Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Role of Fluctuation Potential Enstrophy Flux and Turbulence Spreading in Zonal Flow Momentum Balance Y. KOSUGA, P.H. DIAMOND, University of California, San Diego, O.D. GURCAN, CEA Cadarache, T.S. HAHM, Princeton University, Plasma Physics Laboratory — Analyses of generalized Charney-Drazin theorems for drift wave turbulence indicate that the *unique, explicitly nonlinear effect* controlling flow evolution is the radial transport of fluctuation potential enstrophy. This impacts zonal flow evolution via the divergence of the turbulent potential enstrophy flux, so that turbulence spreading is inexorably linked to zonal flow dynamics. Physically, this follows from the fact that fluctuation pseudo-momentum (generalized wave momentum density) is proportional to potential enstrophy density, so inhomogeneity and transport of the latter must necessarily impact the zonal flow via the balance with pseudo-momentum. Here, we explicitly calculate the potential enstrophy flux for collisional drift wave turbulence and use the result to construct coupled envelope equations for the flow and intensity field. This material is based upon work supported by the Department of Energy under Award Numbers DE-FG02-04ER54738 and DE-FC02-08ER54959.

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Date submitted: 14 Jul 2008 Electronic form version 1.4