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Title: *"Dynamical mechanisms during the formation of non-coplanar planetary systems"*

Abstract. The orbits of extrasolar planets are more various than the circular and coplanar ones of the Solar system. Evidence of mutually inclined orbits has been reported for detected giant planets these last years. Several dynamical mechanisms leading to an excitation of the orbital inclinations during the late-stage formation of planetary systems are studied in detail here, in particular the inclination-type resonance, the nodal resonance and the Kozai resonance, for two different stages of the formation process.

Firstly, by use of extensive n-body simulations, we follow the evolution of three giant planets in the late stage of the gas disc, investigating the gravitational interactions among the planets during the migration phase. Our simulations, which take into account the Type-II migration, the damping of planetary eccentricity and inclination, and an exponential decrease of the disc mass, reproduce the semi-major axis and eccentricity distributions of the detected giant planets. We show that, starting from quasi-circular and quasi-coplanar orbits, highly mutually inclined systems can form, despite the strong eccentricity and inclination damping, due to planet-planet scattering and/or resonant phenomena. Particular attention is given on the different inclination-growth mechanisms at small to moderate eccentricities, guided by the computation of vertical critical orbits and the bifurcation of families of spatial periodic orbits.

Secondly, we study the impact of inclined massive giant planets on the terrestrial planet formation process. In particular, we follow the gravitational interactions of mutually inclined giant planetary systems with an inner disc of planetesimals and embryos, studying the physical and orbital parameters of the formed terrestrial planets, as well as their water content. We show that terrestrial planets can form on stable inclined orbits through the classical accretion theory, even in coplanar giant planet systems emerging from the disc phase.

Joint work with S. Sotiriadis (University of Namur).