

Analysis of homogeneity of the main belt asteroids families with the "color-albedo" plots

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Abstract

Using color indexes from SDSS, WISE albedos for the 57 asteroids families from Nesvorny list we tested the homogeneity using the "color - albedo" plots. We found, that significant fraction of the analyzed families are inhomogeneous in terms of albedos and colours. A fraction of the dark subgroups is not negligible.

1. Introduction

A list of 122 asteroid families are given in [1], that includes more than 140000 asteroids. Asteroid families are easy to identify as clusters of orbits in the space of proper elements (a_p, i_p, e_p). They are interpreted as the observable outcomes of energetic collisional events, leading to complete disruption of original parent bodies. Family-forming collisions are expected to liberate material from a large fraction of the parent body's volume. A homogeneous parent body would produce a family with very narrow distributions of physical properties and a heterogeneous parent body would instead produce a family with wide or multimodal distributions. Analyzing data on physical properties of the family members we can also find possible interlopers in homogeneous families or we can distinguish overlapping of families in (a_p, i_p, e_p) space. Here we test the physical homogeneity of asteroid families based on the color and albedo data.

2. Data

Main belt asteroid families were taken from [1], We have considered only numbered asteroids in our analysis. We use WISE albedos from [2] and a^* which is the first principal component in the $r-i$ versus $g-r$ SDSS color-color plane [3,4] to plot albedo distributions and "albedo - color" diagram for each family.

3. Results

We have found that 15 asteroid families from 57 families included in our analysis demonstrated a bimodal albedo distribution. These results are well-seen on diagrams "albedo-color". As an example, Fig.1 and 2 show the plots for the Gefion family.

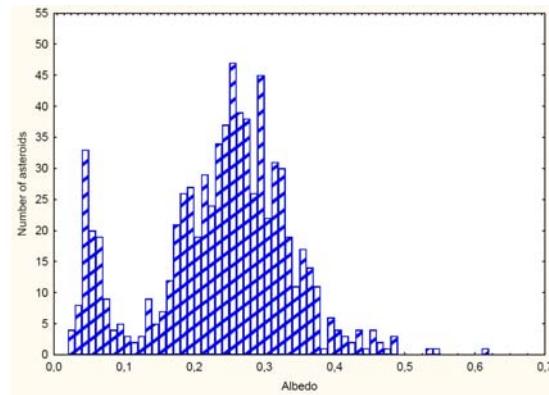


Figure 1: Albedo distribution for Gefion family.

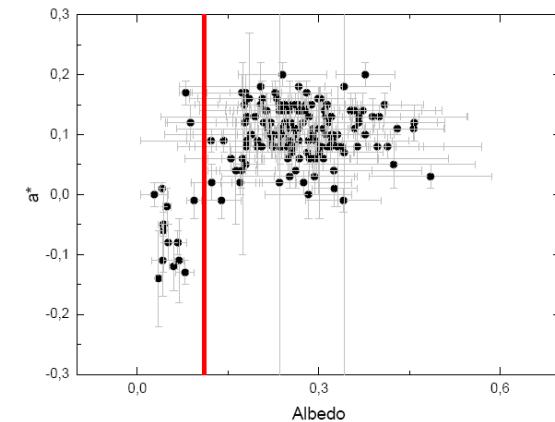


Figure 2: "Albedo - color" diagram for Gefion family.

For all bimodal families the dark subgroup has albedo smaller than 0.08–0.11 (red line in Fig.2) and $a^* < 0$. Only two families (Vesta and Flora) with bimodal albedo distribution on the diagram "albedo-color" have shown, that they consist of three subgroups.

4. Conclusions

Significant amount (25%) of the analysed families are inhomogeneous in terms of albedos and colours. A fraction of the dark subgroups is not negligible (10-15%).

References

[1] Nesvorný, D., Nesvorný HCM Asteroid Families V3.0. EAR-A-VARGBDET-5-NESVORNYFAM-V3.0. NASA Planetary Data System, 2015;

[2] Mainzer, A.K., Bauer, J.M., Cutri, R.M., Grav, T., Kramer, E.A., Masiero, J.R., Nugent, C.R., Sonnett, S.M., Stevenson, R.A., and Wright, E.L., NEOWISE Diameters and Albedos V1.0. EAR-A-COMPIL-5-NEOWISEDIAM-V1.0. NASA Planetary Data System, 2016;

[3]<http://www.astro.washington.edu/users/ivezic/sdssmoc/ADR4.dat>;

[4] Parker et al.: The size distributions of asteroid families in the SDSS Moving Object Catalog 4, Icarus, Vol. 198, pp. 138–155.