Observations of transient ELM stabilization during modulated neutral beam injection in DIII-D

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We report observations of transient stabilization of type-I edge localized modes (ELM), emerging from a combined dataset of DIII-D plasmas with moderate neutral beam (NB) heating P_{NB}=4-6 MW obtained through modulated NB waveforms. Statistical analysis of ELM onset times indicates that, in the selected dataset, the likelihood of ELM occurrence lowers significantly during time intervals of higher NBI, with the stronger correlation found with operation of counter-current beams. The effect is also found in plasma discharges where isolated diagnostic beam pulses are applied over periodic ELM activity, systematically delaying the ELM onset, for time intervals 5-25 ms. The role of the changes of pedestal profiles during NB modulation is investigated with coherent average analysis of plasma density, temperature, and toroidal rotation. The analysis finds relatively small changes (~3%) of pedestal T_e and n_e and toroidal variations up to 5 km/s, during a NB modulation cycle, suggesting that other subdominant effects can play a role in these pedestals conditions close to marginal stability. The role of prompt poloidal acceleration associated with beam-ion losses or kinetic interaction between beam ions and peeling-ballooning modes will be discussed.

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