Electromagnetic transport from microtearing mode turbulence in NSTX

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Non-linear gyrokinetic simulations of microtearing mode turbulence are presented. The physically comprehensive simulations (including kinetic ions and electrons, electromagnetic perturbations, collisionality, and toroidal flow and flow shear) use parameters from a high beta NSTX discharge. Relatively fine radial resolution is required to resolve *all* resonant current layers of the largest simulated toroidal mode numbers ($n \leq 45$), while coarser resolutions lead to non-physical spectra. For the baseline case at r/a=0.6 (β_e=8.8%) without E×B shear, the resulting turbulence exhibits very broad electromagnetic ($\delta A_{||}$) perturbations which are responsible for >98% of the total transport. The predicted $\chi_e \approx 1.2 \rho_s^2 c_s/a$ is within the uncertainty of the experimental value, $\chi_{e,exp} \approx 1\text{-}1.5 \rho_s^2 c_s/a$, illustrating from first principles that microtearing mode turbulence can cause significant electron heat flux. Estimates using the saturated amplitude ($\delta B_r/B \sim 0.15\%$) predict that island widths should be larger than the separation of rational surfaces. Unsurprisingly, Poincare plots illustrate the perturbed field line trajectories are stochastic throughout the entire simulation domain and a test particle stochastic transport model agrees to within 25% of the simulated transport. While the above characteristics differ dramatically from electrostatic turbulence (ITG, TEM, ETG), microtearing turbulence is similarly susceptible to suppression via sheared E×B flows.