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**Neoclassical and Turbulent Transport in Shaped Toroidal plasmas**

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The nonlocal physics associated with turbulent and neoclassical transport in tokamaks has been investigated. When using the global neoclassical particle code GTC-Neo to realistically assess the irreducible minimum level of transport in NSTX plasma, the non-local effects in the collisional relaxation of the ions are clearly observed when the ion orbit size is large compared to either the plasma gradient scale length or the local minor radius. This generally brings the simulated ion thermal transport closer to the experimental measurements. When compared to the radial force balance relation with the standard neoclassical poloidal flow, the radial electric field from these simulations also shows significant differences in the region of the internal transport barrier in NSTX plasmas. Applications of a new general geometry version of the GTC code for gyrokinetic simulation of shaped plasmas have demonstrated that ion temperature gradient (ITG) driven turbulence, which grows initially in the linearly unstable region, spreads in both the inward and outward radial directions into the stable regions, leading to radially global turbulence and transport nonlocality. The global phenomenon of turbulence spreading appears quite generic, independent of the presence of zonal flow. The zonal flow, however, may significantly change the nonlinear dynamics of the spreading process. In the presence of self-generated zonal flow, an early spreading with substantial growth in turbulence intensity is observed before saturation of ITG instability in the unstable region. The nonlinearly driven turbulence in the stable region grows even faster than the initial linear instability. The evolution of the turbulence spectra in both the linearly unstable and stable regions, and the associated nonlinear dynamics of energy cascading to the longer wavelength (low-n) modes, will be presented and compared to a single-n nonlinear simulation. Work collaborated with SciDAC GPS Center and NSTX Experiment, and supported by US Department of Energy.