Boundary perturbations coupled to core 3/2 tearing modes on the DIII-D tokamak

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Abstract. High confinement (H-mode) discharges on the DIII-D tokamak are routinely subject to the formation of long-lived, non-disruptive magnetic islands that degrade confinement and limit fusion performance. Simultaneous, 2D measurement of electron temperature fluctuations in core and edge regions allows for reconstruction of the radially resolved poloidal mode number spectrum and phase of the global plasma response associated with these modes. Coherent, n=2 excursions of the plasma boundary are found to be the result of coupling to an n=2, kink-like mode which arises locked in phase to the 3/2 island chain. This nonlinear coupling dictates the relative phase of the displacement at the boundary with respect to the tearing mode. This unambiguous phase relationship, for which no counter-examples have been observed, is presented as a test for modeling of the perturbed fields to be expected outside the confined plasma.

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