NUCLEAR MAGNITUDES OF SHORT-PERIOD COMETS

Julio A. Fernández[1], Gonzalo Tancredi[1], and Javier Licandro [1,2]

We analyze a sample of absolute nuclear magnitudes (H_N) of short-period (SP) comets (periods $P <$ 20 years) measured after 1950 and that appear in the literature or have been determined by our group. Measurements from different observers are compared and, according to their internal consistency and the circumstances of the observations (heliocentric distance, degree of activity of the comet), we evaluate how close an estimated nuclear magnitude can be to the true magnitude of the comet nucleus. We define three quality classes that reflect the different degrees of uncertainty of the adopted magnitudes. We present a catalog of nuclear magnitudes of SP comets containing about 60% of the total observed sample.

We find that most of the observed absolute nuclear magnitudes are in the range 15–19, which would correspond to nuclear radii between 0.5 km and 3.3 km for an assumed geometric albedo of 0.04. We find no comets fainter than magnitude 19–19.5, which might indicate either increasing difficulties in their detection and/or a true scarcity of small SP comets. The latter is especially relevant, since it would indicate a physical limit of about 0.5 km radius for the survival of a comet in the Sun's vicinity, at least in its active phase. From our sample of absolute nuclear magnitudes we find that the cumulative mass distribution of comet nuclei follows a power law of index −0.8, which turns out to be similar to that of main-belt asteroids, though somewhat steeper than that of the near-Earth asteroids. We find that most SP comets with perihelion distances $q > 2$ AU are brighter than $H_N = 17$, suggesting that a very small fraction (a few percent) of the population of SP comets with large q has so far been detected. These observations suggest a rapid increase in the number of SP comets with increasing q, which would place the total population of SP comets (interior to Jupiter's orbit) at several thousand members.

[1]Departamento de Astronomía, Facultad de Ciencias, Montevideo, Uruguay

[2]Observatorio Astronómico Los Molinos, Montevideo, Uruguay

THE DYNAMICS OF VERY-HIGH-ECCENTRICITY LIBRATIONS

Sylvio Ferraz-Mello[1] and Claudia M. Giordano[2]

The analytical modeling of the planar motion of high-eccentricity asteroids near first-order resonances has been possible only very close to the so-called centers of libration, that is a situation in which the longitudes of the asteroid and Jupiter and the perihelion of the asteroid are such that the angle

$$\theta = (p+1)\lambda_{Jup} - p\lambda - \varpi$$

(p integer) is very close to zero.

In this communication, the theory is reformulated in order to avoid the strong restrictions imposed on θ. The new theory is not limited to the immediate neighborhood of stationary solutions and gives complete formal solutions of the averaged motion.

The theory uses an integrable intermediary — the Hori's kernel— which is not only a good approximation of the given system, but tailored so as to have a more simple topology and, as a consequence, such that the integration may be done in terms of elementary functions. The complete formal solutions obtained with this tailored Hori's kernel allow us to improve the analytical laws of the motion governing the libration of a resonant asteroid.

[1]Instituto Astronómico e Geofísico, Universidade de São Paulo, São Paulo, Brazil

[2]Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata, La Plata, Argentina. PROFOEG