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Saturn's magnetospheric rotation after equinox and a possible influence by the Great White Spot

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Abstract

In this presentation we will show the rotational modulation of Saturn kilometric radiation (SKR) and Saturn narrowband emissions after equinox until early 2013. The rotation period of Saturn's magnetosphere was found to vary with time [1], and changing periodicities were identified in magnetic fields, radio emissions, and charged particles [2,3]. SKR acts as a good tracer of this rotation since these radio emissions have been observed almost permanently by the Cassini Radio and Plasma Wave Science (RPWS) instrument [4] in recent years.

The SKR period temporarily slowed down by ~0.5% from the end of 2010 until August 2011, when it shows a large discontinuity and jumps back to its previous period. This time interval of unusual SKR behavior exactly coincides with the occurrence of the so-called Great White Spot (GWS), a giant thunderstorm that raged in Saturn's northern hemisphere [5]. For several months in 2011, the visible head of the GWS had the same period of ~10.69 h as the SKR.

We suggest that there is a relation and that Saturn's magnetospheric periodicities are driven by the upper atmosphere [6]. The GWS was most likely a source of intense gravity waves that caused a global change in Saturn's thermospheric temperatures and winds. Gravity waves can propagate to high altitudes and produce significant drag on the mean zonal wind [7]. The resulting deceleration might have slowed down the SKR and the hypothetical ionospheric vortices, which, according to some models [8], are driving Saturn's magnetospheric periodicities.

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