ANALITYCAL MODEL OF IMPACT DISRUPTION AND ITS APPLICATION FOR SMALL ICY SATELLITES.
J. Leliwa-Kopystynski[1], M. J. Burchell[2] and I. Wlodarczyk[3]. [1]University of Warsaw, Institute of Geophysic, Pasteura 7, 02-093 Warszawa, Poland, jkopyst@mimuw.edu.pl, [2]Centre for Astrophysics and Planetary Science, School of Physical Sciences, Univ. of Kent, Canterbury, Kent CT2 7NH, United Kingdom, M.J.Burchell@kent.ac.uk, [3]Chorzow Astronomical Observatory, Al. Planetarium 4, 42-500 Chorzow, Poland, astrobit@ka.onet.pl.

Introduction: An analytical model of impact disruption of bodies with size from the laboratory scale to the scale of an order of 100 km is developed. On the lowermost end of the target size the model is based on laboratory data related to the size distribution and to the velocity of the impact produced fragments. On the planetary scale the model is based on data related to the largest observed craters on small icy satellites and on some asteroids [1]. The model takes into account the target disruption and the dispersion of the impact produced fragments against the intermolecular forces acting on the surfaces of the contacts of the fragments and against self-gravitation of the target. The head-on collisions of non-rotating and non-porous targets and impactors are considered. The impactor delivers kinetic energy but its mass is neglected in comparison with mass of the target. For this simple case the analytical formulae are found for specific disruption energy as well as for specific energy of formation of the largest craters. They depend on a set of parameters. The most important (i.e. the mostly influenced on the final result) are four rather weakly known parameters. They are: (i) The exponent γ in the distribution function of the fragments, (ii) The characteristic velocity v_0 involved into the velocity distribution of the ejected fragments, (iii) The exponent β in this distribution, (iv) The size μ of the smallest fragments ejected. An influence of the choice of the numerical values of these parameters on the final results has been studied in their large intervals. The other group of parameters are the material data: (j) The energy σ of breaking of intermolecular bonds of target material per the unit of a fragment surface, (jj) The density of target and these of impactor.

Results: An application of the results for impact cratering and/or for disruption of satellites and asteroids requires data concerning the impactor energy. We have considered rocky-rocky impacts (an asteroid on an asteroid) and icy-icy impacts (icy satellite impacted by a comet or by a circumplanetary icy object; KBO impacted by KBO). Each of these type of impacts requires an appropriate choice of impact velocity [2]. Hypothetical impacts onto Phoebe, Mimas and Miranda were discussed as the examples. The case of Miranda could be intermediate between 'the largest crater producing impact' and 'the catastrophic impact': An impact that disrupted proto-Miranda had not delivered enough energy to disperse the fragments against gravity.

References: [1] Leliwa-Kopystynski J. et al. (2008) *Icarus, 195*, 817-826, [2] Zahnle, K. et al. (2003), *Icarus, 163*, 263-289.

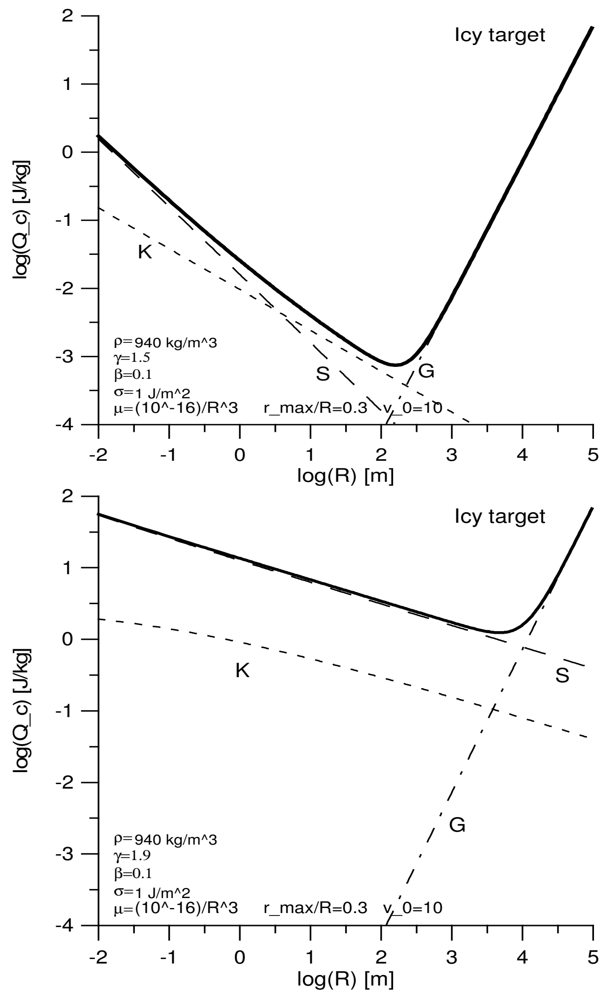

Fig. 1. Specific energy Q_c of formation of a crater with critical size (i.e. the largest crater that can be formed on the body). The letters are: G for gravity energy, S for surface energy, K for kinetic energy. Continuous heavy line is their sum. Upper panel for γ= 1.5, lower panel for γ= 1.9.