Sensitivity of TEM and ITG Modes to Temperature and Density Gradient Scale Lengths and Collisionality*

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The sensitivity of drift wave growth rates to temperature and density gradient scale lengths and collisionality has been computed for an L-mode discharge in DIII-D with 1 MW of electron cyclotron heating using the trapped gyroLandau-fluid (TGLF) linear stability code. Based on experimentally measured profiles, the discharge is calculated to be dominated by trapped electron modes (TEMs) at r/a = 0.5 in the normalized wavenumber range $k_\theta\rho_s$ = 0.1-1 with peak growth rates occurring at $k_\theta\rho_s$ ~ 0.5-0.7 or k_θ ~ 3-4 cm^{-1}. At the experimentally obtained density gradient scale length at r/a = 0.5 both ion temperature gradient (ITG) and TEM growth rates are calculated to be somewhat insensitive to a/L_{Te} such that a factor of 2 reduction in a/L_{Te} results in a 33% decrease in the peak electron mode growth rate. The maximum ion mode growth rate is calculated to increase by 45%. Measurements of electron density fluctuation levels at the plasma mid-radius in the appropriate wavenumber range showed no change in fluctuation levels when the local value of a/L_{Te} was varied by a factor 1.8 experimentally. The TGLF calculations also indicate that the spectral shape of the growth rates, both electron and ion modes, does not change significantly with a factor 2 reduction in a/L_{Te}. A weak sensitivity to collisionality is also calculated for the L-mode discharge studied. However, calculations indicate that if a/L_{ne} is reduced by 50%, thus decreasing the density gradient scale length drive contribution to TEMs, then the sensitivity to variations in a/L_{Te} increases dramatically. For this condition a factor of 2 reduction in a/L_{Te} results in the peak electron mode growth rate dropping by more than a factor of 4 and peaking at slightly larger wavenumbers. The ion mode growth rates decrease slightly but the electron and ion mode growth rates become comparable due to the large reduction in the electron mode growth rate. Prospects for an experiment designed to take advantage of this enhanced sensitivity and allow direct correlation of transport and measured fluctuation levels with TEM activity will be discussed.

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