PHYSICAL MATHEMATICS SEMINAR

Too much of a good thing? Destabilisation and mixing induced by stratification in shear flows

COLM-CILLE CAULFIELD

BP Institute & DAMTP,
University of Cambridge

ABSTRACT:

Statically stable fluids, where the fluid density decreases monotonically with height, are very common in the environment, and arise due to the natural tendency for stationary fluid to be arranged in a state which minimizes the potential energy of the system. It is then natural to suppose that such a statically stable density distribution will reduce the growth rate and ultimate nonlinear saturated amplitude of instabilities associated with some large scale vertical shear of the fluid, compared to the properties of such instabilities in an unstratified fluid. However, stratification not only can introduce primary instabilities of stratified shear flows which do not arise in the absence of density variations, but can also strongly modify the secondary instabilities which subsequently develop, modulating, and in some circumstances significantly accelerating the transition to turbulence. In this talk, I will review some aspects of the present understanding of the destabilising effect of statically stable stratification in shear flows, and discuss the central part such destabilisation plays in the commonly observed non-monotonic dependence of turbulent mixing on overall stratification, leading, through a classical physical mechanism first identified by Phillips, to the inevitable development of layers in stratified fluids.

TUESDAY, NOVEMBER 4, 2014
2:30 PM
Building E17, Room 122

Reception following in Building E17, Room 401A
(Math Dept. Common Room)

http://math.mit.edu/pms/

Massachusetts Institute of Technology