PHYSICAL MATHEMATICS SEMINAR

SHEAR INSTABILITY FOR STRATIFIED FLOWS AND A NOTE ON "AVOIDANCE OF CROSSINGS"

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ABSTRACT:

Stratified flows occur ubiquitously in nature, with atmosphere and ocean as prime examples. Since horizontal scales of such flows are much larger than the vertical ones, they satisfy to a good approximation the hydrostatic balance, whereby the pressure at each position balances the weight of the fluid above it. We introduce a novel stability criterion for stratified flows in hydrostatic balance, which re-interprets stability in terms not of growth of small perturbations, but of the local well-posedness of the time evolution. This reinterpretation allows one to extend the classic results of Miles and Howard concerning steady and planar flows, to the realm of flows that are non-uniform and unsteady.

If time permits, I will also talk about the "avoidance of crossing". In the early days of quantum mechanics, physicists discovered that as a real symmetric matrix evolved along one parameter, its eigenvalues would come close to each other as if they were bound to cross, then suddenly turn apart and "avoid crossing". This phenomenon was first explained by Wigner and von Neumann in 1929. It turns out that simple waves, which are fully nonlinear solutions to quasi-linear PDEs, do not follow this general rule. I will show that instead of repelling simple wave trajectories in phase space, degenerate points attract them.

TUESDAY, DECEMBER 1, 2009
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 290
(Math Department - Common Room)

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