Abstract Submitted
for the APR16 Meeting of
The American Physical Society

Orbital decay of hot Jupiters due to nonlinear tidal dissipation within solar-type hosts REED ESSICK, NEVIN WEINBERG, Massachusetts Inst of Tech-MIT — We study the orbital evolution of hot Jupiters due to the excitation and damping of tidally driven g-modes within solar-type host stars. Linearly resonant g-modes (the dynamical tide) are driven to such large amplitudes in the stellar core that they excite a sea of other g-modes through weakly nonlinear interactions. By solving the dynamics of large networks of nonlinearly coupled modes, we show that the nonlinear dissipation rate of the dynamical tide is several orders of magnitude larger than the linear dissipation rate. We find stellar tidal quality factors $Q'_* \simeq 10^5 10^6 for systems with planet mass \mathrm{M}_p \geq 0.5 M_\mathrm{J}$ and orbital period $P \leq 2$ days, which implies that such systems decay on timescales that are small compared to the main-sequence lifetime of their solar-type hosts. According to our results, there are $\simeq 10$ currently known exoplanetary systems, including WASP-19b and HAT-P-36-b, with orbital decay timescales shorter than a Gyr. Rapid, tidally induced orbital decay may explain the observed paucity of planets with $M_p \geq M_\mathrm{J}$ and $P2$ days around solar-type hosts and could generate detectable transit-timing variations in the near future.

Reed Essick
Massachusetts Inst of Tech-MIT

Date submitted: 06 Jan 2016 Electronic form version 1.4