

**Date:** May 27<sup>th</sup>, 2005 (Special Seminar)

**Time:** 10:30 AM

**Location:** Olin 305

**Speaker:** Dr. Lorena Barba  
Department of Mathematics, University of Bristol

**Title:** “Emergence of tripoles in nonlinearly perturbed planar vortices”

### **Abstract**

Since the observation of spontaneous generation of vorticity concentrations from random 2D turbulence, a huge interest has been stimulated on so-called coherent structures. The tripole is a much less common one than the monopole and dipole in numerical and experimental observations. It was first observed in both domains in the mid-late 1980s, and only in 1991 was a tripolar structure detected in the oceans. Laboratory tripoles occur as a result of the growth of a perturbation of azimuthal wavenumber 2 in unstable axisymmetric shielded vortices (a vortex surrounded by a ring of opposite vorticity). For this reason, shielded monopoles have also been the subject of several numerical studies. In the present study, in contrast, the tripole is seen to emerge from a nonshielded, Gaussian monopole (which is stable), with a large nonlinear perturbation. In this flow, the tripole was first observed by Rossi et al. (Phys. Fluids 9:2329, 1997). We extend the result by performing a parameter study, spanning values of the amplitude of perturbation and Reynolds number, with numerous simulations using a meshless vortex method. One of the goals is to determine whether there is a threshold amplitude that separates two asymptotic states (axisymmetric and tripolar). The possible relationship between this threshold amplitude and Reynolds number is sought, and several observations are made regarding the nonlinear, long-time evolution of the structure.