Asteroid families spin and shape models to be supported by the ProjectSoft robotic observatory

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In our recent work (Hanuš et al. 2013), we studied dynamics of asteroid families constrained by the distribution of pole latitudes vs semimajor axis. The model contained the following ingredients: (i) the Yarkovsky semimajor-axis drift; (ii) secular spin evolution due to the YORP effect; (iii) collisional re-orientations; (iv) a simple treatment of spin-orbit resonances; and (v) of mass shedding.

We suggest to use a different complementary approach, based on distribution functions of shape parameters. Based on ∼1000 old and new convex-hull shape models, we construct the distributions of suitable quantities (ellipticity, normalized facet areas, etc.) and we discuss a significance of differences among asteroid populations. We check for outlier points which may then serve as a possible identification of (large) interlopers among "real" family members.

This has also implications for SPH models of asteroid disruptions which can be possibly further constrained by the shape models of resulting fragments. Up to now, the observed size-frequency distribution and velocity field were used as constraints, sometimes allowing for a removal of interlopers (Michel et al. 2011).

We also outline an ongoing construction of the ProjectSoft robotic observatory called "Blue Eye 600", which will support our efforts to complete the sample of shapes for a substantial fraction of (large) family members. Dense photometry will be targeted in such a way to maximize a possibility to derive a new pole/shape model.

Other possible applications of the observatory include: (i) fast resolved observations of fireballs (thanks to a fast-motion capability, tens of degrees per second); or, (ii) an automatic survey of a particular population of objects (main-belt and near-Earth asteroids, variable stars, novae etc.)

References: Hanuš J., M. Brož, J. Ďurech et al.: An anisotropic distribution of spin vectors in asteroid families. Astron. Astrophys. 559, A134, 2013; Michel P., M. Jutzi, D.C. Richardson, W. Benz: The Asteroid Veritas: An intruder in a family named after it? Icarus 211, 535, 2011.