The Saturnian satellites and possible effects of the planetary migration

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Our knowledge on the Saturnian inner satellites has increased a lot, especially after Voyager mission. Most probably, this increase will be even more pronounced after the recent Cassini-Huygens mission. From dynamical point of view, the large amount of new data provided by Cassini, certainly will give a significant impulse on the study of the Saturnian inner satellites. Of course, for clear reasons, the purpose of these missions cannot include the outer satellites. Therefore the study of the close satellites grows fast and usually neglects completely the outer group of satellites. In this work we analyze the dynamics of these outer satellites and we point out some possible scenario which might have occurred in the past: a direct interaction between the orbits of the outer and inner satellites of Saturn. According to many authors, it is well agreed that in the past the giant planets suffered the phenomenon of the migration. Very roughly speaking, the interaction between the protoplanets and the planetesimals during the early stage of the solar system, caused significant displacements in the primordial configuration of these planets. As a consequence, it is also well agreed that the planets spent some non negligible time in resonant configurations, mainly Jupiter and Saturn . The aim of this work is to analyze the effect of the 2S:1J resonance on the outer and retrograde satellites of Saturn. Assuming primordial satellites we show that even starting with small eccentricity (0.1), very soon their orbits become very eccentric and in about 5 My, in many cases, 50% of them are depleted or collide with Saturn. Before the collision or before being ejected, these satellites can cross very easily the orbits of the inner group. Therefore, several close approaches between these two groups or even some collision between satellites might have occurred in the past. Of course, the consequences are significant depending on the masses. Preliminary results show that the effects of 5S:2J and 2S:1J resonances are almost comparable. Our numerical experiences show that in opposition to Saturn's satellites, Jupiter's outer satellites are much more stable and they almost do not feel the consequences of the 2S:1J or 5S:2J resonances. Had the planets faced these kind of resonances, our results show that, the inner and the outer group suffered some important interactions in the past. Also it seems that some differences and constraints in the origin of the current satellites of Jupiter and Saturn might exist. The study of the outer satellites of Neptune and Uranus is in course.