Abstract Submitted for the Forty-Sixth Annual Meeting
Division of Plasma Physics
November 15–19, Savannah, Georgia

Category Number and Subject: 5.6.2 DIII-D Tokamak

[x] Theory [ ] Experiment

Theoretical Limits on the Onset of Resistive Instabilities in Tokamaks,* D.P. Brennan, *ORISE*, R.J. La Haye, L.L. Lao, A.D. Turnbull, *GA*, S.E. Kruger, *Tech-X*, D.D. Schnack, *SAIC* — Classically destabilized NTMs are analyzed in the fast and slow heating regimes, and the model predicts maximum and minimum rates of heating for immediate NTM onset. In the fast heating regime, the change in the linear stability as β approaches the ideal limit dominates the evolution, and the tearing mode grows faster than the rate of current relaxation. Above the maximum rate the growth time of the tearing mode is longer than the heating time, and the ideal mode becomes unstable before the NTM can grow. In the slow heating regime, the enhancement of transport dominates the evolution through the modification of the current distribution and change in the linear stability. Below the minimum rate the seed island does not evolve into a large NTM but remains saturated at a small size. Between the upper and lower rate limits, classically destabilized NTMs are observed in DIII-D. The fast heating rate limit is found analytically by choosing a limit on the island size when the ideal beta limit is reached. The slow heating rate limit is calculated with numerical integrations of the island evolution equation. Nonlinear initial value simulations are used with insight from simple models to elucidate mode-coupling effects.

*Supported by US DOE under DE-AC05-76OR00033, DE-FC02-04ER54698, and DE-FG03-95ER54309.