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Nonlinear evolution of the elliptical instability ADRIAN BARKER, YORAM LITHWICK, Northwestern University — Tidal interactions between short-period gaseous planets and their host stars can have important effects on the orbits of the planets. In particular, the observational preponderance of circular orbits amongst short-period planets, relative to those in wider orbits, is thought to be explained by tidal dissipation in the planets. However, the mechanisms responsible for this are poorly understood. To a first approximation, the linear response of a rotating gaseous planet to the tidal gravitational perturbation of its host star is an elliptical flow, with its major axis aligned with the star. This flow is subject to the elliptical instability, which is a generic linear instability of elliptical streamlines. We will discuss results from a set of high-resolution numerical simulations of the nonlinear evolution of the elliptical instability in a local model of a rotating tidally deformed fluid body. This model allows a detailed study of the dissipative properties of the turbulence driven by the elliptical instability. We will also present results of simulations including the effects of a weak magnetic field, and how this modifies the resulting evolution. The importance of this mechanism for explaining the observations will be discussed.

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