-Lobe overflow (RLO) has suggested some small short-period planets are actually the fossil cores of disrupted gaseous planets, and recent work provides some support: Stable RLO (atmospheres lost via a steady outflow and a thin accretion disk) can drive orbital expansion that stops and reverses at a maximum period that depends on the core mass, and some small short-period planets have periods consistent with this picture.

However, the periods of the very closest-in planets are too short. Instead, unstable RLO (atmospheres quickly shed on dynamical timescales) may explain the small short-period planets. Indeed as disrupting hot Jupiters transition to hot sub-Neptunes, the accompanying radius evolution, as well as non-conservative angular momentum evolution, may drive the planets from stable to unstable RLO. On the other hand, simple scaling arguments suggest that the very short viscous timescale for the accretion disk may accommodate the increase in overflow rate that results from the radius evolution, allowing the RLO to remain stable after all. In this presentation, we will discuss recent work on planetary RLO and explore outstanding questions.



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