

**MASS DISTRIBUTION IN SELECTED FAMILIES OF ASTEROIDS.** I. Włodarczyk<sup>1</sup> and J. Leliwa-Kopystynski<sup>2</sup>, <sup>1</sup>Chorzow Astronomical Observatory, Al. Planetarium 4, 42-500 Chorzow, Poland, [astrobit@ka.onet.pl](mailto:astrobit@ka.onet.pl), <sup>2</sup>University of Warsaw, Institute of Geophysics, Pasteura 7, 02-093 Warszawa, Poland, [jkopyst@mimuw.edu.pl](mailto:jkopyst@mimuw.edu.pl).

**Introduction:** The main goal of our work is to present mass distribution in the families of asteroids. In particular we are looking for the families with the largest members having the mass equal to about a half of the total mass of the family. Such family, if found, would be a good illustration of the limiting case of the catastrophic impact. It would be as well a good observational support of our theoretical work [1] concerning impact disruption of asteroids and small icy satellites.

**Method of computations:** Members of selected families of asteroids were taken from the dataset of proper elements of 292003 numbered asteroid [2] using HCM numerical analysis [3]. The HCM method requires to make an appropriate choice of the velocity  $v_{cut}$  that is a parameter related to the relative velocity of the asteroids supposed to be the family members.

**Results and Conclusions:** The families of Eunomia, Eos, Themis and Flora were considered. The masses of individual asteroids were found using formula of Fowler and Chillemi [4] with albedo  $p_v = 0.25$  and with bulk density equal  $2500 \text{ kg/m}^3$ . Table 1 lists: The name of family, the chosen value of the parameter  $v_{cut}$ , the numbers of asteroids belonging to the family that were found for this  $v_{cut}$ , the total mass of all selected members of the family, and the normalized masses of the largest members of the Eos, Themis, Flora, and Eunomia families. Finally, the plots of the cumulative mass normalized to the total mass of the family were done, Fig. 1.

**References:** [1] Leliwa-Kopystynski J. et al. (2012) *ACM 2012*, [2] Novakovic A. et al. (2012) <http://hamilton.dm.unipi.it/astdys/index.php?pc=5> updated in Feb. 2012, [3] Zappala P. et al. (1995) *Icarus*, 116, 291-314. [4] Fowler J.W. and Chillemi J.R. (1992) *The IRAS Minor Planet Survey*, 17-43.

Table 1. Computed characteristics of selected families of asteroids

Family	$v_{cut}$ m/s	$N_{v-cut}$	Mass $10^{18} \text{ kg}$	Mass (norm.)
Eos	70	17410	6.778	0.080
Eunomia	85	18825	21.945	0.289
Flora	56.57	30724	5.760	0.488
Themis	75	4900	3.955	0.740

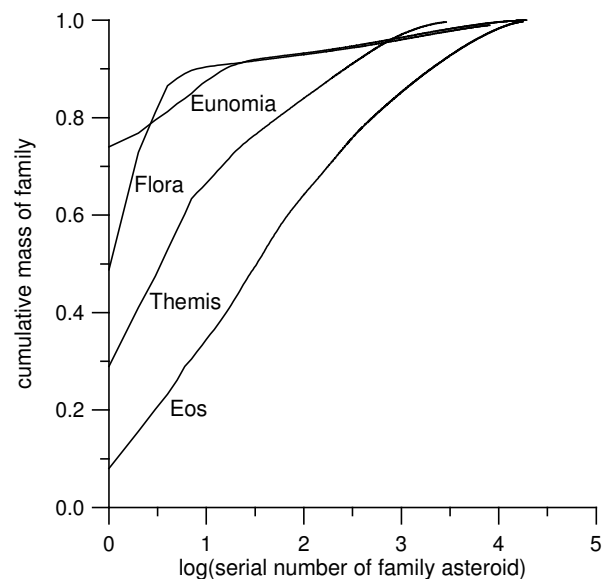


Fig. 1. Cumulative normalized mass of the families presented versus serial number (i.e. versus the number of asteroids ranged according to their size, starting from the largest). The leftmost points of the curves are the masses of the largest members of the families. Eos and Themis are the largest remnants that survived after catastrophic impact on their parent bodies. Flora has the mass equal to the half of mass of the family and thus it is a remnant of the impact that was on the limit of catastrophic impact. The proto-Eunomia due to an impact lost one fourth of its mass.