Geophysical Research Abstracts
Vol. 19, EGU2017-9612, 2017
EGU General Assembly 2017

The Crater Ejecta Distribution on Ceres

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Since March 6 2015 the Dawn spacecraft [1] has been in orbit around the dwarf planet Ceres. At small crater diameters Ceres appears to be peppered with secondary craters that often align in chains or form clusters. Some of such possible crater chains follow curved geometries and are not in a radial orientation with respect to possible source craters [2]. Ceres is a fast rotating body (∼9 h per revolution) with comparatively low surface gravity (∼0.27 m/s^2). A substantial fraction of impact ejecta may be launched with velocities similar to Ceres' escape velocity (510 m/s), which implies that many ejected particles follow high and long trajectories. Thus, due to Ceres' fast rotation the distribution pattern of the reimpacting ejected material is heavily affected by Coriolis forces that results in a highly asymmetrical and curved pattern of secondary crater chains. In order to simulate flight trajectories and distribution of impact ejected material for individual craters on Ceres we used the scaling laws by [3] adjusted to the Cerean impact conditions [4] and the impact ejecta model by [5]. These models provide the starting conditions for tracer particles in the simulation. The trajectories of the particles are computed as n-body simulation. The simulation calculates the positions and impact velocities of each impacting tracer particle with respect to the rotating surface of Ceres, which is approximated by a two-axis ellipsoid. Initial results show a number of interesting features in the simulated deposition geometries of specific crater ejecta. These features are roughly in agreement with features that can be observed in Dawn imaging data of the Cerean surface. For example: ray systems of fresh impact craters, non-radial crater chains and global scale border lines of higher and lower color ratio areas.
Acknowledgment: This work has been supported by the German Space Agency (DLR) on behalf of the Federal Ministry for Economic Affairs and Energy, Germany, grants 50 OW 1505 (NS, AN) and 50 QM 1301 (GM), and Helmholtz-Gemeinschaft (Helmholtz Association) PD-207 (KK). We thank the Dawn flight team for their excellent job of navigating and maintaining the probe.
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