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Electron Kinetic Entropy Generation at Quasi-perpendicular Collisionless Shocks: Dependence on Shock Parameters

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We calculate the change in electron kinetic entropy, ΔS_e, across 22 supercritical quasi-perpendicular Earth bow shock crossings observed by the Magnetospheric Multiscale (MMS) mission. The crossings cover a wide range of shock parameters. We calibrate the measured distribution functions measured by MMS to correct for spacecraft potential, secondary electron contamination, lack of measurements at the lowest energies and electron density measurements based on the plasma frequency measurements. The change in electron kinetic entropy displays a strong dependence on the change in electron temperature, ΔT_e, and the upstream plasma beta. Shocks with a small upstream plasma beta have a large ΔS_e while shocks with high upstream plasma beta have a small ΔS_e.

The calculated changes in kinetic entropy, density and temperature are used to estimate the proxy adiabatic index, γ_e, for each shock crossing. The estimated adiabatic indices are all in the vicinity of 1.6, comparable to that of a monatomic gas with three degrees of freedom.