

Searching for Fast-rotators among the Main-belt Asteroids

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The existence of fast-rotating asteroids with spin-periods faster than ~ 2 hr (there should be monolithic in nature) has recently been reported among near-Earth asteroids (NEAs). All of them are found to be smaller than ~ 0.2 km in diameter (Pravec and Harris 2000; Whiteley et al. 2002), except for NEA 2001 OE84, which has a diameter of ~ 0.7 km (Pravec 2002).

It is generally accepted that NEAs originate dynamically from the main-belt asteroids (MBAs). Hence, it is natural for us to look for fast-rotators among the sub-km MBAs. However, because of their faintness, such an attempt had been unsuccessful with telescopes of a few meters in diameter, which were in common use a decade ago.

With the wide-field mosaic CCD camera (Suprime-Cam) attached to the prime focus of the 8.2 m Subaru telescope atop Mauna Kea, Hawaii, we made a lightcurve survey of sub-km MBAs on 2001 Oct. 20. In a field-of-view of $34' \times 27'$ covered by ten chips, we detected 127 asteroids down to $R \sim 25$ mag and light variations for 92 asteroids were measured. Fourier periodogram analysis brought about 5 certain-class and 20 likely-class fast-rotators, which have sizes ranging from 0.5 to 2 km. Periodic nature of those data was confirmed by reanalysis of simulated lightcurves.

We found that our fast-rotator MBAs have sizes of about one order of magnitude larger than those among NEAs. These show for the first time that the sub-km MBAs contain a population of fast-rotators. Their lightcurve amplitudes were small compared with those for ordinary asteroids. This result may support a tendency that fast-rotators are nearly spherical bodies, as reported from those among NEAs (Pravec and Harris 2000). If this survey could be statistically representative of the population of fast-rotator MBAs, we suggest that they may occupy a non-negligible fraction of MBAs in our observed size range.