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The mechanisms of electron acceleration during magnetic reconnection JAMES DRAKE, JOEL DAHLIN, MARC SWISDAK, University of Maryland — Magnetic reconnection is the dominant mechanism for dissipating magnetic energy in space and astrophysical systems and is an efficient driver of energetic particles. Models of flares with a single reconnection site fail to explain the large number of energetic electrons seen in flares. Reconnection in large systems spontaneously develops at multiple sites, producing large numbers of magnetic islands that dominate magnetic energy release. There are three basic mechanisms for particle energy gain in reconnecting systems: motion along parallel electric fields; and the magnetic curvature and gradient B drifts along perpendicular electric fields. The latter two produce the classical Fermi and betatron acceleration, respectively. In situ satellite observations in the magnetosphere suggest that Fermi reflection drives most ion heating. The observational evidence on electron heating is not as clear. Particle-in-cell simulations suggest Fermi reflection dominates the energy gain of the most energetic electrons. The production of energetic electrons in 3D simulations, where magnetic fields become stochastic, dramatically increases compared with 2D. An extension of the Parker transport model to describe reconnection-driven particle acceleration in macroscale systems has been developed.

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