



Cusp energetic ions as tracers for particle transport into the magnetosphere

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The magnetospheric cusps are focal points in studies of magnetic reconnection at the magnetopause and plasma entry into the magnetosphere. In addition to magnetosheath ions, the observations of energetic ions in the cusp regions (CEP) are still a matter of controversy. It has been suggested that these energetic particles with significant fluxes up to several hundred keV/e are accelerated locally in the cusp. An alternative explanation for the energetic particle events is that they are accelerated at the quasi-parallel bow shock, then transported downstream and enter the cusp along newly reconnected field lines or some other solar wind entry mechanism. Composition and energy spectra of these CEP's resemble those of bow shock energetic diffuse ions and support this model. Using recently developed techniques to determine the location of the reconnection site at the magnetopause, draping IMF field lines over the magnetopause and mapping those field lines back into the solar wind provides the connection between the cusp regions, the Earth bow shock and the upstream region. The Polar/TIMAS cusp pass in September 18, 1996 during variable IMF conditions is analyzed for patterns between the cusp, their connection to the upstream region and the appearance of energetic ions in the cusp. The analysis reveals that, when the cusp is magnetically connected to the quasi-parallel bow shock region, energetic ions can enter the cusp along the interconnected magnetic flux tubes. This method allows us to use energetic ions as tracers for plasma transport into the magnetosphere and better understand the magnetic topology between the solar wind and the ionosphere.