Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Multiple timescale calculations of sawteeth in tokamak plasmas
S.C. JARDIN, PPPL, N. FERRARO, General Atomics, J. BRESLAU, J. CHEN, PPPL — We present results of using M3D-C^1 [1] to perform 3D nonlinear magneto-hydrodynamics calculations of a tokamak plasma that span the timescales associated with ideal and resistive stability as well as parallel and perpendicular transport. We specify the transport coefficients and apply a "current controller" that adjusts the boundary loop-voltage to keep the total plasma current fixed. Depending on the transport model, the plasma either reaches a stationary quasi-helical state in which the central safety factor is approximately unity, or it periodically undergoes sawtooth oscillations [2] with a period that approaches a constant value. These calculations have been performed both in a "fixed boundary" configuration with a wall on the plasma boundary as well as in a "free boundary" configuration with a separatrix surrounded by a scrape-off-layer plasma with open field lines and a resistive wall. We have performed series of runs to determine the dependence of the sequence on the form and magnitude of the resistivity, parallel and cross-field thermal conductivity, and viscosity. We are presently investigating the effect of the plasma shape on the sawtooth behavior, and the effects of two-fluid terms on the dynamics.

[1] J. Breslau, N. Ferraro, S. Jardin, Physics of Plasmas 16 092503 (2009)
[2] X. von Goeler, W. Stodiek, and N. Sauthoff, Phys. Rev. Lett. 33, 1201 (1974)

Stephen Jardin
PPPL

Date submitted: 13 Jul 2011 Electronic form version 1.4