LARGE FAMILIES FROM THE MAIN BELT: ANALYSIS OF THEIR HOMOGENEITY.

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Introduction: Asteroid families were formed during collisional disruptions and their physical properties provide unique information about internal material of the parent bodies. From analysis of data on physical properties of the family members we can also found out possible interlopers in homogeneous families or we can distinguish overlapping families in the (ap,ip,ep,) space. We perform an analysis of the physical homogeneity of 56 large Main belt asteroid families based on the color and albedo data.

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.

Results: Using data on albedo (p) and color index ($a^*=0.89(g-r)+0.45(r-i)-0.57$) from WISE and SDSS databases for large main belt asteroids families we found that all points on "color (a^*) - albedo (p)" plots for all families can be separated in to three subgroups: I ($p<0.1$; $a^*<-0.05$); II ($0.1<p<0.25$; $a^*<0.05$) and III ($p>0.15$; $a^*>0.05$). In all bimodal families with some exceptions there are dark subgroup I and high albedo subgroup III. Only two families (Vesta and Flora) include all three subgroups. Analysis of taxonomic interpretation of these three subgroups gives a clear result only for subgroup III which consists of the S-type asteroids. Subgroup I is a mixture of dark asteroids that belong to F,C,P,D types. Subgroup II probably can be consistent with the M-type asteroids. Analyzed families are divided into **homogeneous**: (27 families); **bimodal** (13 families); and **trimodal** families (2 families, Vesta and Flora).

Families Aeolia, Xizang, Aeria and 15477 have not show bimodality in color and albedo distribution, but they contain asteroids that are intermediate between low (I) and middle-albedo (II) subgroups. All these families are located very near to 2.7 A.U.

More deep analysis of the distribution of proper elements for subgroups and V-shape plots for each bimodal family show that several families consist of two overlapping families as in the case of Nisa-Polyana. As example Figures 1 and 2 show the plot "Albedo – color *a**" and distribution of proper elements (eccentricity and semi-major axis) for Juno family, which is a typical bimodal family. As we can see from Fig.2 Juno family may consist of two overlapping families.

Conclusion: Significant fraction (25%) of the analyzed families are inhomogeneous in terms of albedos and colours. A fraction of the dark subgroup (I) in bimodal families is not negligible (10-30%). 7 bimodal families may contain two overlapping families.

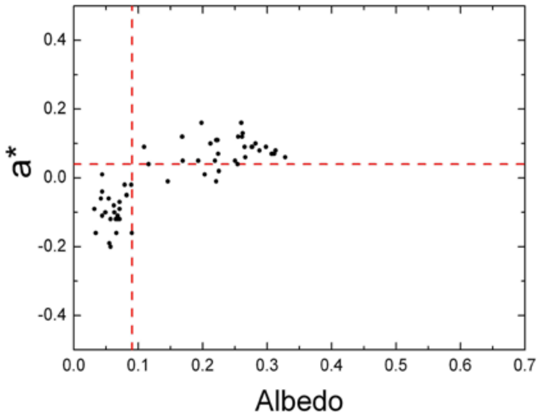

Fig.1. "Albedo – color *a**" plot for Juno family

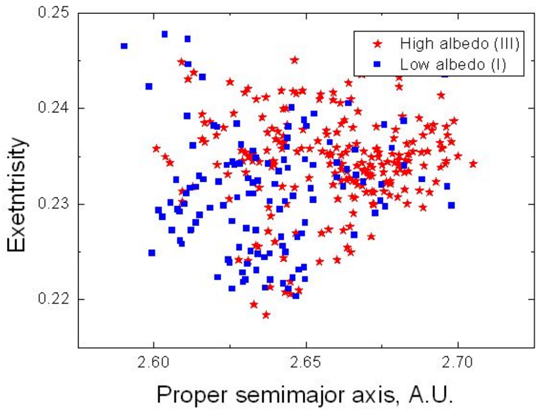

Fig.2. Proper elements distribution for low- and high albedo subgroups in Juno family.

References: [1] Nesvorny, D., Nesvorny 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. (2008) *Icarus, 198*, 138–155.