Asteroid taxonomy and the H,G_{12} magnitude system

D. Oszkiewicz[1], E. Bowell[2], L. Wasserman[2], K. Muinonen[3,4], and A. Penttilä[3]

[1]Astronomical Observatory Institute, Faculty of Physics, Adam Mickiewicz University, Słoneczna 36, 60-286 Poznań, Poland
[2]Lowell Observatory, Flagstaff, USA
[3]Department of Physics, University of Helsinki, Finland
[4]Finnish Geodetic Institute, Masala, Finland

We review the asteroid magnitude systems. The conventionally used $H, \|G$ system (approved by the IAU in 1985) was recently replaced by the H,G_{12} and H,G_1,G_2 systems (approved by the IAU in 2012). The new phase curves were already applied to a large quantity of photometric data (Oszkiewicz et al, 2011). In particular, absolute magnitudes and slope parameters were computed for about half a million asteroids and are publicly available through the Planetary Research Group (University of Helsinki) websites. Several correlations of the shape of the phase curves with asteroid physical parameters were also explored. In general, the steepness of a phase curve relates to the physical properties of an asteroid's surface such as for example composition, porosity, packing density, roughness, and grain size distribution. However, most of those cannot be studied with the currently available data. Some conclusions regarding links to albedo and taxonomy can still be made. First, the G_1 and G_2 parameters correlate with albedo. Generally, the higher the albedo the lower and higher are the G_1 and G_2 parameters, respectively. Second, the G_{12} parameter distributions for the different asteroid taxonomic complexes are statistically different. For example, the C-complex asteroids tend to have high G_{12}'s, S-complex asteroids low G_{12}'s, and objects from the X-complex lean towards average values (Oszkiewicz et al. 2012). Additionally, asteroid families with a few exceptions show homogeneity of the G_{12} parameter (Figure). This is yet another confirmation of homogeneity of asteroid families and therefore the overall tendency to retain the same physical properties across family members.

We study the usability of the G_{12} parameter in topics such as breaking the X-complex degeneracy and taxonomical classification. In particular, we combine the G_{12}'s with the Sloan Digital Sky Survey (SDSS) and the Wide-Field Infrared Survey Explorer (WISE) data (Oszkiewicz et al. 2014) to investigate the predictability of taxonomic complexes.

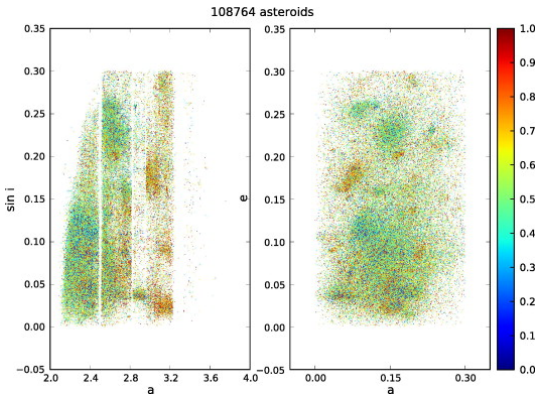

Figure: Distribution of asteroid proper elements, color-coded according to the G_{12} value.

Acknowledgements: Research supported from NSC grant Nr. 2012/04/S/ST9/00022.

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