Dynamical properties of the Watsonia asteroid family

G. Tsirvoulis[1], B. Novakovic[2], Z. Knezevic[1], and A. Cellino[3]

[1]Astronomical Observatory, Volgina 7, 11060 Belgrade 38, Serbia
[2]Department of Astronomy, Faculty of Mathematics, University of Belgrade, 11000 Belgrade, Serbia
[3]INAF- Osservatorio Astrofisico di Torino, Pino Torinese 10025, Italy

Introduction: In recent years, a rare class of asteroids has been discovered [1], with its distinguishing characteristic being the anomalous polarimetric properties of its members. Named Barbarians, after (234) Barbara, the prototype of the class, these asteroids show negative polarization at unusually high phase-angles compared to normal asteroids. Motivated by the fact that some of the few discovered Barbarians seemed to be related to the Watsonia asteroid family, Cellino et al. [2] performed a search for more Barbarians among its members. A positive result of this search led to the conclusion that Watsonia is indeed an important repository of Barbarian asteroids. Based on these findings, we decided to analyze this family in detail.

Basic information: According to available data, Watsonia is an L-type asteroid family, located in the middle of the main asteroid belt ($2.68 < a_p < 2.82$ au), with low to moderate orbital eccentricities ($0.1 < e_p < 0.15$) and relatively high inclinations ($16.5^o < i_p < 18^o$).

Methodology: The first step in our study is to derive a reliable list of Watsonia family members. To that purpose, we first calculate the synthetic proper elements [3] of an extended catalogue including numbered, as well as multi and single opposition asteroids, in a wide region around the family. To this catalogue we apply the Hierarchical Clustering Method (HCM)[4] to determine the membership of the family, coinciding with the requirement that all confirmed neighboring Barbarians are included (see figure). To detect potential interlopers and refine the membership list, additional data such as the SDSS colors and WISE albedos are used. Moreover, we identify all relevant resonances and analyze the dynamical characteristics of the region occupied by the family. Then we estimate the age of the family, and finally, we perform numerical integrations of test particles to investigate possible dynamical links to other known Barbarians and to the near-Earth region.

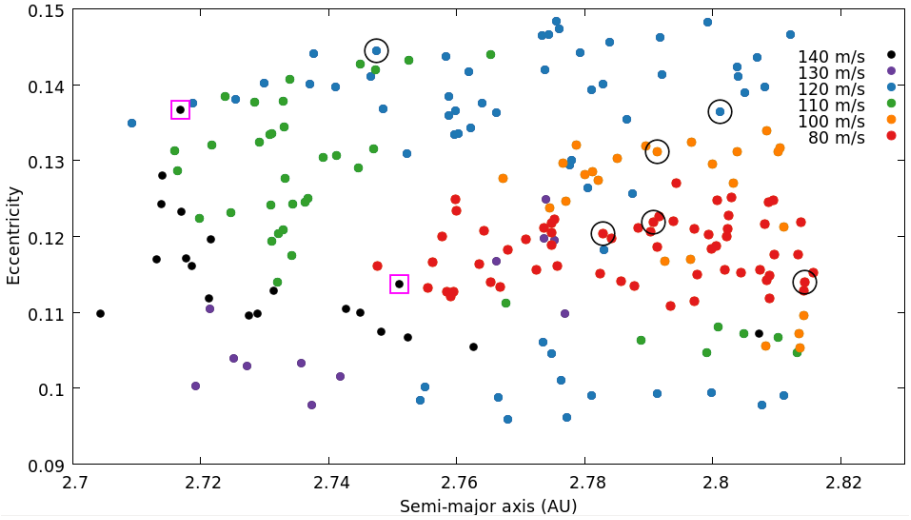

Figure: Distribution of family members on the (a_p, e_p) plane for various threshold distances used in the HCM (see legend). Black circles indicate Barbarian asteroids identified by [2], while pink squares indicate asteroids found by [2] not to be Barbarians.

Acknowledgements: The work of G.T. is supported by the European Union [FP7/2007-2013], project "STARDUST-The Asteroid and Space Debris Network", under grant agreement 317185.

References: [1] Cellino, A.; Belskaya, I. N.; Bendjoya, Ph.; Di Martino, M.; Gil-Hutton, R.; Muinonen, K.; Tedesco, E. F., 2006, Icarus, 180, 565. [2] Cellino, A.; Bagnulo, S.; Tanga, P.; Novaković, B.; Delbò, M., 2014, MNRAS, 439, L75. [3] Knežević, Z.; Milani, A., Celestial Mechanics and Dynamical Astronomy, 2000, 78, 17. [4] Zappala, V.; Cellino, A.; Farinella, P.; Knezevic, Z., 1990, Astronomical Journal, 100, 2030.