Abstract Submitted
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Discrete Particle Noise and Its Effects on Particle-in-Cell Simulations of Plasma Turbulence[1] G. HAMMETT, PPPL, W. NEVINS, A. DIMITS, D. SHUMAKER, LLNL, W. DORLAND, U. of Maryland — In order to understand the differences between gyrokinetic particle simulations and gyrokinetic continuum simulations of Electron Temperature Gradient (ETG) turbulence, we have investigated the role of discrete particle noise. A detailed theory of the spectrum of noise fluctuations in a gyrokinetic particle simulation has been developed. With no free parameters, this theory agrees very well both with the fluctuation spectrum and the transport levels observed at late times in gyrokinetic particle simulations when noise dominates. The theory also matches the simulations well as the average squared weight (and thus the fluctuation energy) is varied by a factor of 500 in noise restart tests. The theory is based on Krommes' calculation of the gyrokinetic noise spectrum[2], extended to include the effects of numerical filtering, finite-size particles, and a resonance-broadening type of renormalization of the dielectric shielding and of the test particle trajectories. The noise builds up in time in present δf algorithms and eventually becomes large enough in typical particle simulations to suppress ETG turbulence, thus explaining why they give lower transport levels at late times than observed in continuum simulations.

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[2]J.A. Krommes, Phys. Fluids B **5**, 1066 (1993).

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