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Modelling Particle Acceleration in Kinetic Simulations of Relativistic Pair Plasma Turbulence[1] KAI WONG, University of Colorado, Boulder, VLADIMIR ZHDANKIN, Princeton University, DMITRI UZDENSKY, GREGORY WERNER, University of Colorado, Boulder, MITCHELL BEGELMAN, JILA — Magnetised turbulent astrophysical systems such as pulsar wind nebulae, accretion flows, and jets from active galactic nuclei generate nonthermal populations of relativistic high-energy particles. To understand the physical processes underlying nonthermal particle acceleration (NTPA) in these environments, we study 3D particle-in-cell simulations of driven turbulence in relativistic pair plasma. By tracking large numbers of particles, we obtain statistical measurements of NTPA and compare them to analytical theories. The NTPA can be described by a Fokker-Planck stochastic energy diffusion-advection model with energy-dependent diffusion and advection coefficients D and A. We investigate the dependence of D and A on the particle energy ϵ and on system parameters such as the initial magnetisation, instantaneous magnetisation σ, system size, and turbulence driving scale. In the nonthermal energy range, we find $D \sim \epsilon^2 \sigma^{3/2}$. We also investigate the time evolution of turbulent fluctuation spectra and the power-law index of the nonthermal particle energy distribution, and their relationship to D. These results shed light on the physical mechanisms and theories governing turbulent NTPA.

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