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Stability properties of tokamak discharges with low edge safety factor in the Madison Symmetric Torus[1] NOAH C. HURST, BRETT E. CHAPMAN, ABDULGADER F. ALMAGRI, BRIAN CORNILLE, DANIEL J. DEN HARTOG, KARSTEN J. MCCOLLAM, JOHN S. SARFF, CARL R. SOVINEC, University of Wisconsin - Madison — High-performance tokamak plasmas are sometimes terminated prematurely by disruptions, one cause of which is operation with an edge safety factor $q_a \leq 2$. In order to better understand plasma behavior near and beyond this stability boundary, and to set the stage for future studies of disruption physics, tokamak discharges are studied with low edge safety factor $0.8 \leq q_a \leq 2.5$ in the Madison Symmetric Torus (MST). The MST has a thick, circular conducting shell which prevents the growth of the external kink instability, but allows the study of internally resonant resistive kink modes. Magnetic equilibria and fluctuations are investigated using a high-spatial-resolution probe spanning roughly the outer half of the minor radius. The effect of density variations on the approach to steady-state is discussed, and internal measurements of sawtooth behavior are presented. Experimental equilibrium reconstructions are used to initiate nonlinear MHD simulations with the NIMROD code, with a Lundquist number, $S \sim 10^5$, similar to that in the experiment. The modeled MHD behavior is compared to that of the experiment, both to help understand the experimental data and to help validate the numerical model.

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