Abstract Submitted
for the APR09 Meeting of
The American Physical Society

Non-diffusive particle transport in a gyrokinetic Z-pinch with pitch-angle scattering[1] KYLE GUSTAFSON, WILLIAM DORLAND, University of Maryland — We have developed a new nonlinear, gyrokinetic, δf PIC code with a pitch-angle scattering collision operator and a gyroaveraging method valid for large $k_\perp \rho_i$. We examine the collisional damping of zonal flows in the Z-pinch entropy mode, where gradients of plasma density and temperature drive a curvature-type instability for $k_\perp \rho_i > 1$. This arrangement is useful for self-consistent particle tracking studies aimed at determining whether non-diffusive transport is relevant for describing radial transport in gyrokinetic microturbulence. Non-diffusive transport is a consequence of non-Gaussian random walks. Zonal flows in turbulence are likely to cause such random walks since short displacements are favored perpendicular to the zonal flows. A subset of particles for each value of $k_\perp \rho_i$ can be selected from the entire set of particles that determine the fields. Displacements of these particles can be tracked and used to determine the dependence of the mean square displacement on time as a function of particle energy. Observable results include power-law scaling of the variance of particle displacements and non-Gaussian displacement distribution functions. Results are compared to analytic expectations and other observations of non-diffusive transport in simpler simulations.

[1]K. Gustafson is partly supported by a Fannie and John Hertz Foundation Fellowship.

Kyle Gustafson
University of Maryland

Date submitted: 06 Jan 2009 Electronic form version 1.4