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Cassini Multi-instrument Assessment of the Open-closed Field Line Boundary of Saturn's Magnetosphere

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Abstract

In gas giant magnetospheres the balance between external solar wind driving and internal driving due to the planet's rotation is a critical issue which needs to be addressed. Following the high-latitude orbits of Cassini during 2006/7, 2008 and 2009 a region where magnetic field lines are "open" to the solar wind has been tentatively identified at Saturn. However, precisely where and how the open-closed field line boundary is determined from the various in situ instrument data sets has not yet been systematically investigated. Here we present a Cassini multi-instrument assessment (using magnetic field analysis, CAPS-ELS electrons, MIMI-LEMMS electrons, Langmuir Probe electron density, and RPWS measurements of the auroral hiss) of the location between "open" and "closed" magnetic field lines for the high-latitude orbits. We

discuss the extent to which the different instruments can locate a common boundary and identify the average co-latitude of the boundary region in each hemisphere. The average co-latitude of the upward field-aligned current region is identified equatorward of the open-closed field line boundary in each hemisphere. There is possible evidence of displacement of the boundary equatorward towards midnight in both hemispheres indicating a local time dependence of the boundary location. Variation in southern co-latitude of the open-closed field line boundary with respect to the southern magnetic oscillation phase is shown to follow a sine relationship with an amplitude of ~2.4° co-latitude. Initial investigation shows no clear relationship in ordering the data by the northern magnetic oscillation phase.