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[**x**] Theory [ ] Experiment

Gyrokinetic Simulations of Neoclassical Flows Embedded in Turbulence,* R.E. Waltz, J. Candy, F.L. Hinton, *GA* – GYRO is a comprehensive nonlinear continuum (Eulerian) gyrokinetic code which can treat either gyroBohm scaled flux tubes at vanishing ρ_* or full-radius core profiles at small but finite ρ_*. It contains all the physics needed for physically realistic simulations of the tokamak core: toroidal ion temperature gradient mode physics, trapped and passing electrons, electron-ion pitch angle collisions, electromagnetic effects up to the ideal beta limit, real geometry, and ExB shear stabilization. GYRO has been used to simulate the DIII-D L-mode dimensionally similar ρ_* pair with Bohm scaling [1]. Neoclassical flows and drivers as well as ion-ion collisions and electron-ion drag have now been added. Previously Wang et al. used a global PIC toroidal mode number n=0 gyrokinetic code to simulate large banana orbit neoclassical flows [2]. The present GYRO work focuses on the interaction of $|n| \geq 0$ turbulence and n=0 neoclassical flows. Parallel ion flows and bootstrap currents are considered. At vanishing ρ_* there is no interaction and little at moderate ρ_*. The in-out neoclassical flows from the n=0 zonal flows vanish on radial average.\par

[1] J. Candy and R.E. Waltz, Phys. Rev. Lett. **91**, 045001 (2003).
[2] W.X. Wang, F.L. Hinton, S.K. Wong, Phys. Rev. Lett. **87**, 055002-1 (2001).

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