

Abstract Submitted  
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**How Are NTMs Seeded?**<sup>1</sup> J.D. CALLEN, UW-Madison, R.J. LA HAYE, GA, R.S. WILCOX, ORNL, E.J. STRAIT, C. CHRYSTAL, GA, M. OK-ABAYASHI, PPPL, E.J. HOWELL, Tech-X, C.C. HEGNA, UW-Madison — A model for how neoclassical tearing modes (NTMs) are seeded by MHD transients (ELMs and sawteeth) explains experimental observations on DIII-D. This research uses extensive DIII-D diagnostics (comprehensive magnetic perturbation measurements, 1 ms resolution CER vertical and toroidal flows, kinetic profile data analysis tools) to describe NTMs in ISS-type DIII-D discharges in terms of a nonlinear, toroidal-based NTM model that includes for the first time MHD transient effects. The evolution of resonant magnetic perturbations through a sequence of m/n modes that ultimately result in large amplitude 2/1 NTMs is diagnosed. The observed NTMs initially decay or grow slowly after MHD transient events until, in response to a particular MHD event, they can grow robustly and brake plasma rotation into a locked mode that may cause a major disruption. Key conditions for a robustly growing NTM and slowing into a locked mode include sufficient bootstrap current drive and a MHD-induced transient that creates a large enough magnetic island and resultant NTM mode rotation change.

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J.D. Callen  
University of Wisconsin - Madison

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