Particle acceleration in simulated flux ropes formed by intermittent flare reconnection.

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Abstract: The mechanism that accelerates particles to the energies required to produce the observed high-energy impulsive emission in solar flares is not well understood. Drake et al. (2006) proposed a mechanism for accelerating electrons in contracting magnetic islands formed by kinetic reconnection in multi-layered current sheets. We apply these ideas to sunward-moving flux ropes (2.5D magnetic islands) formed during fast reconnection in a simulated eruptive flare. A simple analytic model is used to calculate the energy gain of particles orbiting the field lines of the contracting magnetic islands in our ultrahigh-resolution 2.5D numerical simulation. We find that the estimated energy gains in a single island range up to a factor of five. In order to increase their energy by two orders of magnitude and plausibly account for the observed high-energy flare emission, the electrons must visit multiple contracting islands. This mechanism should produce sporadic emission because island formation is intermittent. Moreover, a large number of particles could be accelerated in each magnetohydrodynamic-scale island, which may explain the inferred rates of energetic-electron production in flares. We conclude that island contraction in the flare current sheet is a promising candidate for electron acceleration in solar eruptions.