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Comparison of experimental measurements and gyrokinetic turbulent electron transport models in Alcator C-Mod plasmas[1]

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We present results of core turbulence measurements and associated transport in Alcator C-Mod using phase contrast imaging (PCI) diagnostic. In order to interpret and better understand the measurements we quantitatively compared the results with extensive simulations with the gyrokinetic code GYRO through a synthetic PCI diagnostic. Both L-Mode and H-Mode plasmas were examined. The L-Mode experiments were carried out over the range of densities covering the "neo-Alcator" (linear confinement time scaling with density) to the "saturated ohmic" regime. The key role played by the ion temperature gradient (ITG) turbulence has been verified by measurements of turbulent wave propagation which was dominantly in the ion diamagnetic direction in the laboratory frame. The absolute fluctuation intensity also agreed with simulation within experimental error. In the saturated ohmic and H-Mode regime where ion transport dominates, the simulated ion and electron thermal diffusivities also agree with experiments after varying the ion temperature gradient or adding E×B shear suppression within experimental uncertainty. However, in the linear ohmic regime where electron transport dominates, GYRO does not agree with experiments, showing significantly larger ion thermal transport and smaller electron thermal transport. Our study shows that although the electron temperature gradient (ETG) mode is unstable, the nonlinear simulation with $k_\theta \rho_s$ up to 4 does not raise the electron thermal diffusivity to the experimental level. Further work to explore even higher-k ETG regimes with GYRO is underway and the results will be presented. Work supported by U. S. DOE under DE-FG02-94-ER54235 and DE-FC02-99-ER54512.

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