Multipoint Observations of Non-stationarity of an Isolated Short Large-Amplitude Magnetic Structure

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Abstract

Short large-amplitude magnetic structures (SLAMS) are seen as critical elements in collisionless shocks with quasi-parallel geometries. They can pre-accelerate solar wind ions into suprathermal energy as an injection mechanism for Diffusive Shock Acceleration. To understand the details of injection problem, we present direct observations of nonstationarity of a SLAMS, using Magnetospheric Multiscale (MMS) measurement in a string-of-pearls configuration separated by several hundreds of kilometers. We find that the upstream edge of the SLAMS serves as a local quasi-perpendicular shock front to reflect and accelerate solar wind ions. Accumulation of reflected ions results in upstream expansion of the SLAMS. Whistlers grow quickly as the SLAMS ramp propagates towards upstream and distort the SLAMS in return. Both the non-stationarity and the cooperative roles of whistler waves contribute to the increase of efficiency of the ion injection process to Diffusive Shock Acceleration.

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