A new model of physical evolution of Jupiter-family comets

H. Rickman[1,2], S. Szutowicz[1], and K. Wójcikowski[1]

[1]Space Research Centre Polish Academy of Sciences, ul. Bartycka 18A, 00-716 Warszawa, Poland
[2]Dept. of Physics and Astronomy, Uppsala University, Box 516, SE-75120 Uppsala, Sweden

We aim to find the statistical physical lifetimes of Jupiter Family comets. For this purpose, we try to model the processes that govern the dynamical and physical evolution of comets. We pay special attention to physical evolution; attempts at such modelling have been made before, but we propose a more accurate model, which will include more physical effects. The model is tested on a sample of fictitious comets based on real Jupiter Family comets with some orbital elements changed to a state before the capture by Jupiter. We model four different physical effects: erosion by sublimation, dust mantling, rejuvenation (mantle blow-off), and splitting. While for sublimation and splitting there already are some models, like di Sisto et. al. (2009), and we only wish to make them more accurate, dust mantling and rejuvenation have not been included in previous, statistical physical evolution models. Each of these effects depends on one or more tunable parameters, which we establish by choosing the model that best fits the observed comet sample in a way similar to di Sisto et. al. (2009). In contrast to di Sisto et. al., our comparison also involves the observed active fractions vs. nuclear radii.

Acknowledgements: This work was partially supported by Grant No. 2011/01/B/ST9/05442 of the Polish National Science Center.

References: Di Sisto, R.P.; Fernández, J.A.; Brunini, A., 2009, Icarus 203, 140-154