Abstract Submitted
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Electron turbulence driven non-diffusive transport and intrinsic rotation in tokamaks[1] W.X. WANG, T.S. HAHM, PPPL, P.H. DIAMOND, UCSD, S. ETHIER, G. REWOLDT, W.M. TANG, PPPL — Global gyrokinetic simulations have found that meso-scale phenomena and associated nonlocal transport are largely enhanced in the trapped electron mode (TEM) turbulence regime due to strong coherent wave-particle interaction at the trapped electron precession frequency. Robust radial pinches in toroidal flow, heat and particles, which emerge "in phase" in collisionless TEM turbulence, are found to play remarkable roles in determining plasma transport. Particularly, toroidal flow perturbations, which are generated locally (in the center of the plasma in the simulation case) by the turbulence, are found to propagate radially. This result amazingly reproduces the experimental phenomenon of radially inward penetration of perturbed flows created by modulated beams in peripheral regions [1], and thus is highly illuminating. The revealed universal, nonlinear flow generation process due to the residual stress produced by the fluctuation intensity and the intensity gradient, acting with the zonal-flow-shear-induced $k_{//}$ symmetry breaking [2,3] offers an ideal mechanism to drive intrinsic rotation via wave-particle momentum exchange [4]. This turbulence driven intrinsic rotation scales close to linearly with plasma gradients and the inverse of the plasma current in various turbulence regimes, reproducing empirical scaling obtained in multiple fusion devices.

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