Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Multi-Scale Nested Simulations of Plasma Instabilities: Turbulent Mixing and Lagrangian Dynamics in Ionospheric Plasma Flows ALEX MAHALOV, Arizona State University — Turbulent hydrodynamic mixing induced by the Rayleigh-Taylor (RT) instabilities occurs in settings as varied as exploding stars (supernovae), inertial confinement fusion (ICF), and macroscopic flows in fluid dynamics such as ionospheric plasmas Nested numerical simulations of ionospheric plasma density structures associated with nonlinear evolution of the Rayleigh-Taylor (RT) instability in Equatorial Spread F (ESF) are presented. The equation for the electric potential is solved at each time step with a multigrid method. For the limited area and nested simulations, the lateral boundary conditions are treated via implicit relaxation applied in buffer zones where the density of charged particles for each nest is relaxed to that obtained from the parent domain. The high resolution in targeted regions offered by the nested model was able to resolve secondary RT instabilities, and to improve the resolution of the primary RT bubble compared to the coarser large domain model. Our studies focus on the charge-neutral interactions and the statistics associated with stochastic Lagrangian motion. In particular, we examine the organizing mixing patterns for plasma flows due to polarized gravity wave excitations in the neutral field, using Lagrangian coherent structures (LCS).

Alex Mahalov
Arizona State University

Date submitted: 12 Jul 2013 Electronic form version 1.4