Title: Impact crater relaxation throughout the Solar System

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Abstract: In this thesis, we study the viscous relaxation of an impact-deformed icy shell of a dwarf planet Pluto. Motivation for this work is the position of Sputnik Planitia, a 1000 km wide, nitrogen-filled elliptic basin, which is located very close to Pluto-Charon tidal axis. Given this unlikely position on Pluto's surface, it was suggested that the basin was formed elsewhere and the whole body reoriented afterwards. For the reorientation to occur, the basin has to generate a positive gravity anomaly for which a combination of impact-related subsurface ocean uplift, ejecta blanket and accumulation of nitrogen ice was suggested. However, to maintain the orientation towards the minimum principal axis of inertia until today, the ocean uplift must be present on timescales of billions of years, which may be achieved due to an insulating layer of high viscosity clathrates at the ice/ocean interface. We solve Pluto's ice shell evolution by the finite element method in 2D spherical axisymmetric geometry with an evolving free surface and assuming a viscous rheology. Our results show that the thermal effect of the impact and nonlinear rheology can substantially decrease the relaxation timescale. It thus seems unlikely that the uplift would be stable long enough, even if the clathrates are present.

Keywords: Pluto, viscous deformation, crater relaxation, axisymmetric geometry