Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Nonlinear Modeling of Forced Magnetic Reconnection with Transient Perturbations[1] MATTHEW T BEIDLER, JAMES D CALLEN, CHRIS C HEGNA, CARL R SOVINEC, University of Wisconsin-Madison — Externally applied 3D magnetic fields in tokamaks can penetrate into the plasma and lead to forced magnetic reconnection, and hence magnetic islands, on resonant surfaces. Analytic theory has been reasonably successful in describing many aspects of this paradigm with regard to describing the time asymptotic-steady state [1]. However, understanding the nonlinear evolution into a low-slip, field-penetrated state, especially how MHD events such as sawteeth and ELMs precipitate this transition, is in its early development. We present nonlinear computations employing the extended-MHD code NIMROD, building on previous work [2] by incorporating a temporally varying external perturbation as a simple model for an MHD event that produces resonant magnetic signals. A parametric series of proof-of-principle computations and accompanying analytical theory characterize the transition into a mode-locked state with an emphasis on detailing the temporal evolution properties. [1] R. Fitzpatrick, Nucl. Fusion 33, 1049 (1993). [2] M.T. Beidler, J.D. Callen, C.C. Hegna, and C.R. Sovinec, Phys. Plasmas 24, 052508 (2017).

[1]Supported by DOE OFES grants DE-FG02-92ER54139, DE-FG02-86ER53218, and the U.S. DOE FES Postdoctoral Research program administered by ORISE and managed by ORAU under DOE contract DE-SC0014664.

Matthew T Beidler
University of Wisconsin-Madison

Date submitted: 13 Jul 2017

Electronic form version 1.4