

Negatively-charged particle pickup in the Enceladus plume

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Abstract

One of the key discoveries of the Cassini spacecraft's traverses of the Enceladus plume was that of negatively-charged nanograins and ions [1,2]. These particles are detected by the electron sensor of the Cassini Plasma Spectrometer, CAPS-ELS [3]. The trajectories of these charged particles are expected to be affected by the motional electric field in the vicinity of the moon, especially those of the low mass ions. During some Enceladus encounters, the particles have been observed arriving at the spacecraft in the local ram direction, i.e. close to being at rest with respect to Enceladus, presumably shortly after their formation and before the acceleration associated with the pickup process.

During other encounters however, the ions have been observed to arrive at the spacecraft well away from the ram direction, in the gyroplane at ~90 degrees to the local magnetic field direction, indicating their pickup by the local plasma flow. Here, we present an overview of observations of these negative pickup ions in the Enceladus plume, both at low mass/charge ratios and in the higher mass, nanograin range. We associate some variations in the observed pickup ion fluxes with known jets within the plume. With the aid of local variations in the penetrating background radiation, we constrain the likely sources of these particles.

References

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