Rotation Period Clustering for Asteroid Family's Members

Kang-Shian Pan[1]; Chan-Kao Chang[1]; Hsing-Wen Lin[1]; Win-Huen Ip[1]
[1]*Graduate of Institute of Astronomy, NCU*

The Slivan state describes the spin vector alignment of asteroid family's members as a function of size and difference of the semimajor axis with respect to the central value. The Yarkovsky effect due modification of the asteroidal orbits by solar radiation is believed to be the main driving mechanism. It was first discovered in the Koronis family. Among 10 members examined, six of them have retrograde rotation with periods either < 5 hr or > 13 hr. The other four have prograde rotation with the rotation periods clustering between 7 and 10 hr. However, except for the Koronis family, very few other asteroid families have been tested for such spin vector alignment distribution due to the difficulty of obtaining asteroid spin vectors from photometric lightcurve. Here we propose a new approach to test the existence of Slivan state in asteroid families. Considering that the Yarkovsky effect moves the asteroids with prograde sense rotation outward and the asteroids with retrograde sense of rotation inward, we can expect that the family members with smaller semi-major axes should have retrograde rotation with period distribution characterized by being either <5 hr or > 13 hr. On the other hand, the family members with larger semi-major axes should have prograde rotation with periods 7-10 hr - if the Slivan state exists. Moreover, such rotation period clusterings should only appear in old asteroid families, because the timescale to reach the Slivan state is about Gyr. We apply this idea to the light curve analysis of 25 asteroid families using the iPTF asteroid rotation periods data. We also studied the period clustering ratio in the spin-rate distributions for the families. Both of the results showed that the Slivan state may not exist in most of the family members because of other physical effects such as impact collision.