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Correlation of Increased Electron Heat Transport With Modifications in ETG to ITG Scale Turbulence During Electron Cyclotron Heating on DIII-D[1]

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Increased high-k, electron temperature gradient (ETG)-scale ($k_\perp \sim$35-40 cm^{-1}, $k_\perp\rho_i$ = 4-10, ρ_i = ion gyroradius) plasma density turbulence has been found to correlate with increased electron thermal flux during electron cyclotron heating experiments on the DIII-D tokamak. In contrast, low k ($k_\perp \sim$1 cm^{-1}) ITG-scale turbulence levels remain virtually unchanged indicating that the high-k fluctuations ($k_\perp \sim$35-40 cm^{-1}) are potentially responsible for driving the observed increase in electron heat transport and further that they are not simply remnants of low-k turbulence. Depending on the model utilized and/or plasma studied recent theoretical work indicates that high-k turbulence at the ETG scale can drive either significant or negligible electron heat transport. This highlights the critical need for turbulence measurements in this spectral region as well as detailed comparisons with transport properties and theoretical predictions. Quantitative measurement of low-k and high-k $\tilde{n}$ shows a much larger level of low-k, however integration over the appropriate $k_\perp\rho_e$ range could significantly increase the high k level. Observed changes in low-k measurements are consistent with linear gyrokinetic growth rate calculations only if the effects of electric field shear are accounted for. Intermediate and high-k measurements show somewhat better consistency. This indicates a differing effect of electric field shear on low and high k which is of theoretical interest. Nonlinear simulations utilizing diagnostic filters to simulate experimental diagnostics are underway.

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