Origin, evolution and unbiased distribution of Near Earth Asteroids

Alessandro Morbidelli

CNRS, Observatory of Nice,
B.P. 4229, 06304 Nice Cedex 4, France. E-mail: morby@obs-nice.fr

Due to chaotic resonant phenomena, many main belt asteroids increase their orbital eccentricity and start to cross the orbits of the terrestrial planets. When their perihelion distance becomes smaller than 1.3 A.U. they are called Near Earth Asteroids (NEAs). Understanding the dynamics of these resonant transport routes has been a brilliant result of analytic and semi–analytic Celestial Mechanics. Nowadays, fast computers and integration algorithms allow to simulate the chaotic evolution of thousands of test particles, thus quantifying from a statistical viewpoint the possible behaviors of the asteroids that escape from the main belt and become NEAs. Using this modern statistical approach, it has been recently possible to construct a model of the unbiased orbital and size distribution of the NEAs, calibrated on Spacewatch discoveries (Bottke et al., 2000). This model allows to estimate the total number of NEAs of a given magnitude, the relative repartition of the NEAs in Aten, Apollo, and Amor populations, the impact rates on the terrestrial planets and the relative importance of the major transport routes.