Presentation Abstract

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Title **Trojan Asteroids and the Early Evolution of the Solar System**

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Abstract Trojan asteroids can be used to constrain Trojan formation mechanisms, giant planet formation/migration and the orbital structure in the asteroid and Kuiper belts. We performed numerical simulations totaling a few million massless objects under the gravitational influence of the four giant planets. Firstly, we looked at the dynamics of primordial (local) Neptune Trojans placed at the L4/L5 Lagrange points in compact planetary systems prior to planet migration, over 10Myr. We also investigated the evolution of local Neptune Trojans and captured Trojans from a planetesimal disk for all giant planets during planet migration. The orbits were integrated for several Myr, after which the giant planets acquired their current orbits. The orbits of representative final populations were also integrated over Gyr. Overall, the great majority of plausible pre-migration planetary systems resulted in severe levels of depletion of the Neptunian Trojan clouds prior to planet migration. In particular, substantial Trojan losses occurred when Uranus and Neptune were placed near their mutual 2:3 or 3:4 MMR and within 18 AU. Neptune Trojan populations were obtained at the end of the migrating scenarios, composed of remaining local and captured Trojan asteroids. In addition to Neptune, the other three giant planets were also able to capture and retain a significant population of Trojan objects from the disk after planet migration. Finally, the distributions of these objects and their resonant properties were obtained after Gyr. In general, captured Trojans yielded a wide range of eccentricities and inclinations, while local Trojans survived with colder orbital conditions. However, the bulk of captured objects decay over Gyr, providing an important source of new objects on unstable orbits (the Centaurs). Our results suggest the bulk of observed Jovian and Neptunian Trojan populations were captured from the primordial planetesimal disk during planet migration, but their high-i component (>20°) remain unexplained so far.