The Creation of Small Scale Pressure Pulses in Interplanetary Space: Magnetic Holes Detected at Cluster and Ulysses

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Magnetic holes (MHs) are regions of low magnetic field intensities and high plasma densities and temperatures that that are convected by the solar wind. The high densities will act as ram pressure pulses when they impact the Earth's magnetosphere. Such pulses can therefore create auroras in the dayside auroral zone and potentially trigger nightside substorms. It is argued that the Ponderomotive Force associated with phase-steepened interplanetary Alfvén waves can energize solar wind ions in a direction perpendicular to the ambient magnetic field. This heated plasma creates the magnetic holes through a diamagnetic effect, explaining the higher $T_\perp / T_\parallel$ ratio inside the MH compared to outside. We will discuss all of the above observations/mechanisms as well as yet unsolved mysteries such as how the PF can account for higher densities within MHs.

EGS-AGU Joint Assembly,
Nice, FR

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