Turbulence and flow dynamics in I-mode and in I-H transitions

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The role of turbulence driven, large scale edge flows in entering and maintaining high confinement regimes is now fairly well established. The edge turbulence dynamics of the L-H transition is quite well characterized as a lossless transfer mechanism leading to turbulence suppression while driving edge zonal flows (ZF). Furthermore, one of the most intriguing alternative high-energy-confinement regimes, the I-mode, has been shown to exhibit geodesic-acoustic modes (GAM) which couple nonlinearly to a coherent mode in the edge, forming the regime's characteristic edge fluctuation known as the "weakly coherent mode" (WCM). Although these results suggest that the two edge flow structures play analogous roles, their specific dynamics is not well understood yet in transitions involving the I-mode regime.

We study edge fluctuations in and near I-mode regimes with a focus on the nonlinear interaction between the broadband turbulence and edge flows. In particular, ZF structures are studied in I-mode for the first time and their role in triggering the I-H transition is addressed. Although at higher magnetic field (5-6T) the I-H power threshold is higher than that at lower field (2.5-3T), both configurations become more prone to I-H transitions at high plasma density. In some situations a *drop* in auxiliary power has been shown to cause these transitions. Since the damping, and thus the existence, of GAM in the plasma edge strongly depends on collision frequency, and therefore plasma density, the role of GAM-ZF competition or interaction is directly addressed in high magnetic field I-modes.

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