



Correlation Between Ceres' Water Vapor Detections and Energetic Solar Proton Events

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Ceres was expected to be, and Dawn has confirmed, an ice-rich body. Prior to the Dawn mission, several attempts were made to detect exospheric water using terrestrial spacecraft around closest approach of Earth and Ceres. These attempts show the exosphere to be time varying. While it has been proposed that sublimation controls the presence of the exosphere, there is not a correlation between Ceres' heliocentric distance and the positive detections or the magnitude of the signal. Recently, Dawn indirectly twice sensed the presence of an exosphere through the presence of energetic electrons reflected at Ceres' bow shock surface; a shock which is created through the exosphere's interaction with the solar wind. Both these events were preceded by large solar proton events. This is important because water ice can be sputtered by these very energetic protons, the flux of which are highly variable. A solar proton event could produce a transient atmosphere that would last on the order of a week before it disappeared. We analyze the correlation between the observed production rates and the energetic proton flux preceding each observation using space-based measurements near 1 AU. We conclude that solar proton events occurred in conjunction with positive detections, and were absent during negative detections. Since Dawn has seen the same correlation and has not detected evidence for active plumes, optically or thermally, we conclude that the variability of solar energetic protons explains the transient behavior of the Ceres water exosphere.