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Shock Motion and Ion Acceleration at Current Sheets Downstream of the Bow Earth' s Bow Shock.

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At the Earth's bow shock, most of the solar wind's kinetic energy is partitioned into wave energy, particle acceleration, and heating. Very recent publications provide strong evidence that current sheets at the shock ramp region and downstream participate in the thermalization of the solar wind plasma. Their occurrence varies from single to multiple current sheets. What role do they play in downstream thermalization and ion acceleration?

We studied multiple bow shock crossings into the magnetosheath by the MMS spacecraft with its sophisticated instrumentation, characterizing and quantifying the occurrence of these current sheets, the associated magnetic field wave turbulence, and ion acceleration downstream of the shock. Shock traversals during increasing Mach number/dynamic pressure showed higher wave activity and broader distribution functions with suprathermal tails. Much less suprathermal ions downstream of the shock are observed at shock crossings during decreasing Mach numbers. These MMS observations show that current sheets and field gradients are associated with ion acceleration. The associated turbulence is likely a mediator for energy partition. With increasing Mach numbers, the bow shock moves away from the Sun and compresses the magnetosheath that favours reconnection of currents sheets, stronger electric field gradients and thus ion acceleration. With decreasing Mach numbers, the bow shock moves towards the Sun, becomes blunter, and the sheath region relaxes, making reconnecting current sheets less likely and smoothens field gradients resulting in less acceleration.