

Modeling Saturn's magnetospheric field periodicities by a hinged rotating current sheet

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This talk presents an overview of periodic current sheet crossings observed by Cassini Magnetometer experiment. These crossings are marked by two reversals of the radial and azimuthal components of the magnetic field in each rotation period of Saturn. The crossings are reminiscent of magnetic field observations made by Voyager and Galileo spacecraft in the outer magnetosphere of Jupiter. For example, in both of the magnetospheres, the duration between successive current sheet crossings is determined by the latitude of the spacecraft with respect to the average location of the current sheet. Similarly, in both of the magnetospheres, the magnetic field is much more disturbed and reaches a minimum in the current sheet. This comparison suggests that a tilted rotating current sheet is a valid explanation for the observed periodicities of the magnetic field data from Saturn's magnetosphere.

A statistical analysis of parameters like the radial distance, latitude, longitude and local time of the spacecraft shows that the current sheet crossings are observed over all local times and radial distances. The preferred longitudes of current sheet crossings is determined by the spacecraft latitude with respect to the current sheet.

We are using a global model of Saturn's magnetosphere to understand the magnetic field observations. We have now introduced a tilt in the current sheet of the global model to show that the periodic magnetic field data can indeed be quantitatively modeled by a tilted current sheet. We show that a large tilt, of the order of 10 degrees is required to explain the magnetic field data. We explore different physical mechanisms that can explain such a large tilt in the Saturnian current sheet.