Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Subdiffusive radial transport in a gyrokinetic Z-pinch plasma with zonal flows[1] KYLE GUSTAFSON, WILLIAM DORLAND, University of Maryland — We report on numerical gyrokinetic studies of a confined, magnetized plasma in a Z-pinch configuration. Building upon previous results[2] for the entropy mode in a gyrokinetic Z-pinch, we examine the details of particle transport as diagnosed by the displacements of an ensemble of tracer particles in simulations[3]. The density-gradient driven entropy mode of instability leads to vertical zonal flow structures in the turbulence that impede particle transport in the radial direction. Tracer displacements in this study point to the existence of subdiffusive radial transport, such that the spreading of the tracers proceeds more slowly than predicted by a canonical turbulent diffusion equation. The relevance of this result to the usual predictions of confinement-time scaling for fusion machines is examined. We compare the effects of collisions and several values of the density gradient for significant periods of time, measured in $v_{thermal}/L$. We use continuous-time random walk and fractional diffusion equation models to understand the transport process more generally. The importance of long-range velocity correlations and scale-free transport is considered.

[1]Work supported by a Fannie and John Hertz Foundation Fellowship and the DOE Center for Multiscale Plasma Dynamics.
[2]Ricci et al PRL 97 245001 2006
[3]Broemstrup, Thesis University of Maryland

Kyle Gustafson
University of Maryland

Date submitted: 28 Jul 2009 Electronic form version 1.4