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Jupiter's Magnetospheric Dynamics: Evidence of Solar Wind Driving?

M. F. Vogt (1), E. J. Bunce (2) and E. A. Kronberg (3)
(1) Boston University, USA, (2) University of Leicester, UK, (3) Max-Planck-Institut für Sonnensystemforschung, Germany (mvogt@bu.edu)

Abstract

Jupiter's magnetosphere is a highly dynamic environment. Analysis of magnetic field and particle measurements collected by the Galileo spacecraft in Jupiter's magnetotail has shown evidence of hundreds of reconnection events [3,7]. It has long been suggested that Jupiter's magnetospheric dynamics are controlled primarily by rotational stresses, rather than by the solar wind, due to the rapid planetary rotation period and large spatial scales [6]. Such an internally-driven mass loading and release process is expected to occur with a typical 2-4 day recurrence period. Quasi-periodic behavior, suggestive of reconnection, has been observed on a similar time scale intermittently in several data sets, including magnetic field dipolarizations, flow bursts, and the hectometric radio emissions [4,5]. However, several questions remain unanswered, including why some specific spacecraft orbits were particularly dynamic (such as Galileo orbits G2 and G8), why the periodicity is not always observed, and why the characteristic time scale varies from ~1 to 7 days when the periodicity is present. One possible explanation is that the periodic magnetospheric reconfigurations may be modulated by the solar wind, as seen in global MHD simulations of plasmoid release and other dynamics in the magnetospheres of both Jupiter and Saturn [1,2]. In this study we use the Michigan mSWiM propagated solar wind MHD model to estimate the solar wind conditions upstream of Jupiter. We make use of event association tests to determine whether there is a statistical link between Jovian reconnection events and solar wind compressions or other disturbed solar wind conditions. We also consider the possibility that varying solar wind conditions may alter the characteristic periodicity in Jupiter's magnetosphere. For example, we perform a Lomb periodogram analysis on the solar wind model data during both quiet intervals and intervals when quasi-periodic behavior is observed in the *in situ* magnetospheric data.

References

[1] Fukazawa, K., T. Ogino, and R. J. Walker (2010), A simulation study of dynamics in the distant Jovian magnetotail, J. Geophys. Res., 115, A09219, doi:10.1029/2009JA015228.

[2] Jia, X., K. C. Hansen, T. I. Gombosi, M. G. Kivelson, G. Tóth, D. L. DeZeeuw, and A. J. Ridley (2012b), Magnetospheric configuration and dynamics of Saturn's magnetosphere: A global MHD simulation, J. Geophys. Res., 117, A05225, doi:10.1029/2012JA017575.

[3] Kronberg, E. A., J. Woch, N. Krupp, A. Lagg, K. K. Khurana, and K.-H. Glassmeier (2005), Mass release at Jupiter: Substorm-like processes in the Jovian magnetotail, J. Geophys. Res., 110, A03211.

[4] Kronberg, E. A., J. Woch, N. Krupp, and A. Lagg (2009), A summary of observational records on periodicities above the rotational period in the Jovian magnetosphere, Ann. Geophys., 27, 2565-2573.

[5] Louarn, P., A. Roux, S. Perraut, W. S. Kurth, and D. A. Gurnett (2000), A study of the Jovian "energetic magnetospheric events" observed by Galileo: role in the radial plasma transport, J. Geophys. Res., 105, 13073-13088.

[6] Vasyliūnas, V. M. (1983), Plasma Distribution and Flow, in Physics of the Jovian Magnetosphere, edited by A. J. Dessler, p. 395, Cambridge Univ. Press, New York.

[7] Vogt, M. F., M. G. Kivelson, K. K. Khurana, S. P. Joy, and R. J. Walker (2010), Reconnection and flows in the Jovian magnetotail as inferred from magnetometer observations, J. Geophys. Res., doi: 10.1029/2009JA015098.