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Global gyrokinetic particle simulation of trapped electron mode turbulence ZHIHONG LIN, University of California, Irvine, YASUTARO NISHIMURA, IHOR HOLOD, GTC TEAM — Kinetic electrons have been implemented in our gyrokinetic toroidal code (GTC) using the fluid-kinetic hybrid electron model. Global nonlinear simulations of TEM turbulence have been carried out with contribution of kinetic electrons to zonal flows properly retained. The nonlinear electron dynamics is found to be constrained by the conservation of the second invariant, resulting in simultaneous diffusions of electron banana orbits in both energy and real space, which have not been studied in analytical theories or local simulations. Zonal flows with short radial wavelength are found to be generated in the TEM turbulence, and the electron contribution to the zonal flow generation is found to be larger than the ion contribution. The key difference between TEM and ITG is that the perpendicular wavelength of TEM can be on the order of ion gyroradius, which is much shorter than that of the ITG. E x B nonlinearity and ion polarization nonlinearity are therefore on the same order of magnitude, which invalidates the nonlinear analysis of ITG turbulence assuming time scale separation between these two nonlinearities.

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