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Geophysics of Ceres from Dawn

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Abstract

Dawn's 16-month investigation of Ceres will return comprehensive data elucidating its geology and morphology, composition, and gravity field. One of the objectives of the investigation is to understand Ceres' interior structure and the possibility of communication between the subsurface ocean, thought to have existed during the first half of Ceres' evolution, and the surface. Geophysical data collected to date provide a preliminary assessment of the structure and composition of the ice shell and implications for past mobility.

1. Introduction

Data collected by the Dawn spacecraft during Approach (beginning in January 2015), RC3 (April-May 2015) and Survey (August 2015) have produced a preliminary shape model [1] and gravity field [2], as well as image mosaics and compositional maps. These data have been examined for evidence of resurfacing, which would indicate mobility of the ice shell that may have brought material from the early subsurface ocean's floor to the surface and which might be continuing to the present day. The morphology of the surface, and in particular the impact basins, constrains the thickness of the ice shell. It also reflects the percentages of ice and rock in the outermost layer of Ceres, and the composition of the icy layer. This information illuminates the degree to which the deep silicate core has communicated with the surface.

2. Crater Morphology

The degree of cratering seen on the surface of Ceres is surprising given the expectation of a thick ice shell at the surface. At Ceres' surface temperatures, pure water ice would be quite weak and would not have retained the original morphology of the ancient impact basins [e.g., 3]. The large number of craters seen on the surface indicates that the near-surface layer is not as weak as pure water ice. The diversity of crater morphologies and their lateral heterogeneity indicates variations in the underlying ice shell. It is likely that rock fragments resulting from impacts, and/or ice that have been mixed with salts can explain the strength of the shell. We employ a finite element modelling code to examine the ice shell properties that could produce the observed morphology.

We will present geophysical modeling results and the inferences obtained on the ice shell of Ceres.

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References

[1] Preusker et al., [2015], Shape model and rotational state of dwarf planet Ceres from Dawn FC stereo images, this meeting

[2] Park, R. et al, [2015]. Gravity Science Investigation of Ceres from Dawn, this meeting.

[3] Bland, M., [2013], Predicted crater morphologies on Ceres: Probing internal structure and evolution. *Icarus* 226, 510-521.