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Jupiter's magnetopause: A search for wave and reconnection signatures

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Abstract

Surface waves and magnetic reconnection are two key processes taking place at the planetary magnetopause. They allow the coupling, through energy (and particle) transfer, of the interplanetary medium and the magnetosphere. The relative importance of large scale Dungey reconnection and viscous interaction (including small-scale intermittent reconnection associated with Kelvin-Helmholtz vortices) are expected to be different at Jupiter compared to the Earth's case. Such differences would be due to the combination of a) a weaker solar wind pressure and Alfvén velocity as the distance to the Sun increases, b) a high- β plasma sheet, originating from Io's outgassing, which inflates the Jovian magnetosphere, c) the rapid rotation of the planet relative to its size (e.g. Desroche et al. 2012). Here we analyse the signatures of wave activity and reconnection on the magnetopause of Jupiter, based on magnetic field and energetic particle measurements from the successive spacecraft that explored the Jovian system.

Up to now, 7 spacecraft equipped with a magnetometer have crossed the Jovian magnetopause: Pioneer 10, Pioneer 11, Voyager 1, Voyager 2, Ulysses, Galileo and Cassini. We make use of several normal direction finding techniques, such as the Minimum Variance Analysis, in order to identify waves and Kelvin-Helmholtz vortices.

As far as the reconnection is concerned, small scale signatures of flux-tube events (FTEs) had been identified by Walker and Russell (1985), based on a limited data-set from the Pioneers' and Voyagers' fly-bys. Here we will extend this search to the extensive data-set from all the missions that explored Jupiter's system.

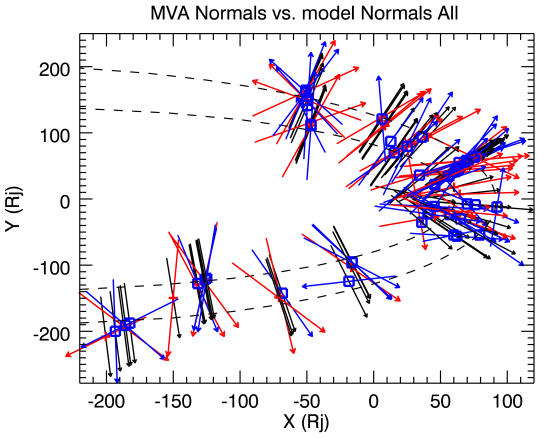

Figure 1: Orientation of the magnetopause normal in the XY plane (the Sun is on the right and dusk is towards the top). The coloured arrows are inferred from the measurements while the black ones correspond to the magnetopause shape model from Joy et al. 2002.

References

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