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Characterising Diffusive Nonthermal Particle Acceleration in Kinetic Turbulence of Relativistic Pair Plasma[1] KAI WONG, University of Colorado, Boulder, VLADIMIR ZHDANKIN, Princeton University, DMITRI UZDENSKY , GREGORY WERNER , University of Colorado, Boulder, MITCHELL BEGELMAN, JILA — Turbulent high-energy astrophysical systems such as pulsar wind nebulae and active galactic nuclei accelerate a substantial fraction of particles to nonthermal energies, as inferred from their emission spectra. Nonthermal particle acceleration in 3D particle-in-cell simulations of driven turbulence in relativistic pair plasmas is well-described by a Fokker-Planck energy diffusion-advection model in which particles receive stochastic energy kicks. This model is characterised by energy diffusion (D) and advection (A) coefficients, which are functions of particle energy ϵ. By tracking particles in the simulation, we study the dependence of these coefficients on key physical parameters including plasma magnetisation and the turbulence driving scale. We consistently observe that, at nonthermal energies, $D \sim D_0\epsilon^2$, in line with theoretical expectations. We find that the scaling factor D_0 increases as a power law function of magnetisation, and that it depends primarily on driving scale rather than system size. We also comment on the statistical properties of spatial transport. These results have implications for models of nonthermal particle acceleration in a broad range of high-energy astrophysical systems.

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Kai Wong
University of Colorado, Boulder

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