Gyrokinetic equations for the non-linear simulation of toroidal tearing modes\textsuperscript{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 $\omega/\Omega \sim k_{\parallel}/k_{\perp} \sim e\phi/T \sim \rho_{i}/L_{n} \sim \delta B/B \sim O(\epsilon)$, $k_{\perp}\rho_{i} \sim O(1)$. 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 \textit{within} the magnetic surface is one order lower in $\epsilon$. An ‘inner’ solution to these equations, in the region of the rational surface, is matched to and ‘external’ MHD solution encapsulated by a quantity $\Delta'$ [Furth \textit{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.

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