



## Local Time Asymmetries in Saturn's magnetosphere

Krishan Khurana and Jiang Liu

Dept. of Earth, Planetary and Space Science, UCLA, Los Angeles, CA, United States (kkhurana@igpp.ucla.edu)

Saturn is the second largest planet of the solar system (radius = 60,330 km) and possesses a moderately strong internal field (surface equatorial strength = 0.2 Gauss) which is exceedingly axially symmetric and devoid of a measurable tilt. The role of Saturn's rotation in powering its magnetosphere is well known. However, there is intense debate on whether the solar wind driven convection plays a substantial role in Saturn's magnetospheric dynamics. Jupiter's magnetosphere is a very close analogue of Saturn's magnetosphere, as both magnetospheres are large, are populated by internal plasma sources and derive most of their energy from planetary rotations. In Jupiter's magnetosphere, it has been shown that major local time asymmetries exist in the middle and inner magnetosphere suggesting that solar wind plays a substantial role in redistributing plasma in the magnetosphere, determining the plasma sheet thickness and reconnection geometry in the outer magnetosphere.

As Saturn's dipole axis is aligned with its rotation axis, the current sheet does not move appreciably up and down and any spacecraft crossings of the current sheet are extremely slow. Harris current sheet equation (which assumes that the ring current strength is constant with radial distance) is a poor approximation to the observations and provides spurious current strength and current sheet thickness estimates. We have developed a new technique that generalizes the Harris current sheet equations using Euler potentials that allows radial variations in the strength of the azimuthal current using the formalism of Goertz,(1976) and Khurana (1997).

In this presentation, I will present results from this new technique and summarize our findings on local time asymmetries (with a special focus on the dawn-dusk asymmetries) of the current sheet thickness, asymmetries of the height integrated azimuthal and radial electric currents in Saturnian magnetospheres. I will next discuss if these asymmetries could arise merely from the Chapman-Ferraro currents flowing on Saturn's magnetopause or require an active role of solar wind driven electric field in their generation.

### References:

Goertz, C. K., D. E. Jones, B. A. Randall, E. J. Smith, and M. F. Thomsen, Evidence for open field lines in Jupiter's magnetosphere, *J. Geophys. Res.*, 81, 3393, 1976.

Khurana, K. K., Euler potential models of Jupiter's magnetospheric field, *J. Geophys. Res.*, 102, 11,295, 1997.