Asteroid Families Mechanics with Application to the Family Eunomia

Krivka, Adam (School: The St. Cyril and Methodius Comprehensive School and Pedagogical High School Brno)

Asteroids are remnants of first planets – planetesimals. When two asteroids collide, an asteroid family is formed. I studied the mechanics of asteroid families and I applied newest methods for identification, analysis and simulation to the Eunomia family located in the main belt. Firstly, I identified the members of the numerous Eunomia family from newest catalogues of observational data using the Hierarchical Clustering Method. Then, I created a synthetic population of 6210 particles, I simulated an initial isotropic impact and I modeled the orbital evolution of the population for 1.2 million years using the numerical integrator SWIFT, which is adapted to long-term simulations and which also includes non-gravitational effects such as the Yarkovsky effect, YORP, random reorientations of rotational axis and chaotic diffusion. I applied the "blackbox" method to the gathered data set: I divided the synthetic and observed particles into boxes in orbital elements and I compared the number of particles in them using the chi squared distribution method, which I used for an age estimate. I found that the Eunomia family is contaminated by nearby families, so I had to remove them by hand from the observational data. I have described the dynamical structure of the Eunomia family (I have confirmed the effect of orbital resonances and non-gravitational forces) and I estimated its age: the Eunomia family is most probably not younger than 500 million years. Further extensions of this study include longer simulation period or a simulation of the nearby families.

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