Characterization of MHD activity and its influence on radiation asymmetries during massive gas injection in DIII-D

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Abstract.

Measurements from the DIII-D tokamak show that toroidal radiation asymmetries during fast shutdown by massive gas injection (MGI) are largely driven by $n = 1$ magnetohydrodynamic modes during the thermal quench. The phenomenology of these modes, which are driven unstable by profile changes as the thermal energy is quenched, is described based on detailed magnetic measurements. The toroidal evolution of the dominantly $n = 1$ perturbation is understood to be a function of three parameters: the location of the MGI port, pre-MGI plasma rotation, and $n = 1$ error fields. The resulting level of radiation asymmetry in these DIII-D plasmas is modest, with a toroidal peaking factor (TPF) of 1.2 ± 0.1 for the total thermal quench energy and 1.4 ± 0.3 for the peak radiated power, both of which are below the estimated limit for ITER (TPF ≈ 2) [M. Sugihara *et al.*, Nucl. Fusion **47**, 337 (2007)].

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