ROTATIONAL PERIODICITIES IN SATURN'S MAGNETOSPHERE

PONTUS C. BRANDT 1, D. G. Mitchell 1, K. K. Khurana 2, B. Zieger 3, K. C. Hansen 3, C. P. Paranicas 1, J. F. Carbary

1. The Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA, email: pontus.brandt@jhuapl.edu
2. University of California Los Angeles, Los Angeles, USA.
3. University of Michigan, Ann Arbor, MI, USA.

A central question for Saturn's magnetospheric dynamics is the origin of periodicities close to the presumed rotational period of Saturn (~10.8 h). Periodic oscillations are observed in the magnetic field, particles, Saturn kilometric radiation (SKR) and more. We discuss the possibility that all periodicities are likely to have one common cause: periodic plasmoid release from the night side sector. The rapid magnetic field reconfigurations following the plasmoid release energize charged particles and create the large scale "injections" that are clearly seen in energetic neutral atom (ENA) images observed by the INCA camera on board Cassini. We further show that the magnetic field oscillations and SKR can be explained by the currents driven by the injected and energized plasma pressure distribution drifting around Saturn. The evolution of these pressure-driven currents is consistent with the evolution of the SKR. To quantify the magnetic field oscillations we estimate the distribution and strength of the plasma pressure from Cassini/MIMI and CAPS observations of hot and cold plasma. An important constraint is the how the magnetospheric dynamics respond to variations in solar wind dynamic pressure (SWP). In order to quantify this constraint we use SWP measurements from when Cassini is in the solar wind as well as model propagated solar wind properties to investigate how periodicities vary as a function of SWP. We further speculate that the ultimate cause of the periodic plasmoid releases is an effect of the inherent stability of the cold plasma without the need of a longitudinal "anomaly" tied to the planet's core or ionosphere.

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Pontus C. Brandt, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723, USA, email: pontus.brandt@jhuapl.edu