Evolution of the shape and the axial moment of inertia of comet 67P/Churyumov-Gerasimenko

B. Dziak-Jankowska (1), J. Leliwa-Kopystynski (1), M. Królikowska (2)

(1) University of Warsaw, Institute of Geophysics, ul. Pasteura 7, 02-093 Warszawa, Poland, (2) Space Research Centre of the Polish Academy of Sciences, ul. Bartycka 18A, 00-716 Warszawa, Poland

We study the evolution of nucleus shape of a short-period comet 67P/Churyumov-Gerasimenko. Our goals are to calculate numerically the changes of the moment of inertia due to water ice sublimation and due to blowing out the dusty component. The past and future dynamical evolution of Churyumov-Gerasimenko orbit was calculated within the time interval of (-2000, +200) years, therefore about 400 orbital periods. Cometary motion have been integrated numerically using recurrent power series method and taking into account the perturbations by all the nine planets. It is assumed that the orbital elements remain unchanged during each individual orbital revolution. Comet is orbiting on the fixed orbit until the point in the 'vicinity of aphelion' of this orbit; next it jumps to the new orbit to the point in the 'vicinity of the new aphelion'. The orbital jump, as it appears in the vicinities of aphelion points, is related to the negligible-week, jump-like, changes of the sublimation. The change of orbit is accompanied by changes of the inclination of the nucleus rotation axis to the orbital plane. However, axis of angular momentum is conserved in space. Inclination of the rotation axis to the ecliptic plane is one of the parameters. The second parameter is related to the orientation of the rotation axis in the perihelion passage. Several pairs of this dynamical parameters were applied in order to choose the best fitting to the observational data. moreover the physical parameter (the heat conductivity coefficient) of the model is also tested to give results consistent with the available observations. The nucleus is assumed to be initially spherical. The dust to ice mass ratio is equal to one. The whole surface of the comet nucleus has the same 'mean' activity, it means the surface has no active and passive areas. The nucleus surface is divided into equal-area parallel strips corresponding to different intervals of cometographic latitude. Next, the strips are divided by the meridian network. So, the surface of the nucleus is divided on the courvelinear quadrangles. For each quadrangle the insolation and next the sublimation flux are calculated.