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Non-thermal particle acceleration in relativistic, collisionless, electron-positron magnetic reconnection[1] GREGORY WERNER, DMITRI UZDENSKY, University of Colorado, BENOIT CERUTTI, Princeton University, KRZYSZTOF NALEWAJKO, MITCHELL BEGELMAN, JILA, University of Colorado, and NIST — Relativistic magnetic reconnection converts magnetic field energy to particle kinetic energy, and has been proposed to explain particle acceleration in pulsar wind nebulae (PWNe) and gamma ray bursts. Observable synchrotron and inverse Compton radiation from such sources depends on the resulting energy spectra of electrons and positrons. Our 2D reconnection simulations in relativistic, collisionless, electron-positron plasmas without guide field show that reconnection creates non-thermal particle distributions, with power-law energy spectra $dN/d\epsilon \sim \epsilon^{-\alpha}$ extending well beyond the mean dissipated magnetic energy per particle. For large system size L and upstream magnetization $\sigma \gg 1$, the power-law index is independent of L and σ: $\alpha \approx 1.2$. Decreasing σ, the power-law steepens to $\alpha \approx 2.3$ at $\sigma = 3$. We find that for large L, the power law cuts off at high energies as $\exp(-\epsilon/\epsilon_1)$; the cutoff ϵ_1 is proportional to σ but nearly independent of L. Small system sizes exhibit a super-exponential cutoff, $\exp(-\epsilon^2/\epsilon_2^2)$, with ϵ_2 proportional to L but essentially independent of σ. Implications for interpreting PWN observations will be discussed.

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