KINETIC SIMULATIONS OF CURRENT-SHEET FORMATION AND RECONNECTION AT A MAGNETIC X LINE

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The integration of kinetic effects into macroscopic numerical models is currently of great interest to the plasma physics community, particularly in the context of magnetic reconnection. We are examining the formation and reconnection of current sheets in a simple, two-dimensional X-line configuration using high-resolution particle-in-cell (PIC) simulations. The initial potential magnetic field is perturbed by thermal pressure introduced into the particle distribution far from the X line. The relaxation of this added stress leads to the development of a current sheet, which reconnects for imposed stress of sufficient strength. We compare the evolution and final state of our PIC simulations with magnetohydrodynamic simulations assuming both uniform and localized resistivities, and with force-free magnetic-field equilibria in which the amount of reconnection across the X line can be constrained to be zero (ideal evolution) or optimal (minimum final magnetic energy). We will discuss implications of our results for reconnection onset and cessation at kinetic scales in dynamically formed current sheets, such as those occurring in the terrestrial magnetotail and solar corona.

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