SHAPES AND ROTATIONAL PROPERTIES OF THE SELECTED HILDA AND TROJAN ASTEROIDS

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Introduction: Trojan asteroids lie in stable orbits at Jupiter's L4 and L5 Lagrange points and Hildas are in 3:2 resonance with Jupiter. The origin of these two populations varies between competing Solar System evolution models, see e.g. [1, 2, 3]. Bulk density may offer the only unequivocal evidence as to their origin, with low density objects being consistent with outer solar system formation, and high densities with inner solar system formation. The only feasible means of measuring density directly is through confirmed binary asteroid systems.

The aim of our study is to identify new binary asteroids within Trojan and Hilda populations by searching for light curve features indicative of binarity. Binary asteroid systems contain key information about the dynamical and chemical environments in which they formed. Identifying and characterizing binary asteroids within the Trojan and Hilda populations offer a powerful means of discerning between Solar System evolution models. For example, determining the formation environments of Trojan and Hilda asteroids will provide critical constraints on how small bodies and the planets that drive their migration must have moved throughout Solar System history.

Binary candidates selection: Dozens of possibly close or contact binary Trojans and Hildas were identified within the data obtained by NEOWISE [4]. Densely sampled light curves of these candidate binaries have been obtained in order to resolve rotational light curve features that are indicative of binarity (e.g., [5, 6, 7]).

We present analysis of the shapes, rotation, and pole solutions of some of the follow-up targets observed with optical ground-based telescopes.

Lightcurve inversion: For modelling the asteroid photometric properties, we use parameters describing the shape, surface light scattering properties and spin state of the asteroid. Scattering properties of the asteroid surface are modeled using a two parameter H-G12 magnitude system. Determination of the initial best-fit parameters is carried out by first using a triaxial ellipsoid shape model, and scanning over the period values and spin axis orientations, while fitting the other parameters, after which all parameters were fitted, taking the initial values for spin properties from the spin scanning. In addition to the best-fit parameters, we also provide the distribution of the possible solutions, which should cover the inaccuracies of the obtained solution, caused by the observing errors and by the model. The distribution of solutions is generated by Markov-Chain Monte Carlo sampling the spin and shape model parameters, using both an ellipsoid shape model and a convex model, Gaussian curvature of which is defined as a spherical harmonics series [8, 9, 10].

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