Astronomy in Focus - XXX
Proceedings IAU Symposium No. XXX, 2018
M. T. Lago, ed.

doi:10.1017/S1743921319003302

The common origin of family and non-family asteroids: Implications

Stanley F. Dermott[1], Apostolos Christou[2] and Dan Li[3]

[1]University of Florida, Department of Astronomy, Gainesville, FL 32611,USA
email: sdermott@ufl.edu

[2]Armagh Observatory and Planetarium, College Hill, Armagh BT61 9DG, UK
email: apostolos.christou@armagh.ac.uk

[3]National Optical Astronomical Observatory, Tucson, AZ, USA
email: dli@noao.edu

Abstract. Because the number of asteroids in the IMB with absolute magnitude H<16.5 is effectively complete, the distributions of the sizes and the orbital elements of these asteroids must be devoid of observational selection effects. This allows us to state that the observed size-frequency distributions (SFDs) of the five major asteroid families in the IMB, defined by Nesvorný (2015) using the Hierarchical Clustering Method (Zappala *et al.* 1990), are distinctly different and deviate significantly from the linear log-log relation described by Dohnanyi (1969). The existence of these differences in the SFDs, and the fact that the precursor bodies of the major families have distinctly different eccentricities and inclinations, provides a simple explanation for the observations that the mean sizes of the family asteroids, *taken as a whole*, are correlated with their mean proper eccentricities and anti-correlated with their mean proper inclinations. While the latter observations do have a simple explanation, we observe that the mean sizes of the non-family asteroids in the IMB are also correlated with their mean proper eccentricities and anti-correlated with their mean proper inclinations. We deduce from this, and from the fact that the SFDs of the non-family and the family asteroids (again *taken as a whole)* are almost identical, that the family and most of the non-family and asteroids have a common origin. We estimate that ∼85% of all the asteroids in the IMB with H<16.5 originate from the Flora, Vesta, Nysa, Polana and Eulalia families with the remaining ∼15% originating from either the same families or, more likely, a few ghost families (Dermott *et al.* 2018).

More information is available online.

References

Dermott, S. F., Christou, A. A., Li, D., Kehoe, T. J. J., & Robinson, J. M. 2018, *Nat. Astron.*, 2, 549

Dohnanyi, J. S. 1969, *J. Geophys. R.* 74, 2531

Nesvorný, D. 2015, EAR-A-VARGBDET-5-NESVORNYFAM-V3.0. NASA Planetary Data System

Zappala, V., Cellino, A., Farinella, P., & Knežević, Z. 1990, *Astron. J.*, 100, 2030