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Nonthermal particle acceleration in 3D relativistic pair reconnection[1] GREGORY WERNER, DMITRI UZDENSKY, University of Colorado, VLADIMIR ZHDANKIN, MITCHELL BEGELMAN, JILA, University of Colorado, and NIST — Magnetic reconnection in relativistic pair plasma may power nonthermal high-energy flares in astrophysical sources (e.g., the Crab Nebula). Recently, 2D particle-in-cell (PIC) simulations have demonstrated nonthermal particle acceleration (NTPA) that could explain the observed nonthermal (i.e., power-law) photon spectra. However, 3D effects, such as the relativistic drift kink instability (RDKI), have the potential to disrupt NTPA. We present a systematic PIC investigation of 3D relativistic reconnection in collisionless pair plasma, showing that key observationally-relevant aspects of reconnection, such as energy dissipation rate and NTPA, are only weakly affected by increasing "3D-ness"–e.g., by increasing the simulation length in the third dimension or decreasing the guide magnetic field. NTPA remains a robust product of 3D reconnection, despite clear manifestation of the RDKI in the absence of strong guide field. While a strong guide field suppresses RDKI as expected, it also suppresses NTPA (in 2D and 3D), yielding power-law particle spectra with steeper slopes and lower cutoff energies; we conjecture that the effect of the guide field may be captured by including its enthalpy in the magnetization σ, which has previously been shown to affect the NTPA power-law.

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