ETG Scale Turbulence and Plasma Transport in the DIII-D Tokamak*

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Small-scale density turbulence ($k_\perp \rho_i \sim$ 4-10) and electron thermal flux are both observed to increase during electron cyclotron heating (ECH) of a high temperature tokamak plasma ($k_\perp$ is the turbulent wavenumber and ρ_i the ion gyroradius). In contrast, large ($k_\perp \rho_i \leq 1$) and intermediate ($k_\perp \rho_i \sim$ 1-3) scale turbulence $\tilde{n}/n$ levels and ion thermal transport remain effectively constant. This implies that the small-scale turbulence is not a remnant or tail of the ubiquitous, large-scale or intermediate scale turbulence and also indicates a potentially important role in determining anomalous electron thermal transport. Radial scans of small-scale turbulence during ECH indicate decreased fluctuations in the deep core compared with increased levels towards the edge. This trend is consistent with linear gyrokinetic growth rate predictions for electron temperature gradient driven instabilities.

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