Transport Studies in DIII-D with Modulated ECH*

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Measuring the plasma response to local heat pulses has been shown to be a sensitive test of plasma transport properties and provides a means to critically test transport models. Experiments will be discussed where the T_e profile stiffness was tested at several spatial locations by varying the ECH resonance location and the propagation of the pulses was Fourier analyzed and compared to simulations based on several transport models. The experiments were carried out in sawtooth-free, L-mode plasmas limited against the inside wall of the vacuum vessel with $n_e = 2.5 \times 10^{19}$ m^{-3} and T_i/T_e near one over the mid-radius region of the plasma. Defining stiffness in terms of a local T_e response to a local heat pulse, and a stiff response being one where the rise in T_e is clearly limited or restricted, no evidence was found for a stiff T_e profile. With a modest 4 MW of NB heating, a fixed value of $R/L_{Te} \sim 5$ existed over much of the plasma, perhaps indicating the existence of a critical gradient. These plasmas were at the marginality condition for both ETG and ITG modes over most of the minor radius. Even though the plasma appeared to be at a critical temperature gradient or gradient scale length in the region $\rho = 0.2–0.7$, the local T_e response to the ECH pulses applied was not stiff and could be understood without the need to invoke a non-linear clamping process. The temporal response of T_e could be fit with a simple exponential rise representing the local confinement with the pulse shape determined by the relation between the local confinement time and the duration of the heat pulse. Small amplitude modulation of low-k turbulence was also observed just inside the ECH resonance location for the case with $\rho_{ECH} = 0.8$, possibly associated with TEM and ITG mode activity, and was out of phase with respect to the ECH pulses [1]. Experimental results for both T_e and T_i will be compared to simulations with the GLF23, Multimode and IFS-PPPL transport models, including a renormalized version of the GLF23 model which places more emphasis on ETG mode activity. If available, preliminary results from planned experiments with modulated ECH on discharges with an internal transport barrier will also be discussed.

[1] R.V. Bravenec, "Turbulence Measurements on DIII-D Discharges with Modulated ECH and Comparisons with Turbulence Simulations," these proceedings.

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*Work supported by U.S. Department of Energy under Contract DE-AC03-99ER54463, and Grants DE-FG03-97ER54415, DE-FG02-92ER54141, DE-FG03-96ER54373, and DE-FG03-01ER54615.