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Energetic Particle Evidence for Magnetic Filaments in Jupiter's Magnetotail

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Abstract

We will show that energetic ions with Iogenic composition are recurrently injected at 150 ± 30 R_J (R_J = 71,492 km) anti-sunward of Jupiter and funnelled down the magnetotail [1,2]. The particle events show velocity dispersion and were observed during the first half of 2007 [3] by the PEPSSI (Pluto Energetic Particle Spectrometer Science Investigation) instrument [4] on the Pluto-bound New Horizons (NH) spacecraft. Our survey to 2562 R_J down the magnetotail characterizes the behavior of ~few-keV – 1 MeV particles and their environment, yielding an estimate of the injection site location.

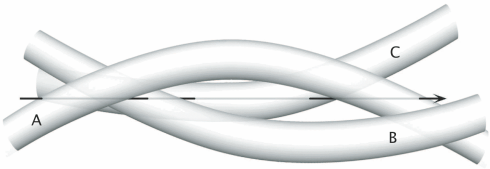

Figure 1: The New Horizons spacecraft passing through filamentary ~1 R_J-wide structures in Jupiter's magnetotail. This illustration is in qualitative agreement with observations during the 28 April 2007 events. NH enters tube A where PEPSSI detects the beginning of a dispersion event (a burst of Jovian and Iogentic particles). Then it leaves tube A and passes through tubes B and C, where other dispersion events are observed. Finally the spacecraft re-enters tube A where the end of the original dispersion event is seen. In addition to the overall observations of the dozen or so dispersive particle events, the timing and position of the boundary transitions and the dispersive activity during the 28 April events constrain the geometry and scale of the structures. Figure adapted from Hill et al. (2009)[2].

A case study of one of the most interesting events, beginning on day-of-year 118, 28 April 2007, contributes to the determination that the ~400 R_J-wide > 9000 R_J-long magnetotail is actually composed of narrow ~1 R_J-diameter filaments stretching down the tail (Figure 1)[1]. Reconciling this with the large (~500 R_J) plasmoid interpretation supported by the NH/SWAP (Solar Wind Around Pluto) [5] observations is an opportunity to greatly expand our understanding of the Jovian magnetotail and its particle dynamics. We will present our results and discuss the many intriguing open questions.

References

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