PHYSICAL MATHEMATICS SEMINAR

Internal wave streaming

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ABSTRACT:

Recently, there has been a surge of research activity on internal gravity wave beams – time-harmonic plane waves with locally confined profile – in stratified fluids. These fundamental disturbances are manifestations of the inherent anisotropy of internal wave motion and are relevant in various geophysical processes. This presentation focuses on a combined theoretical--experimental study of the nonlinear interaction of a three-dimensional modulated internal wave beam with its induced mean flow in a slightly viscous fluid. An asymptotic model is developed for the coupled wave--mean-flow dynamics, which predicts the generation of two distinct types of mean flow: (i) an inviscid, purely modulation-induced mean flow akin to that induced by surface wave packets; and (ii) streaming, a horizontal mean flow associated with the production of mean potential vorticity via the combined action of dissipation and nonlinearity. Under laboratory flow conditions in particular, the latter type of mean flow is expected to dominate. The theoretical predictions, over the entire mean-flow evolution, are in excellent agreement with laboratory experimental observations and Navier--Stokes numerical simulations. [This is joint work with B. Fan (MIT), T. Kataoka (Kobe University, Japan), T. Jamin and T. Dauxois (ENS de Lyon, France).]

TUESDAY, December 14, 2021
2:30 PM – 3:30 PM
Building 2, Room 449

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