Long-term evolution of asteroid families among Jovian Trojans

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We updated the database of resonant elements (i.e. the libration amplitude Δ, eccentricity e, inclination I) of Jupiter Trojans and we identified and verified clusters by both the Hierarchical Clustering Method and Monte Carlo simulations, which allow us to assess also the statistical significance of the asteroid families.

Apart from the Eurybates family (Brož & Rozehnal 2011), we also found five clusters of potentially collisional origin — namely families around asteroids (20961) Arkesilaos, (624) Hektor and (9799) 1996 RJ in L4 cloud and (17492) Hippasos and (247341) in L5 cloud. As these clusters fulfill our criteria for collisional families (i.e. statistical significance, albedo homogeneity, steeper SFD than that of background), we tried to simulate their origin and consequential orbital evolution in different scenarios of planetary migration (e.g. Nesvorný et al. 2013).

Using the WISE albedos and diameters (Grav et al. 2011, 2012), we constructed size-frequency distributions of Trojans in both the leading/trailing clouds which we compared to SFDs of the families. We then simulated the collisional evolution of the families (using the Boulder code, Morbidelli et al. 2009). The results show that the evolution of bodies larger than $D > 50$ km is very slow and they exhibit only little evolution over the last 3.85 Gyr (i.e. post-LHB phase). Hence we can consider this part of the SFD as primordial. In the frame of this model, we also tried to constrain ages of the families. We also analyzed the dependence of the total number of catastrophic disruptions on the target diameter.

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References: Brož M., Rozehnal J., 2011, MNRAS, 414, 565–574; Grav T. et al., 2011, ApJ, 742, 40–80; Morbidelli A. et al., 2009, Icarus, 204, 558; Nesvorný D., Vokrouhlický D., Morbidelli A., 2013, ApJ, 768, 45.