P329a Effects of Planetary migration on the long-term orbital stability of a multi-planetary system: case of HL Tau

Shijie Wang, Kazuhiro Kanagawa, Toshinori Hayashi, Yasushi Suto (Univ. of Tokyo)

It is well known that the observed exoplanets exhibits large diversity. Many previous studies on dynamical evolution have shown that the orbital instability plays a vital role in shaping the planetary configurations after the disk dispersal. However, their results are often biased towards unstable initial conditions, and it is not clear whether such unstable configurations can be produced through planet-disk interactions. The recent ALMA observation on HL Tau offers the primordial planetary configuration directly. Simbulan et al.(2017) indeed presented a pioneering work along this line. We perform improved simulations incorporating realistic planetary migration and mass accretion that are missing the their study, and adopt a disk profile that takes account of feedbacks due to evolution of multi-planets. We successfully produce super-Jupiter planets with a wide distribution over semi-major axis and mass by varying disk parameters. In contrast to Simbulan's study, our results show that the planetary systems remain stable for at least 5 Gyr after the disk dispersal. Some systems survive longer than the time-scale predicted by previous instability criteria based on Hill radius separation. To account for this discrepancy, we investigated systems consisting of three equal-mass planets and we found the stability is enchanced by more massive planets, as the critical stable separation normalised by Hill radius decreases when mass increases. We will also discuss the relation between the stability and the 2:1 mean motion resonance, and show how migration can stabilise the planetary system by letting planets enter resonance.