An Eulerian Gyrokinetic-Maxwell Solver

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Abstract

In this report we present a time-explicit, Eulerian numerical scheme for the solution of the nonlinear gyrokinetic-Maxwell equations. The treatment of electrons is fully drift-kinetic, transverse electromagnetic fluctuations are included, and profile variation is allowed over an arbitrary radial annulus. The code, GYRO, is benchmarked exhaustively against analytic theory, linear eigenmode codes, and nonlinear electrostatic gyrokinetic particle-in-cell codes. We have attempted preliminary finite-β calculations in the range $\beta/\beta_{\rm crit} = [0.0, 0.5]$ for a reference discharge. Detailed diagnostic data is presented for these simulations, along with a number of caveats which reflect the uncharted nature of the parameter regime.