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Gyrokinetic simulation of effects of zonal flows and equilibrium electric fields on ITG turbulence in FRC XISHUO WEI, WENHAO WANG, ZHIHONG LIN, University of California, Irvine — Gyrokinetic simulations of ion temperature gradient (ITG) in the scrape-off layer (SOL) of the field-reversed configuration (FRC) find that ITG saturates by self-generated zonal flows, which reduce ITG saturation amplitude, turbulence eddy size, and the ion heat flux. Zonal flows are mostly generated by nonlinear coupling of high-n modes (n is toroidal mode number) rather than modulational instability. Turbulence intensity and transport level continue to drop to very low level in the nonlinear phase since zonal flows are undamped in collisionless simulations with adiabatic electrons. Zonal flows can be damped by collision operators with pitch-angle and gyro-angle scatterings that induce ion guiding center random walk. Steady state ITG turbulence has been observed in simulations with collisions. The turbulence intensity and transport level are found to increase with higher collision frequency. Furthermore, the shear of equilibrium radial electric fields are found to reduce ITG linear growth rate, nonlinear fluctuation amplitude, and ion heat conductivity by tilting the turbulence eddies.

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