Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

Localization and homoclinic snaking in plane Couette flow[1]

TOBIAS M. SCHNEIDER, Harvard University, SEAS

For linearly stable shear flows such as pipe and plane Couette flow exact equilibrium and traveling wave solutions of the Navier-Stokes equations have recently been shown to play key roles in the transition to turbulence and the turbulent dynamics itself. Until now such solutions have been computed only for small, spatially periodic domains. Here we examine a new class of spatially localized solutions to plane Couette flow. Under continuation in Reynolds number these solutions exhibit a sequence of saddle-node bifurcations strikingly similar to the "homoclinic snaking" phenomenon observed in the Swift-Hohenberg equation. The localized solutions originate from bifurcations off the spatially periodic equilibria discovered by Nagata and others and retain their physical structure, demonstrating the relevance of exact solutions to turbulent flows in spatially extended domains, where localized perturbations are observed to induce spatially localized patches of turbulence which slowly invade the surrounding laminar flow.

[1]In collaboration with John F. Gibson, GeorgiaTech and John Burke, Boston University.