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Particle transport by flux rope kink instability and condition of power law spectra formation in 3D low beta magnetic reconnection QILE ZHANG, FAN GUO, HUI LI, BILL DAUGHTON, Los Alamos National Laboratory, XIAOCAN LI, Dartmouth College — Solar flare observations have suggested that magnetic reconnection in the non-relativistic low-beta regime efficiently accelerates particles and the resulting energy spectra often take a power-law. However, it has been difficult to produce a clear power-law in non-relativistic particle-in-cell (PIC) reconnection simulations. Recent progress on this has suggested that 3D physics may be a key to the power-law formation. Using a series of 3D PIC simulations with different domain sizes, we find that in the low guide field regime kink instability of reconnection flux ropes disrupts the close flux surfaces and enhance separation of magnetic field lines. This leads to efficient transport of energetic electrons out of the flux ropes and those electrons keep accessing the acceleration regions. The criterion of kink instability (safety factor at the edge of flux ropes less than 1) suggests a threshold for the dimension in the guide field direction for efficient acceleration and power-law formation.

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