Shapes and binary fractions of Jovian Trojans and Hildas through NEOWISE

S. Sonnett[1], A. Mainzer[1], T. Grav[2], J. Bauer[1], J. Masiero[1], R. Stevenson[1], and C. Nugent[1]

[1]Jet Propulsion Laboratory / California Institute of Technology
[2]Planetary Science Institute

Jovian Trojans (hereafter, Trojans) and Hildas are indicative of planetary migration patterns since their capture and physical state must be explained by dynamical evolution models. Early models of minimal planetary migration necessitate that Trojans were dynamically captured from the giant planet region (e.g., Marzari & Scholl 1998). The Nice model instead suggests that Trojans were injected from the outer solar system during a period of significant giant planet migration (e.g., Morbidelli et al. 2005). A more recent version of the Nice model suggests that asymmetric scatterings and collisions would have taken place, producing dissimilar L4 and L5 clouds (Nesvorny et al. 2013).

Each of these formation scenarios predicts a different origin and/or collisional evolution for Trojans, which can be inferred from rotation properties. Namely, the physical shape as a function of size helps determine the degree of collisional processing (Farinella et al. 1992). Also, the binary fraction as a function of separation between the two components can be used to determine the dominant binary formation mechanism and thus helps characterize the dynamical environment (e.g., Kern & Elliot 2006). Rotational variation usually corresponds to elongated shapes, but high amplitudes ($>$ 0.9 magnitudes; Sheppard & Jewitt 2004) can only be explained by close or contact binaries. Therefore, rotational lightcurves can be used to infer both shape and the presence of a close companion.

Motivated by the need for more observational constraints on solar system formation models and a poor understanding of the rotation properties and binary fraction of Trojans and Hildas, we are studying their rotational lightcurve amplitudes using infrared photometry from NEOWISE (Mainzer et al. 2011; Grav et al. 2011) in order to determine debiased rotational lightcurve amplitude distributions for various Trojan subpopulations and for Trojans compared to Hildas. Preliminary amplitude distributions show a large fraction of potential close or contact binaries (having $\Delta m > 0.9$). These distributions can be used to constrain the collisional and dynamical history of solar system formation models.

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