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Numerical Simulations of Fine Structures within Reconnecting Current Sheets in Solar Flares CHENGCAI SHEN, Harvard-Smithsonian Center for Astrophysics, JUN LIN, Yunnan Astronomical Observatory, NICHOLAS A. MURPHY, JOHN C. RAYMOND, Harvard-Smithsonian Center for Astrophysics —
Solar flares occur when magnetic energy is quickly converted into heat and kinetic energy by magnetic reconnection in a current sheet (CS). Based on 2D MHD experiments, we simulate the development of instabilities and turbulence in a long CS. The simulations start with a vertical current sheet that is in mechanical equilibrium and line-tied at the lower boundary. Reconnection commences gradually due to an initially imposed perturbation, but becomes faster when plasmoids form and produce small-scale structures inside the current sheet. These structures include magnetic islands or plasma blobs flowing in both directions along the sheet, and X-points between pairs of adjacent islands. The various properties of the energy conversion in the reconnection region are studied through performing a 1D Fourier analysis. The results display a power law distribution for the energy versus the scale of small structures inside the CS, suggesting that the reconnection process is turbulent.

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