Toward a full-radius continuum gyrokinetic simulation code

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Abstract

In this paper we detail some first results from the continuum gyrokinetic microturbulence code, GYRO. In addition to standard ITG (ion temperature gradient) and adiabatic electron physics, GYRO includes trapped and passing electrons with electromagnetic effects in real geometry. These features are in common with the GS2 code [F. Jenko, W. Dorland, M. Kotschenreuther, and B.N. Rogers, Phys. Plasmas **7** (2000) 1904, Fluids **25** (1982) 502]. The novel feature of GYRO is the use of a radial grid rather than a grid in $k_r = -i\,\partial / \partial r$. The real-space grid allows GYRO to include profile variation effects. When operated with periodic radial boundary conditions in the vanishing-ρ_* flux-tube limit, GYRO is designed to reproduce GS2 results (obtained using a ballooning-mode formalism). GYRO results at finite-ρ_* (*i.e.*, profile variation) will be reported in future work. To date we have *complete agreement* with finite-β comparisons to the linear GKS code [M. Kotschenreuther et al., Comput. Phys. Commun. **88** (1995) 128], and have also verified the Rosenbluth-Hinton linear decrement of the $n = 0$ zonal flows [M.N. Rosenbluth and F.L. Hinton, Phys. Rev. Lett. **80** (1998) 724.