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Progress in predicting pedestal transport in NSTX H-modes

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— The kinetic ballooning mode (KBM) transport constraint used within pedestal structure models like EPED reproduces the pedestal width scaling in many tokamaks. However, it does not reproduce the strong scaling ($\Delta\psi_{\mathrm{N,ped}}$~$\beta_\theta^{1.05}$) observed in NSTX H-modes. Previous gyrokinetic analyses in the pedestal of NSTX H-modes predict that many theoretical micro-instabilities may play a role in determining pedestal gradients and structure. Analysis has continued to further characterize the linear thresholds and nonlinear transport of these various mechanisms that will be required to form the basis of a predictive model. The cases investigated, spanning a range of pedestal width ($\Delta\psi_{\mathrm{N,ped}}$ =0.05-0.3+), are all found to be very near local KBM thresholds across the entire pedestal. Furthermore, ETG instability is also unstable in the outer half region of the pedestal where experimental values of $\eta_{\mathrm{e,exp}}$ are larger than predicted ETG thresholds, $\eta_{\mathrm{e,ETG,crit}}$ ≈1.4-1.6. Nonlinear simulations predict that ETG can contribute relevant levels of electron heat flux in these regions, but are unlikely to account for all of the transport. In some pedestals, microtearing modes are also found to be unstable at relatively lower wavenumbers ($k_\theta\rho_s$<0.1), with a broad spectrum of TEM present at increasing $k_\theta\rho_s$. Non-linear simulations of these ion-scale mechanisms are commencing to determine whether they predict significant transport. This work supported by the U.S. Department of Energy under DE-AC02-09CH11466, DE-FC02-04ER54698 and DE-AC02-05CH11231.

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