EPSC Abstracts
Vol. 11, EPSC2017-915, 2017
European Planetary Science Congress 2017

Forming compact planetary systems via type I migration

T. Hands (1,2), R. D. Alexander (2)
(1) University of Zurich, Switzerland (2) University of Leicester, UK (tomhands@physik.uzh.ch)

Abstract

Of the myriad of insights into exoplanetary systems provided by the Kepler mission, one of the most intriguing new discoveries is that of a class of compact planetary systems which include Kepler-11 and Kepler-90. In such systems, ensembles of several planets are found in very closely packed orbits (often within a few percent of an astronomical unit of one another). These systems present a challenge for traditional formation and migration scenarios, since these planets presumably formed at larger orbital radii before migrating inwards. In particular, it is difficult to understand how some planets in such systems could have migrated across strong mean-motion resonances without becoming trapped. It is also difficult to explain how such systems remain dynamically cold, as resonant interactions tend to excite orbital eccentricity and lead to close encounters. Using both N-body models and two dimensional hydrodynamical simulations, I explore this problem in detail, and show that under the right conditions, super Earths can indeed migrate through mean-motion resonances [1]. I demonstrate that systems with giant outer planets such as Kepler-90 are more likely to exhibit tighter resonances [2], and that interactions with the protoplanetary disc itself can lead to the breakdown of otherwise-stable resonances [3].

References

[1] Hands, T. O., Alexander, R. D., Dehnen, W.: Understanding the assembly of Kepler's compact planetary systems, MNRAS, Vol. 445, pp. 749-760, 2014.

[2] Hands, T. O., Alexander, R. D.: There might be giants: unseen Jupiter-mass planets as sculptors of tightly packed planetary systems, MNRAS, Vol. 456, pp. 4121-4127, 2016.

[3] Hands, T. O., Alexander, R. D.: Breaking mean-motion resonances during Type I planet migration, MNRAS, submitted, 2017.