Abstract Submitted
for the APR06 Meeting of
The American Physical Society

Computing Coherent Structures with Chebyshev-Fourier Pseudospectral Techniques in Confinement Systems[1] J.C. PEREZ, W. HORTON, University of Texas at Austin, IFS, R. DAHLBURG, Naval Research Laboratory — Chebyshev-tau pseudospectral methods have been widely used for decades in the linear and nonlinear simulations of neutral fluid dynamics. In this work, we apply these techniques to different reduced models of fluid like plasma equations that describe various instabilities commonly present in many plasma confinement configurations, ranging from laboratory to space plasmas. Nonlinear high-resolution simulations are performed for a plasma slab, periodic in one direction and satisfying Dirichlet boundary conditions in the other. As opposed to Fourier-Fourier methods, usually applied to homogeneous problems, the Chebyshev-Fourier method allows for the study of equilibrium states that are inhomogeneous along one direction and have Dirichlet, Neumann or Robin boundary conditions. Adaptive fifth/sixth order RK time integration scheme is used to advance the initial condition. Simulations show the formation of long-lived coherent structures from different equilibrium states with a random noise initial perturbation. The morphologies of the structures obtained include mushrooms, associated to the Rayleigh-Taylor Instability, Kelvin-Helmholtz vorticity roll-up, streamers and blobs. The simulations examples are in conexion to shear flow experiments in the LArge Plasma Device.

[1]Work supported by DOE grant DE-FG02-04ER5474

Jean Perez
University of Texas at Austin, IFS

Date submitted: 13 Jan 2006 Electronic form version 1.4