Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Locally Induced Dynamics of Thin Cored Vortex Geometries with Application to Bose-Einstein Condensates[1] SCOTT A. STRONG, LINCOLN D. CARR, Colorado School of Mines — The self-induced dynamics of a vortex defect in a Bose-Einstein condensate (BEC) are well modeled by phenomenological hydrodynamics. At the macroscopic scale, vortex defects are thought to be precursory to turbulent fluid dynamics. However, at the microscopic scale, the vortex defects take on additional structure since some of their important features become quantized. While the study of vortex-tubes is most applicable for these phenomenon, nontrivial dynamics also manifests from idealized line vortices and are expressed by a concise asymptotic expansion consistent with the Euler equations relating the local dynamics of the defect to nonlinear Scrödinger (NLS) evolution. This *local induction approximation* (LIA) states that a bent line-vortex generates a local velocity field with an asymmetry in the binormal direction. Binormal flows correspond to NLS, which is a completely integrable nonlinear PDE admitting soliton solutions whose amplitude and phase controls the line-vortex curvature and torsion, respectively. Our recent work, generalizing LIA, indicates that higher order expansions offer no new dynamics in the case of a line-vortex, which is in contrast to existing results relating the dynamics of slender vortex tubes to a hierarchy of integrable dynamics. We also discuss the applicability of these expansions to BEC vortex dynamics.

[1]Funded by NSF

Scott A. Strong
Colorado School of Mines

Date submitted: 22 Jan 2010

Electronic form version 1.4