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Dissipation at the Earth's Quasi-Parallel Bow Shock: Cluster Observations of the Electric Potential and Ion Reflection Rates

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Short Large-Amplitude Magnetic Structures (SLAMS) are commonly observed at the Earth's quasi-parallel bow shock. These structures may play an important role for decelerating and deflecting the incident solar wind. In order to investigate the importance of SLAMS for thermalization in the foreshock region, we present multi-spacecraft measurements of the Cluster satellites. We study the electric potential over SLAMS in the Normal Incidence Frame Φ_{NIF}. We obtain a substantial electric potential Φ_{NIF} over SLAMS ranging from a few 100 V for small-amplitude SLAMS up to 1000-2500 V for large-amplitude structures. Comparing these results with data from the ion spectrometer, we find that SLAMS effectively reflect a substantial part of the incoming ions and slow down transmitted particles. In addition, at the trailing edge reflection of shock-reflected, upstream propagating, ions occurs. For large-amplitude SLAMS, the amount of reflected solar wind ions reaches values of 30%. Thus, SLAMS represent effective ion reflectors of both solar wind ions and shock-reflected ions and might play a significant role for dissipation upstream of, and at, the Earth's quasi-parallel bow shock.