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Gyrokinetic theory and simulation of toroidal ETG turbulence and zonal flow T.-H. WATANABE, H. SUGAMA, National Institute for Fusion Science / The Graduate University for Advanced Studies, Japan, W. HORTON, Institute for Fusion Studies, University of Texas at Austin, USA — Electron temperature gradient (ETG) turbulence is considered as a plausible cause that is responsible for producing the anomalous electron heat transport in magnetic confinement fusion plasma. While linear mode properties of the electrostatic ETG and ITG (ion temperature gradient) instabilities are isomorphic, their different nonlinear saturation processes are associated with zonal flows. Here, the linear response of the zonal flow in the toroidal ETG system is analytically studied, and then, is verified by the gyrokinetic-Vlasov (GKV) simulation. While the residual zonal flow level has higher normalized amplitude than that in the ITG case, the nonlinear excitation of zonal flows by ETG turbulence is much weaker. Nonlinear saturation process of the toroidal ETG turbulence is also investigated by means of the GKV simulation performed on Earth Simulator. Large modulation of streamer-like potential structures of nonlinearly excited mode is clearly found in case with a wide flux tube simulation box. *Numerical simulations are carried out by means of Earth Simulator under the support by JAMSTEC and of Plasma Simulator at NIFS. This work is supported in part by grands-in-aid of the Ministry of Education, Culture, Sports, Science and Technology (No. 16560727 and 17360445) and by NIFS collaborative research programs.

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