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O4.103 Pedestal modes interactions triggering bursts and leading to the onset of edge localized modes on DIII-D

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We report on recent investigations in DIII-D of three-wave interactions between pedestal modes during quasi-stationary inter-ELM phases leading up to the type I ELM onset. Prior to eruptive events such as ELMs, these pedestal modes, also called quasi-coherent fluctuations, are observed in the edge of fusion devices[1]. Analysis of these dominant modes, with density and magnetic signatures, identifies them as a key player in the triggering mechanism of a certain class of ELMs. This class of ELMs appears to be triggered far away from the peeling ballooning limit, similar to observations in JET-ILW [2]. We demonstrate that one of these modes is amplified by the two others through three-wave interactions. This result is obtained using bicoherence analysis of magnetic signals to show that coherent wave coupling leads to the amplification of a third mode of frequency that is the sum of the first two modes. The intensity of the third mode increases during the second half of the ELM cycle and is radially shifted relative to the other two modes towards the last-closed flux surface as the ELM event approaches[3]. This shifting is observed with spatially localized measurements of density fluctuations at the same frequencies as observed in the magnetics. In addition, there are regimes where the pedestal modes' nonlinear interaction results in burst activities prior to ELMs[4,5]. The talk will describe analyses of the two regimes and argue that pedestal modes interaction via three-wave coupling, associated with radial distortions pushing out of the pedestal, is a possible mechanism for the triggering of low frequency type I ELMs relevant for future fusion devices.

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[5] P. Hennequin et al., In 44th EPS Conf. on Plasma Physics, number PI.167, 2017.

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