Design of an Experiment to Discriminate Between ITG and TEM Turbulence*

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DIII-D has assembled a comprehensive set of diagnostics for the measurement of drift wave turbulence with wavenumbers $k \lesssim 40$ cm^{-1}. We are now in a position to begin to tackle the large task of validating turbulence models by comparing measured fluctuation spectra with threshold stability and relative turbulence intensity calculations of drift wave turbulence. In an effort to simplify initial tests of the models emphasis is placed on trying to discriminate between the effects of ion temperature gradient (ITG) and trapped electron mode (TEM) turbulence by creating discharges where one of these modes is clearly dominant or where line splitting (positive or negative shifts of ITG or TEM frequencies about the Doppler shift frequency due to a radial electric field) allows identification of both modes simultaneously.

Two experimental approaches have been identified. With the aid of the GKS and TGLF linear gyrokinetic stability codes, a low-density target L-mode discharge with electron cyclotron heating has been identified where TEM modes are calculated to dominate. By replacing electron cyclotron heating (ECH) power with neutral beam power, ITG modes are expected to become dominant. A second approach utilizes modulated ECH to vary the local value of R/L_{Te} in a TEM dominated discharge to alternately turn off and on the TEM mode. The so-called ECH swing technique, where ECH is deposited at two closely spaced radial locations with power alternately applied at each spatial location, has been employed previously to create large variations in R/L_{Te} at fixed T_e. This approach may allow direct comparisons of the threshold stability conditions for the TEM mode. Scoping studies will be shown where the GKS and TGLF codes were employed to analyze previous L-mode discharges in order to guide the choice of an initial target plasma.

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