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Internal wave shoaling in nearly linear stratifications

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In the theory of internal waves in the coastal ocean, linear stratification plays an exceptional role. This is because the nonlinearity coefficient in KdV theory vanishes, and in the case of large amplitude waves, the DJL theory linearizes and fails to give solitary wave solutions. We consider small, physically consistent perturbations of a linearly stratified fluid that would result from a localized mixing near a particular depth. We demonstrate that the DJL equation does yield exact internal solitary waves in this case. These waves are long due to the weak nonlinearity, and we explore how this weak nonlinearity manifests during shoaling.