EPSC Abstracts,
Vol. 2, EPSC2007-A-00093, 2007
European Planetary Science Congress 2007

The potential hazard to Cassini from small dust in Enceladus plumes

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The Cassini UVIS star occultations measure the water vapor in the Enceladus plume. UVIS measures water source large enough to create Saturn's neutral oxygen cloud and to re-supply E ring. UVIS column density is equal to about a single 1mm ice grain per square meter. A uniform source could loft ice particles of radius about 1 micron; higher density jets could loft particles dangerous to Cassini. Models proposed for the plume include the following: Fumarole model. Misty vapor cools as it expands; ice particles condense. [T $\sim$ 170K]. Geyser model. Local heating gives boiling water at depth, vent geometry gives vertical velocity, collimation; bubbles form and liquid freezes, effectively lofting larger particles to high speeds. [T $\sim$ 270K]. Comet model. Sublimating vapor lifts ice grains from vent interface and carries them away. [T $\sim$ 200K].

In all these models, there is a close coupling between the ice and vapor. Growth, lofting and/or evaporation involve an interchange between water molecules and solid ice particles. For any significant interchange of mass or momentum, the column of water vapor incident on an ice grain's surface area must have a comparable mass to the grain mass. Thus, the vapor measurements provide an estimate for the entrained solids. This is true as long as the mean values do not overlook high pressure jets, which could loft much larger and more dangerous particles. Heterogeneity in the occultation would be evidence for such jets. We present results from 2 independent searches, sensitive to events as small as 50m; opacity as small as 10%. We see no significant deviations from smooth variation

Outlier events have width less than 1km and opacity less than twice the mean. The

homogeneity of our results provides no evidence for high pressure vents.

Extrapolating Cassini plume measurements to rev 61 and to radius that is dangerous to Cassini, using the most favorable size range, provides a conservative estimate of the number of hits expected: The value is 0.2% or less. Better measurements of the size distribution and its opacity would improve the model.