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Thermal electrons in Saturn's magnetotail

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In this paper we examine the structure and properties of thermal electrons between 0.5eV and 28keV in Saturn's magnetotail, as observed by the Cassini Electron Spectrometer (ELS). The spectral shape of electron distributions often indicate suprathermal tails well characterised by Kappa distributions. Moment integrations are performed and we study the distribution of electron number and energy densities in the tail plasma sheet. Most counts come from electrons in the 100-200eV energy range. Counting statistics and spacecraft potential measurements are used to place upper limits on the electron number density in the magnetotail lobes.

In equilibrium, the particle energy density at the centre of the plasma sheet should balance the magnetic energy density in the lobes bounding the sheet. We use the calculations of electron energy density, with some assumptions regarding the thermal ion energy density, to establish this pressure balance. We show that unlike the jovian magnetotail, energetic particles do not appear to contribute significantly to this pressure balance in the tail.

Using this understanding of the properties of electrons in the magnetotail, we examine the encounters with the plasma sheet and their relationship to current sheet crossings. The periodic encounters with the plasma sheet are discussed with reference to models of periodicities in Saturn's magnetosphere and different longitude systems that have been defined in recent years.