Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

High order Lagrangian computations of elliptical electron vortices LOUIS ROSSI[1], University of Delaware, TRAVIS MITCHELL, XIAOJUN WANG, TAREQUE AZIZ COLLABORATION[2] — Vortex methods are numerical schemes for approximating solutions to the Navier-Stokes equations using a linear combination of moving basis functions to approximate the vorticity field of a fluid. Typically, the basis function velocity is determined through a Biot-Savart integral applied at the basis function centroid. These naturally adaptive methods are advantageous in flows dominated by localized regions of vorticity. The new method is a viscous core spreading algorithm using deforming elliptical Gaussian basis functions that achieve fourth order spatial convergence. This technique is unusual because one must evaluate the Biot-Savart integral of an elliptical Gaussian basis function and basis functions do not move with the physical flow velocity at the basis function centroid. Rather, high order accuracy is obtained when one adds a consistently small flow field curvature correction. To demonstrate the method's efficacy, we have been using these techniques for comparison with electron beam experiments which obey dynamics that are very similar to the Euler equations. In particular, we are exploring the growth of large non-axisymmetric modes and their dependence upon the initial aspect ratio and profile of an elliptical electron vortex.

[1]Department of Mathematical Sciences
[2]Department of Physics

Louis Rossi
University of Delaware

Date submitted: 02 Aug 2006 Electronic form version 1.4