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Nonlinear Evolution of the Tearing Mode NUNO LOUREIRO, CMPD / PPPL, STEVE COWLEY, UCLA / Imperial College London, WILLIAM DORLAND, UMD, MALCOLM HAINES, Imperial College London, ALEXANDER SCHEKOCHIHIN, University of Cambridge — We present recent numerical results on the nonlinear evolution of the strongly and weakly driven resistive tearing mode. Slab geometry is adopted and the equations of reduced-MHD (RMHD) are used. A high-resolution numerical scan of the parameter space (Δ', η) shows that, in general, the tearing mode evolves through five stages: exponential growth, algebraic growth (Rutherford stage), X-point collapse followed by current-sheet exponential reconnection (Sweet–Parker stage), tearing instability of the current sheet (generation of secondary islands), and saturation. The X-point collapse occurs at a critical island width that scales as $Wc \sim 1/\Delta'$. During the collapse, reconnection proceeds with a rate $\propto \eta^{1/2}$. The resulting current sheet becomes unstable if it has a length-to-width ratio that exceeds a certain critical value. Secondary islands are then formed, the evolution of which occurs in a self-similar way to the original perturbation. At low Δ', the saturation amplitude is shown to be in good agreement with recent analytic theories. At large Δ' we show that the saturated amplitude depends on the existence of a previous collapse.

Nuno Loureiro
CMPD / PPPL

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