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Validation of Energetic Particle Transport in DIII- D Tokamak

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— First-principle global Gyrokinetic Toroidal Code (GTC) is employed to simulate the turbulent transport in fusion plasmas with realistic equilibrium and profiles of DIII-D discharges. In the linear simulations, ion temperature gradient (ITG) mode and trapped electron mode (TEM) are found dominant exactly as experimentally observed in two shots with low plasma temperature and high temperature, respectively. In the nonlinear simulations, electrostatic fluctuation intensity, energetic particle (EP) diffusivity and the perturbations in its density and temperature are analyzed in detail for both the low-temperature ITG and high-temperature TEM cases. For these two cases, energetic particle's diffusivity and density perturbation are almost on the same level in radial direction. This is in reasonable agreement with experimental results that no measured change of energetic particle transport is observed when dominant instability changes from low-temperature ITG to high-temperature TEM. The underlying mechanism responsible for these EP transport by background microturbulence is that the electrostatic fluctuation intensity spectrum in terms of perpendicular wavenumber are similar in nonlinearly steady stage for both low-temperature ITG and high-temperature TEM cases.

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