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Benchmark Studies of the Gyro-Landau-Fluid code and Gyrokinetic Codes on Kinetic Ballooning Modes[1] TENGFEI TANG, XUEQIAO XU, Lawrence Livermore Natl Lab, CHENHAO MA, Peking University, CHRIS HOLLAND, University of California San Diego, JEFF CANDY, General Atomics
— A Gyro-Landau-Fluid (GLF) 3+1 model has been implemented in BOUT++ framework recently, which contains full Finite-Larmor-Radius (FLR) effects, Landau damping and toroidal resonance.[2] A linear global beta scan has been done using the cbm18 series equilibriums, showing that the unstable modes are kinetic ballooning modes (KBMs). In this work, we use the GYRO code, which is a gyrokinetic continuum code widely used for simulation of the plasma microturbulence, to benchmark with GLF 3+1 code on KBMs. As the modes locate in peak pressure gradient region, a linear local beta scan using the same set of equilibriums has been done at this position for comparison. With the drift kinetic electron module in the GYRO code by including small electron-ion collision to damp electron modes, GYRO generated mode structures and parity suggest that they are kinetic ballooning modes, and the growth rate is comparable to the GLF results. However, a radial scan of the pedestal for a particular cbm18 equilibrium shows that the growth rate of the most unstable mode shifts outward to the bottom of pedestal and the real frequency of what was originally the KBMs steadily approaches and crosses over to the electron diamagnetic drift direction.

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[2]C. H. Ma, X. Q. Xu, et al., *Phys. Plasmas* **22**, 055903 (2015).

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