

The Compositional Profile of the Enceladus Dust Plume II. Modeling

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Abstract

Prior compositional measurements of E ring grains with Cassini's Cosmic Dust Analyser (CDA) suggested salt-rich water as the dominant source of Enceladus' dust plume (Postberg et al. 2009, Nature). Although the E ring dust population is dominated by ice particles stemming from Enceladus, the relative abundance of various compositional types of grains might be expected to differ from the original plume grain ensemble owing to dynamical filtering in the plume (size-dependent ejection speeds). During 2008 and 2009 Cassini passed deep into the plumes on several occasions, allowing the CDA team to analyse the compositions of freshly ejected plume particles for the first time. Our modelling of the grain dynamics is consistent with the measured compositional profile of the plume if the population of freshly ejected grains is dominated by particularly sodium rich particles ($NaCl/H_2O \approx 10^{-3}$) which make only 5-10% of the ensemble seen in the E ring.