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Title: *"On the stability of resonant planetary systems of Super-Earths"*

Abstract. Super-Earths are estimated to be the most abundant exoplanets in the Galaxy. They are often present in multi-planet systems. Although current models predict that, due to their migration through the protoplanetary disk, Super-Earths should reside in a chain of mutual mean motion resonances, many observed systems are not even close to such an orbital configuration. Numerical simulations suggest that many resonant systems should eventually become unstable, but a definitive explanation for these instabilities has not been provided.

We study the stability of multi-planetary systems in chains of mutual mean motion resonances and its dependence on the mass of the planets. To obtain the initial resonant configuration, we perform numerical simulations where the planets' interaction with the protoplanetary disk results in slow convergent migration. Once the resonance configuration is obtained, we slowly deplete the gas. Finally we slowly increase the masses of the planets and obtain a critical mass above which the planetary system becomes dynamically unstable. We perform this study for different populations of planets and various first order resonances.

In the case of two planets, we have available a quasi-integrable approximation of the resonant dynamics. This allows us to calculate analytically the equilibrium eccentricities arising from the resonant interaction and from the damping caused by the disk. Subsequently we can follow the resonant dynamics as the masses increase, thus obtaining a complete (albeit approximate) analytic description of the evolution of the system.

By looking at the fundamental frequencies of the system, we obtain an explanation for the onset of the instability that destroys the resonant configuration.

Joint work with A. Morbidelli and A. Crida.