Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Gyrokinetic equations for the non-linear simulation of toroidal tearing modes[1] SIMON ALLFREY, STEVEN COWLEY, Center for Multi-Scale Plasma Dynamics, Department Physics & Astronomy, UCLA, Box 951547, Los Angeles, CA 90095-1547, BILL DORLAND, Center for Multi-Scale Plasma Dynamics, Department Physics, The University of Maryland, College Park, MD 20742-3511 — The standard gyrokinetic ordering is given by $\omega/\Omega_i \sim k_\parallel/k_\perp \sim e\phi/T_e \sim \rho_i/L_n \sim \delta B/B \sim \mathcal{O}(\epsilon)$, $k_\perp \rho_i \sim \mathcal{O}(1)$. We derive equations with a modified electromagnetic gyrokinetic ordering appropriate for the description of tearing modes in toroidal geometry. While the radial wave-number of the perturbation remains of the same order as the ion gyroradius, the perpendicular variation *within* the magnetic surface is one order lower in ϵ. An 'inner' solution to these equations, in the region of the rational surface, is matched to and 'external' MHD solution encapsulated by a quantity Δ' [Furth *et al* 1963]. These equations will form the basis of numerical simulations of magnetic island evolution. The eventual application of this formulation will be the study of the non-linear interaction of turbulence and evolving island structures.

[1]Work supported by the U.S. DOE.

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Date submitted: 26 Jul 2005 Electronic form version 1.4