Observation of reduced core electron temperature fluctuations and intermediate wavenumber density fluctuations in H-mode plasmas

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Abstract. In this paper, we report observations of reduced ITG-scale core electron temperature and intermediate-scale density fluctuations in H-mode. Electron temperature fluctuation levels are observed to decrease from L-mode levels [$0.5\% \le \tilde{T}_e/T_e \le 2\%$ for $k_\theta \rho_s < 0.5$ as measured by correlation ECE (CECE) radiometry] by at least a factor of four in H- and QH-mode regimes in the DIII-D tokamak ($r/a = 0.7$). Linear stability calculations (using the TGLF trapped gyro-Landau code) indicate that the observed temperature fluctuations are associated with L-mode ITG turbulence which is shear-stabilized at the L- to H-mode transition. Recent results from DIII-D provide the first experimental evidence that, in addition, intermediate-scale turbulence ($0.5 < k_\theta \rho_s \le 2$) is reduced at the L-H transition. A 30%–40% prompt reduction ($r/a \ge 0.7$) has been found at the L-H transition in co-injected plasmas, with a larger decrease ($\ge$75%) observed near the pedestal top. Experimental results and TGLF calculations indicate that intermediate/small scale turbulence persists in H-mode at a reduced amplitude ($0.6 \le r/a \le 1$) and may substantially contribute to the residual anomalous H-mode electron heat transport.