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Forced Magnetic Reconnection In A Tokamak Plasma[1] J.D. CALLEN, C.C. HEGNA, University of Wisconsin — The theory of forced magnetic field reconnection induced by an externally imposed resonant magnetic perturbation usually uses a sheared slab or cylindrical magnetic field model and often focuses on the potential time-asymptotic induced magnetic island state. However, tokamak plasmas have significant magnetic geometry and dynamical plasma toroidal rotation screening effects. Also, finite ion Larmor radius (FLR) and banana width (FBW) effects can damp and thus limit the width of a nascent magnetic island. A theory that is more applicable for tokamak plasmas is being developed. This new model of the dynamics of forced magnetic reconnection considers a single helicity magnetic perturbation in the tokamak magnetic field geometry [1], uses a kinetically-derived collisional parallel electron flow response, and employs a comprehensive dynamical equation for the plasma toroidal rotation frequency. It is being used to explore the dynamics of bifurcation into a magnetically reconnected state in the thin singular layer around the rational surface, evolution into a generalized Rutherford regime where the island width exceeds the singular layer width, and assess the island width limiting effects of FLR and FBW polarization currents.

[1] C.C. Hegna and J.D. Callen, Phys. Plasmas 1, 2308 (1994).

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