Self-similar vortex spiral solutions of the 2d incompressible Euler equations

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March 29, 2013

Vortex spirals are ubiquitous in fluid flow, for example as turbulent eddies or as trailing vortices at aircraft wings. However, there are few proofs of existence for any of the common fluid models. We consider solutions of the 2d incompressible Euler equations that have vorticity stratifying into algebraic spirals. The solutions are selfsimilar: velocity $v(t,x) = t^{m-1}v(t^{-m}x)$, for similarity exponent $\frac{1}{2} < m < \infty$. Selfsimilar flows are special solutions of the full initial-value problem, but obtained by solving more tractable boundary value problems. The key to the existence proof is a coordinate change which is implicit, depending on the a priori unknown solution. We will also discuss the importance of the program for showing non-uniqueness in the initial-value problem for the 2d incompressible Euler solutions.

The lecture will take place in Thackeray 704 at 3:30pm.
Refreshments will start at 3:00pm.