EVAN MILLER, University of Toronto

Enstrophy Growth and the Navier Stokes Strain Equation

In this talk I will derive an evolution equation for the symmetric part of the gradient (the strain tensor) in the incompressible Navier Stokes equation, and prove the existence of L^2 mild solutions for this equation locally in time. I will use this PDE to derive a simplified identity for the growth of enstrophy for mild solutions that depends only on the strain tensor, not on the interaction of the strain tensor with the vorticity; this will also allow a substantial improvement of the constant in the differential inequality for enstrophy growth of the form $\partial_t E(t) \leq CE(t)^3$. I will use this to prove a lower bound on blow-up time in terms of the initial enstrophy, as well as provide analytical evidence for the observed alignment of vorticity to the middle eigenvector of the strain matrix. Finally, I will consider the variational problem related to enstrophy growth that corresponds to maximizing the instantaneous rate of enstrophy growth.