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土星・木星の散乱による小惑星の不規則衛星への進化

Evolution of asteroids into the irregular satellites due to the scattering by Jupiter and Saturn

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We have investigated the possible origin of the irregular satellites in the asteroid belt. The irregular satellites might not be formed by accretion in a circumplanetary disk, as were the regular satellites. The inclination distribution and large semimajor axes of the irregular satellites tell us that they must have formed elsewhere and later been captured into their current orbits around their host planets. The original places where irregular satellites were formed have not been clarified so far. However, their low albedo (around 0.05) derived from the observations may indicate that they are physically similar to asteroids rather than Kuiper belt objects. Our study has been started on this observational indication.
How many asteroids have been transported near Jupiter/Saturn? What is the Jupiter/Saturn ratio? To answer these questions we calculate the orbit of mass-less particles initially distributed around the asteroid belt (2-5AU) under the perturbations by Jupiter and Saturn. Jupiter and Saturn have their current masses and in circular orbits with their current semimajor axes. These two planets have no gravitational interaction between them (so-called restricted circular 4-body problem). During the calculation, we count the number of encounters of the particles within the Hill radii of Jupiter and Saturn as the irregular satellite candidates (hereafter J-, S-candidates).
We find that (1) asteroids can be transported near both Jupiter and Saturn, (2) the number of J-candidates is about three times larger than that of S-candidates, and (3) the orbital distribution has some differences between J- and S-candidates.
On our poster paper, we will show the detailed results and discuss the consistency of the produced candidates by our calculations and the observational results referring to the scenario of the long-term dynamical evolution of the captured objects around planets proposed by several authors so far.

キーワード:不規則衛星,起源,軌道進化,小惑星

Keywords: irregular satellites, origin, orbital evolution, asteroids