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Gyrokinetic simulation of microturbulence in EAST tokamak

YONG XIAO, TAIGE ZHANG, CHEN ZHAO, Institute for Fusion Theory and Simulation, Zhejiang University — A complete understanding of anomalous transport is critical for designing future magnetic fusion reactors. It is generally accepted that the micro-scale turbulence leads to anomalous transport. For low beta toroidal plasmas, the electrostatic modes may dominate and ion temperature gradient (ITG) mode and trapped electron mode (TEM) are two very important candidates accounting for ion and electron turbulent transport respectively. Recently the massively parallel gyrokinetic simulation has emerged as a major tool to investigate the nonlinear physics of the turbulent transport. The newly-developed capabilities enable the gyrokinetic code GTC to simulate the turbulent transport for real tokamak plasma shape and profiles. These capabilities include a new gyrokinetic Poisson solver and zonal flow solver suitable for general plasma shape and profiles, improvements on the conventional four-point gyroaverage and newly-developed nonuniform initial marker loading. The GTC code is now able to import experimental plasma profiles and equilibrium magnetic field that come from the EFIT or TRANSP equilibrium reconstruction. Linear and nonlinear gyrokinetic simulations are carried out with the new capabilities in GTC for the electron coherent mode (ECM) recently observed in the EAST tokamak (EAST shot # 38300). We found that in the pedestal region with strong electron temperature gradient, the unstable waves propagate in the electron diamagnetic direction, showing a trapped electron mode (TEM) feature. It is also found in the collisionless limit, the linear mode frequency is higher than that from the experiment.

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