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Composite study of energetic ions, magnetic fields and plasma waves, detected by Cassini upstream from the Saturnian bow shock.

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Abstract

In July 2009 Cassini will have completed 5 years orbiting Saturn. During this time, the spacecraft spent more than 260 days in the solar wind and detected a number of energetic particle events, associated with IMF field fluctuations, unambiguous presence of O^+ ions and definitive plasma wave activity. Such events -first seen by Voyager- may appear in a periodic fashion, as some models predict for plasmoids within the magnetosphere, but are observed only if the projected IMF connects the spacecraft to the bow shock. We now report events observed in two different local time sectors: off the dawn bow shock and in the noon-to dusk region. The MIMI sensors (CHEMS, LEMMS and INCA) provide directional particle intensities, pitch angle distribution and ion composition of the ambient hot plasma, while the Radio and Plasma Wave Science experiment (RPWS) offers supplemental information on in-situ Langmuir waves at a few kHz, indicative of low energy (a few tens of keV) electrons travelling up from the planetary bow shock. The MAG measures the IMF magnitude and direction as well as low frequency fluctuations. Some of the examined events appear modulated at the planetary rotation period, but what remains uncertain is whether the events are always periodic if the IMF is connected to the bow shock continuously, indicative of plasma escape from the magnetosphere. Analysis of all available data and a statistical approach is employed to address this question, and relate the appearance upstream to magnetospheric activity manifested by ENA emissions.