Lightcurve variation distributions among YORP-dominated main-belt asteroids from sparse lightcurve sampling
sparse lightcurve sampling

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Through study and understanding of the rotational behaviour of main-belt asteroids, information relating to their physical and collisional evolution may be derived. For small asteroids, particularly those found in the inner main belt, the YORP rotational timescales are shorter than those for collisions, and, thus, we expect YORP to be the dominant effect. This makes the small-body population ideal for looking for evidence in lightcurves of spin-axis orientation due to YORP.

We have so far studied the lightcurve variations of >10,000 asteroids as obtained by Pan-STARRS 1. Asteroids were only considered with a formal uncertainty in w-band of 0.02 magnitudes or better. The majority of asteroids so far observed by Pan-STARRS have too few observations to allow lightcurve periods and amplitudes to be derived as proposed by Warner and Harris (Icarus 216, 610, 2011). Hence we have analyzed the cumulative distribution functions of the rate of magnitude change between pairs of observations separated by ∼15 minutes. This was carried out for a range of asteroid diameters to observe the effect of size on magnitude variation in population samples in the inner and outer main belt. Analysis up to this point has shown that the rates of change in magnitude decrease toward lower rates with decreasing diameter for objects with diameters < 8 km in both the inner main belt (2.0 au $< a <$ 2.5 au) and the outer main belt (3.0 au $< a <$ 3.5 au). This decrease towards slower rates of change could be due to (a) smaller physical elongations, (b) slower rotation rates, and/or (c) changes in the fraction of YORP-aligned spin axes. We will present these initial findings along with comparison to simple theoretical models.

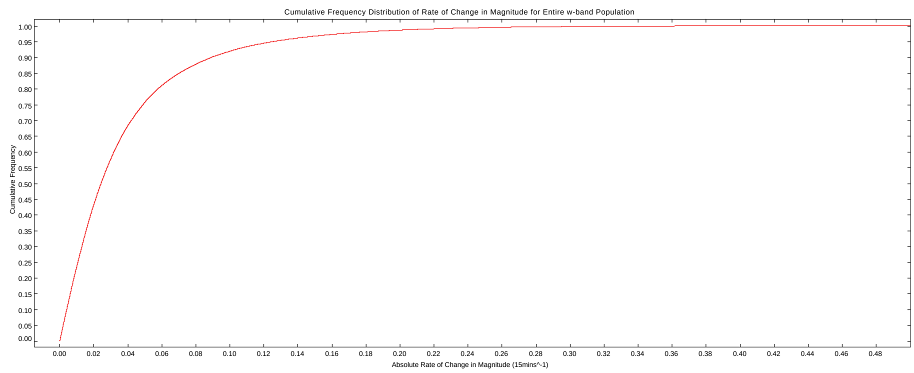

Figure: A sample cumulative frequency distribution of absolute rate of change in magnitude covering the entire reduced w-band data set from PS1.

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References: Warner and Harris (2011) "Using sparse photometric data sets for asteroid light curve studies" (Icarus 216, 610).