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# Clear Signature of Micro-Tearing Modes in the DIII-D Pedestal

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Recent and growing evidence points toward the micro-tearing mode (MTM) as an important fluctuation in the H-mode pedestal for the anomalous electron heat transport. An extensive study of the instabilities in the pedestal region has been carried out using local/global linear gyrokinetic simulations implemented in the GENE code and successfully reproduced the magnetic spectrogram for an ELMy H-mode DIII-D discharge (USN configuration, 1.4 MA plasma current, and 3 MW heating power). The simulations of the main instabilities show many properties that can clearly be identified as MTM, including predominantly electromagnetic heat flux, small particle flux, and a substantial degree of tearing parity. The magnetic spectrogram from Mirnov coils exhibits three distinct frequency bands —two narrow bands at lower frequency (~50-100 kHz) and a broader band at higher frequency (~325-425 kHz), which are located at the peak of the $\boldsymbol{\omega}^*$ profile. Linear GENE simulations for the pedestal region reproduce these bands quantitatively. Many features of these bands can be understood from the basic physical mechanisms underlying the instabilities. For example (1) instability of certain toroidal mode numbers (n) is controlled by the alignment of their rational surfaces with the peak in the $\boldsymbol{\omega}^*$ profile, and (2) MTM instabilities in the lower n bands have a slab-like nature, whereas the higher n band involves toroidal effects. Preliminary global nonlinear simulations find experimentally relevant transport levels, which provides further evidence that the MTM instability is a major contributor to electron transport in some H-mode pedestals.

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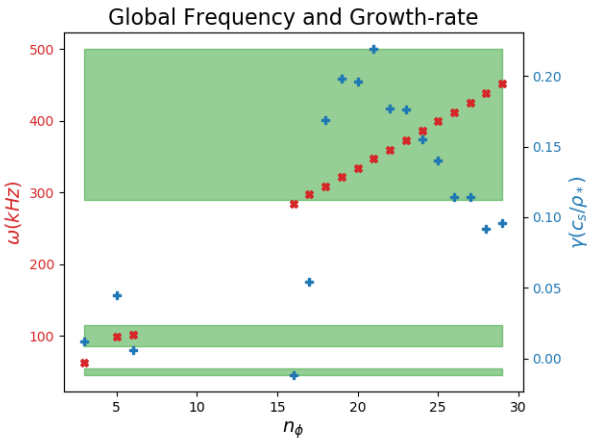


Figure 01: A comparison between the unstable modes frequencies (in SI units) in (red crosses) and the frequency of the magnetic fluctuations measured experimentally (green bands) shows that the global simulation perfectly reproduced the three distinct bands in the spectrogram. Also, the growth rates of the unstable MTM modes are shown in blue pluses.