Hybrid-like 2/1 flux-pumping and magnetic island evolution due to edge localized mode-neoclassical tearing mode coupling in DIII-D

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Abstract. Direct analysis of internal magnetic field pitch angles measured using the motional Stark effect diagnostic shows $m/n = 2/1$ neoclassical tearing modes exhibit stronger poloidal magnetic flux-pumping than typical hybrids containing $m/n = 3/2$ modes. This flux-pumping causes the avoidance of sawteeth, and is present during partial electron cyclotron current drive suppression of the tearing mode. This finding could lead to hybrid discharges with higher normalized fusion performance at lower q_{95}. The degree of edge localized mode-neoclassical tearing mode (ELM-NTM) coupling and the strength of flux-pumping increase with beta and the proximity of the modes to the ELMing pedestal. Flux-pumping appears independent of magnetic island width. Individual ELM-NTM coupling events show a rapid timescale drop in the island width followed by a resistive recovery that is successfully modeled using the modified Rutherford equation. The fast transient drop in island width increases with ELM size.

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