Global gyrokinetic simulations of electrostatic microturbulent transport using kinetic electrons in LHD stellarator

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Global gyrokinetic simulations of ion temperature gradient (ITG) and trapped electron mode (TEM) in the LHD stellarator are carried out using the gyrokinetic toroidal code (GTC) with kinetic electrons. ITG simulations show that kinetic electron effects increase the growth rate by more than 50% and more than double the turbulent transport levels than simulations with electrons treated adiabatically. Zonal flow dominates the saturation mechanism in ITG turbulence in LHD. TEM simulations show that the eigenmode is located at the outer mid-plane as in the ITG case. Nonlinear simulations of the TEM turbulence show that the main saturation mechanism is not the zonal flow but the inverse cascade of high to low toroidal harmonics. Further nonlinear simulations with different pressure profiles indicate that the ITG turbulence is more effective in driving heat conductivity whereas the TEM turbulence is responsible for the particle diffusivity.

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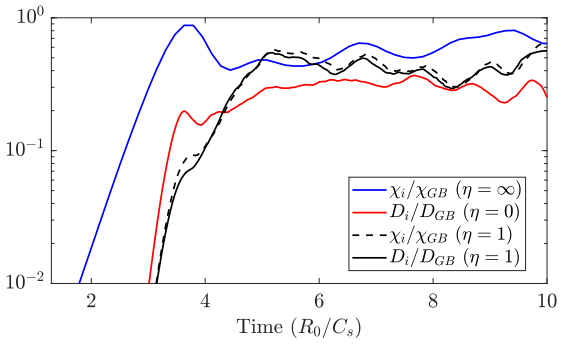

Figure 1: *The time history comparison of the transport averaged over* $\psi \in [0.19, 0.45]\psi_w$ *for* $\eta = 0$, 1, *and* ∞.