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Interaction between internal and surface waves in a two layers fluid.

We consider a situation in which a fluid is composed of two essentially immiscible layers separated by a sharp interface such as a thermocline or a pycnocline of differential salinity. Internal waves of various types are commonly generated in the world's oceans, and large amplitude, long wavelength nonlinear waves can be produced in the interface and propagate over large distances. In some physically realistic instances, the visible signature of internal waves on the surface of the ocean is a band of roughness which propagates at the same velocity as the internal wave. Several of the earliest observations are the most striking, consisting of long brightly shining strips of many kilometers in extent, visible through the effect of the reflection at an oblique angle of the setting sun, and photographed from the Space Shuttle.

I will discuss the asymptotic analysis of the coupling between the interface and the free surface of a two layers fluid in a scaling regime chosen to capture these observations, in which the internal mode is treated as a long wavelength nonlinear internal wave, while the surface mode is smaller and taken in a modulational regime.

This talk is based on joint work with Walter Craig and Philippe Guyenne.