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Nitrogen from Enceladus: CAPS-Cassini detection of N^+ in the inner magnetosphere

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Using our Saturnian magnetosphere neutral cloud models and data from the Cassini Plasma Spectrometer (CAPS), we describe the origin of low energy N^+ in Saturn's inner magnetosphere ($3.5 < L < 9.5$). While we initially searched for N^+ originating from Titan's nitrogen-rich atmosphere (Barbosa, 1987; Sittler et al 2004a; b; Smith et al, 2004), CAPS instead detected N^+ locally formed in the inner magnetosphere (Young et al., 2005; Smith et. al, 2005). Here we show that the principal source of these ions is material from Enceladus (Waite et al. 2005; Hansen et al 2005; Spahn et al. 2005) due to the 'jets' emanating from the south polar 'tiger stripes' that were seen in the Cassini ISS images. This ejection of gas and dust likely produces the relatively young surface on Enceladus (Verbischer et al. 2005) and the E-ring grains (Showalter and Nicholson 1991) as well as sustaining the neutral OH torus (Johnson et al. 2006) modeled by Jurac and coworkers (Jurac et al. 2002; Jurac and Richardson 2005). Here we assume the N^+ originates from a parent molecular species, either NH_3 or N_2, the latter detected by INMS near Enceladus (Waite et al. 2005). We use our neutral torus Monte Carlo model (Smith et al. 2004) to track molecules ejected either directly from Enceladus or locally from E-ring grains. These molecules are dissociated and eventually ionized producing the observed N^+. We then test the spatial distribution of simulated ion production rates to spatial distribution of detected N^+ densities in order to determine the likely parent molecule and whether they originate directly from Enceladus or are sputtered from a grain locally.

References

Barbosa, D.D., Titan’s Atomic Nitrogen Torus: Inferred Properties and Consequences for the Saturnian Aurora. *Icarus*. 72, 53-61, 1987.

Sittler, et al., Pickup ions at Dione and Enceladus: Cassini Plasma Spectrometer simulations, *J. Geophys. Res*. Vol. 109, A1., 2004a

Sittler, E.C et al, Energetic Nitrogen Ions within the Inner Magnetosphere of Saturn, *J. Geophys. Res*. Submitted, 2004b.

Smith, H.T., R.E. Johnson, and V.I. Shematovich, "Titan’s Atomic and Molecular Nitrogen Tori", *Geophys. Res. Lett*., Vol. 31, No. 16, L16804, 2004.

Young, D.T. et al, Composition and Dynamics of Plasma in Saturn’s Magnetosphere, *Science*, 307, 1262-1264, 2005.

Smith, H. T. et al, Discovery of nitrogen in Saturn’s inner magnetosphere. *Geophys. Res. Lett.*, Vol. 32, No. 14, L14S03

Waite et al. 2005; The Atmospheric Plume of Enceladus as Observed by the Cassini Ion Neutral Mass Spectrometer, In press *Science* 2005.

Hansen et al; Cassini ultraviolet imaging spectragraph (UVIS) investigation of Encealdus’ water vapor plume, In press, *Science* 2005.

Spahn et al., Cassini Dust Measurements at Enceladus:Implications for Saturn’s E Ring, In press, *Science* 2005.

Showalter and Nicholson, Saturn’s rings through a microscope - Particle size constraints from the Voyager PPS scan. *Icarus*, vol. 87, p. 285-306, 1990

Verbischer et al. Near-infrared spectra of the leading and trailing hemispheres of Enceladus, Submitted to *Icarus*, 2005.

Johnson et al. The Enceladus Neutral Cloud and the OH Torus, to be submitted 2006.

Jurac, S., et al, Saturn: Search for a missing water source. *Geophysical Research Letters*, Volume 29, Issue 24, pp. 25-1, 2002.

Jurac, S., J.D. Richardson. A self-consistent model of plasma and neutrals at Saturn: Neutral cloud morphology. *J. Geophys. Res., 2005*