WAVE BREAKING AND MODULATIONAL INSTABILITY IN FULL-DISPERSION SHALLOW WATER MODELS

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In the 1960s, Benjamin and Feir, and Whitham, discovered that a Stokes wave would be unstable to long wavelength perturbations, provided that (the carrier wave number) $\times$ (the undisturbed water depth) $> 1.363....$ In the 1990s, Bridges and Mielke studied the corresponding spectral instability in a rigorous manner. But it leaves some important issues open, such as the spectrum away from the origin. The governing equations of the water wave problem are complicated. One may resort to simpler approximate models to gain insights.

I will begin by Whitham's shallow water equation and the wave breaking conjecture, and move to the modulational instability index for small-amplitude periodic traveling waves, the effects of surface tension and constant vorticity. I will then discuss higher order corrections, extension to bidirectional propagation and two-dimensional surfaces. This is based on the joint works with Jared Bronski (Illinois), Mat Johnson (Kansas), Ashish Pandey (Illinois), and Leeds Tao (UC Riverside).