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Observations of the Polar Flattening of Saturn's Magnetosphere using in-situ Cassini Data

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Abstract

For the first time, evidence for polar flattening of Saturn's magnetosphere has been observed using in-situ data obtained by the Cassini spacecraft during a series of high-inclination orbits between 2007 and 2009. This work builds on that of Kanani et. al (2010) who characterised the equatorial magnetopause. Following from those authors, we assume an equilibrium between the solar wind dynamic and static pressure (which Cassini is unable to measure directly), and the magnetic and plasma pressures inside the magnetosphere. This assumption thus allows us to estimate the upstream solar wind dynamic pressure for a series of magnetopause crossings, and hence to determine the expected location and shape of the magnetopause.
A clear divergence from the familiar axisymmetric models of the magnetosphere is observed between values of the Z coordinate in the KSM system of 14-26Rs, which may be characterised with an 'apparent flattening parameter' of 17-20% (representing a simple dilation of the nominal axisymmetric boundary along the Z_{KSM} axis).
The phase of the magnetic oscillation observed at Saturn has also been considered for each magnetopause crossing. The crossings at large Z_{KSM} were not at similar phases which indicates that the oscillation is not the cause of the flattening.

References

[1] Kanani, S. J., Arridge, C S, Jones, G. H., Fazakerley, A. N., McAndrews, H. J., Sergis, N., Krimigis, S. M., Dougherty, Michelle K., Coates, Andrew J, Young, D. T., Hansen, K. C., Krupp, N. et al., 2010, Journal of Geophysical Research, Vol. 115, 2010.