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The Scale Height of Charged Particles in Jupiter's Magnetosphere

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We have recently developed a new technique that uses the timings of any three consecutive current sheet crossings to determine the instantaneous motion of Jupiter's current sheet relative to the spacecraft. Using this information on the instantaneous location of Jupiter's current sheet, we have modeled the external field of the magnetic disc observed by Juno and Galileo spacecraft in terms of a Harris current sheet type equilibrium and obtained a map of the thickness of the Jovian current sheet over all local times and radial distances. Our modeling of Juno and Galileo magnetic field data shows that in all local times the current sheet thickness increases with radial distance. We also find that the Jovian current sheet thickness is highly asymmetric in local time, being at its thinnest in the dawn sector and the thickest in the dusk sector. The current sheet thickness on the dayside is comparable to that in the dusk sector. The nightside current sheet is intermediate in its thickness to the dawn and the dusk sectors.

In this presentation, we use the instantaneous location of the current sheet to model the electron densities measured by the plasma or plasma wave instrument. We show that overall, the scale height of electrons and the current sheet tend to be identical. However, we have encountered many cases where the electrons have a two scale-height structure where a thin plasma sheet is embedded within a thicker current sheet, the cause for which is not known. By using the magnetic field and electron density data, we have computed the plasma content of flux tubes in several local time locations in the magnetosphere. We relate the plasma content of these flux tubes to plasma rotation, plasma density and current sheet thickness. It appears that as flux tubes rotate to the dusk side, they slow down and the plasma scale height increases but the total plasma content remains constant.