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Dual periodicities in the flapping of Saturn's magnetodisk

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It is already common knowledge that Saturn's huge rotating magnetosphere forms a magnetodisk in the vicinity of the equatorial plane, and fields and particles exhibit rotational periodicities in all plasma parameters.
In the SKR emission two components were observed since 2007 that have different rotational modulation rates in north and south, and the two periods reversed in 2010 [Gurnett et al, 2010], a few months after the equinox. These two periods were found in several plasma measurements as well.
Arridge et al. [2011] proposed a simple structural model (SSM) to describe the flapping of the magnetodisk. This simple structural model established a connection between the periodic vertical motion of the plasma sheet and the periodic variation of the magnetic field, based on the southern SKR period. The SSM comprises two terms: one gives account of the average location of the magnetodisk describing its bowl shape supposedly as the result of the disk interaction with the solar wind, the second, periodic term superimposed on the first describes the flapping.
Here we propose a modification of the simple structural model of Arridge et al [2011]. The modification is based on the new results of Andrews et al. [2012] and Provan et al. [2012], who have shown that magnetic field modulation near the current sheet exhibits dual periodicities; and introduced new magnetic phase functions for the north and south modulations. Using the modified structural model, and using the dual periodicities for the magnetic field, we improved the fit for the flapping of the magnetodisk reported in Szego et al. [2012]. The flapping could be modelled with fewer parameters when the effect of both the north and the south magnetic field modulations were taken into account. The phase of the vertical motion of the disk in the time range DOY 092–285, 2009, around Saturnian equinox can be described using the phase parameters of the radial component of the magnetic field only. This new result demonstrates a much stronger coupling between the vertical motion of the central sheet of the magnetodisk and the radial magnetic field variation on the nightside than that previously believed.

References

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