Lightcurves and rotational periods of comet-sized Jovian Trojan asteroids

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The Jovian Trojans are among the most enigmatic objects in the Solar System. They have been studied less than main-belt asteroids because of their low albedos and greater distance from the Sun. Several lines of evidence support a common origin for the Jovian Trojan asteroids and cometary nuclei. Their spectra and low albedos bear a strong resemblance to those of comets. The Nice Model predicts that the Trojans may well be objects that originated with today's Kuiper Belt Objects which predicts that today's Trojans were trapped in their current locations at Jupiter's L4 and L5 points after Saturn and Jupiter passed through a 2:1 resonance.

We are surveying Trojan rotation properties to test the Nice Model hypothesis. One approach is a comparison of rotation properties of similar-sized Trojans and comets. We present new lightcurve information for several Trojans $\lesssim$ 30 km in diameter, more than doubling the number of objects in this size range for which some rotation information is known. The minimum densities for objects with complete lightcurves are estimated and are found to be comparable to those measured for cometary nuclei.

Observations were obtained using the Cerro Tololo (CTIO) Blanco 4-m telescope, the CTIO 0.9-m telescope, and 0.4-m and 0.35-m telescopes at the Center for Solar System Studies (CS3) from 2011 August to 2014 May. The lower limit of densities of the small Trojans in our study are comparable to the densities for the two Trojans which have been directly measured, and those of similar sized comets. These results suggest these Trojans have an icy composition with significant amount of internal space; they are consistent with a comet-like composition for these bodies.

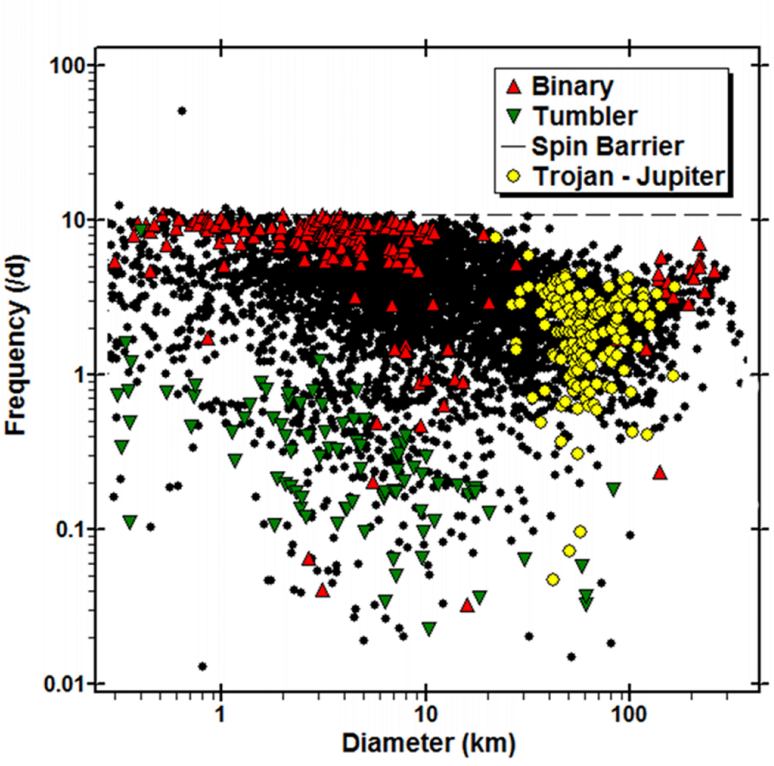

Figure: A zoomed in look at a traditional frequency-diameter plot of asteroids with Jovian Trojans shown as yellow dots. This plot shows that few Trojans smaller than 30 km have rotational periods determined. The Spin Barrier is suggested to be at a somewhat lower frequency than that for main-belt asteroids.

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