Experimental Investigation of Stiff Electron Temperature Profiles at the Alcator C-Mod Tokamak*

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Stiff turbulent transport - which is also known as temperature profile stiffness - is a limiting mechanism in achieving high fusion gains in tokamaks. Temperature profile stiffness is linked to a critical value for the inverse temperature gradient scale length (L_C^{-1}) above which turbulence and heat flux increase rapidly. Here we present a measurement of the profile for the critical gradient scale length (L_c) in L-mode discharges at Alcator C-Mod tokamak. In these experiments [S. Houshmandyar *et al*, Phys. Plasmas, in press], electrons were heated by ICRF through minority heating with the intention of simultaneously varying the heat flux and changing the local gradient. The electron temperature gradient scale length ($L_{Te}^{-1} = |\nabla T_e|/T_e$) profile was measured via the B_T-jog technique [S. Houshmandyar *et al*, Rev. Sci. Instrum. **87**, 11E101 (2016)], and it was compared with electron heat flux from power balance analysis. The T_e profiles were found to be very stiff and already above the critical values, however the stiffness was found to be reduced near the $q = 3/2$ surface. The measured L_c profile is in agreement with ETG models which predict dependence of L_c^{-1} on local Z_{eff}, T_e/T_i, and the ratio of the magnetic shear to the safety factor. The results from *linear* GENE gyrokinetic simulations suggest ETG to be the dominant mode of turbulence in the electron scale, and ITG/TEM modes in the ion scale. The measured L_c profile is in agreement with the profile of ETG critical gradients deduced from the GENE simulations. Furthermore, future plans for measuring the scale length using variable ECE channels will be presented.

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