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Characteristics of charged dust inferred from the Cassini RPWS plasma measurements in the vicinity of Enceladus

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The data obtained by the Cassini Radio and Plasma Wave Science (RPWS) instrument during the shallow (17.02.2005) and the steep (14.07.2005) crossings of the E ring revealed a considerable electron depletion in proximity to the icy moon Enceladus. Simultaneous dust impact measurements by the Cosmic Dust Analyser (CDA) demonstrated the peak number density of micron particles. Following analogy with laboratory complex plasmas, where the negatively charged dust can lead to significant electron depletion, we associate the observed effect with increase of charged dust density. The link between the two physically independent RPWS and CDA data allows us to reconstruct the size distribution down to submicron range, i.e. outside the cutoff for dust impact sensors. We estimate the integral dust number density and discus the characteristic length scales of the dust structure formed around the Enceladus orbit. Remarkably such estimates are consistent with the corresponding numbers of the cumulative dust density for submicron particles predicted by the model for the formation of Enceladus's dust plumes (Schmidt et al. Nature, 2008, Fig. 3b). Moreover, our results imply that the dust structure near Enceladus is characterized by approximately the same vertical length scale and reaches a maximum at the same radial distance (displaced outward of the orbit of Enceladus) as was found from the CDA data by Kempf et al., Icarus, 2008.