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Experimentally Relevant Benchmarks for Gyrokinetic Codes[1]

RONALD BRAVENEC, Fourth State Research — Although benchmarking of gyrokinetic codes has been performed in the past, e.g., The Numerical Tokamak, The Cyclone Project, The Plasma Microturbulence Project, and various informal activities, these efforts have typically employed simple plasma models. For example, the Cyclone "base case" assumed shifted-circle flux surfaces, no magnetic transport, adiabatic electrons, no collisions nor impurities, $\rho_i << a$ (ρ_i the ion gyroradius and a the minor radius), and no $\mathbf{E}\times\mathbf{B}$ flow shear. This work presents comparisons of linear frequencies and nonlinear fluxes from GYRO and GS2 with none of the above approximations except $\rho_i << a$ and no $\mathbf{E}\times\mathbf{B}$ flow shear. The comparisons are performed at two radii of a DIII-D plasma, one in the confinement region ($r/a = 0.5$) and the other closer to the edge ($r/a = 0.7$). Many of the plasma parameters differ by a factor of two between these two locations. Good agreement between GYRO and GS2 is found when neglecting collisions. However, differences are found when including e-i collisions (Lorentz model). The sources of the discrepancy are unknown as of yet. Nevertheless, two collisionless benchmarks have been formulated with considerably different plasma parameters.
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