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The Effect of Latitudinal Electron Temperature Variations in Saturn's Magnetosphere on the Diffusive Equilibrium Density Model

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Abstract

In the past twenty years, there have been several plasma density models derived from solutions to the full force balance equation for the plasma distribution along Saturn's magnetic field lines [1, 2]. All of the models have considered only the dominant cold electron component and have assumed that the electron temperature, an important variable in the ambipolar electric field force, is constant along the magnetic field lines. Recent Langmuir Probe measurements from the Radio and Plasma Wave Science (RPWS) instrument have shown that the cold electron temperature has a latitudinal temperature gradient which, at latitudes below 15^o, varies with distance from the equatorial plane as z^2/H^2, where H is the scale height. However, cold electron temperature measurements from the Cassini Plasma Electron Spectrometer (CAPS/ELS) indicate that there is no consistent increase in the cold electron temperatures above 20^o and that the hot electron temperatures have an inverse latitudinal gradient with the highest temperatures found at the lowest latitudes. A revised diffusive equilibrium density model will be presented, showing the effect of latitudinal variations in the electron temperature on the distribution of the plasma in Saturn's inner magnetosphere.

References

[1] Richardson, J.D. and Sittler, E.C. (1990) *JGR*, 95, 12,019-12,031.

[2] Persoon, A.M. et al. (2009) *JGR,114*, A04211, doi:10.1029/2008JA013912.