3D Nonlinear Simulations of Disruptions, Saturated Modes, and Soft Beta Limits in NSTX, S. C. Jardin[1], S. Gerhardt[1], N. Ferraro[2], J. Breslau[1], J. Chen[1], [1]Princeton Plasma Physics Laboratory, Princeton, NJ 08540, [2]General Atomics, San Diego, CA In this paper we apply the M3D-C1 [1,2] extended magneto-hydrodynamics code to model several discharges in NSTX in which the ideal and/or resistive β-limits are approached and exceeded at some point in the discharge. The goal is to understand when and by what mechanism exceeding the stability limits leads to a disruption, and by what mechanism the plasma self-limits itself by some form of enhanced transport when it does not. The self-limiting mechanisms are a form of enhanced transport that occurs when MHD β-limits are approached, and this transport mechanism is not well described by existing gyrokinetic codes. We present examples of the plasma self-limiting when the β-limit is exceeded both near the edge and near the axis [3], and give other examples of when exceeding the β-limit leads to a hard disruption. The insight gained by these calculations will be directly applicable to operational considerations during the burn phase of ITER.

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