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Chaotic Long-term Dispersion of Jovian Retrograde Satellite Orbits

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Abstract

The dynamical time evolution of jovian irregular satellites is mainly governed by solar and planetary gravitational perturbations and the satellite orbits are expected to exhibit chaotic dynamics to some degree. Usually chaotic motion arises from the existence of nearby orbital resonances (i.e mean-motion and secular resonances) and their possible overlap, which results in changes in a satellite's proper elements over time. For the retrograde jovian satellites several clusters have been identified, most likely pointing to past collisions. At the current time a kinematic conundrum exists: These clusters exhibit an excess in their observed velocity dispersion. To reconcile their observed velocity fields with laboratory and hydro-code experiments on the collisional fragmentation of small bodies, an additional dynamical mechanism is required to further disperse a post-collisional satellite cloud. We have applied the MEGNO technique to map the locations of solar mean-motion resonances and planetary secular resonances in the vicinity of retrograde satellites. These have been followed up with long-term numerical integrations of synthetic satellite clusters to ascertain whether these resonances can introduce sufficient orbital dispersion to explain the observed orbital distribution of jovian retrograde satellites. The results of these experiments will be presented and discussed at the meeting.