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Multi-scale Simulations of DIII-D near-edge L-mode plasmas[1]

T. NEISER, F. JENKO, T. CARTER, L. SCHMITZ, D. TOLD, A. BANON NAVARRO, UCLA, G. MCKEE, Z. YAN, U.W. Madison — In order to self-consistently describe the L-H transition we have to be able to quantitatively characterize near-edge L-mode plasmas (ρ=0.8). Instructed by a linear analysis, we perform nonlinear gyrokinetic simulations of a DIII-D L-mode discharge. Comparison between single-scale and multi-scale simulations reveals that stability of ion temperature gradient (ITG) turbulence affects cross-scale coupling. When ion transport is stabilized by zonal flows, electron temperature gradient (ETG) streamer amplitude is reduced but persists at sub-ion-scales, causing radial electron heat transport to dominate. When ITG modes are unstable, we find that ion heat transport dominates, in agreement with experimental data. Moreover, nonlinear de-stabilization of ion transport occurs at higher critical gradients for multi-scale than for single-scale simulations, showing an enhanced Dimits shift. All simulations are performed with the GENE code (genecode.org).

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