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Internal wave tunnelling: Laboratory experiments KATE D. GREGORY, BRUCE R. SUTHERLAND, University of Alberta — Heuristics based upon ray theory are often used to predict the propagation of internal waves in non-uniform media. In particular, they predict that waves reflect from weakly stratified regions where the local buoyancy frequency is less than the wave frequency. However, if the layer of weak stratification is sufficiently thin, waves can partially transmit through it in a process called tunnelling. In this work, the first laboratory evidence of internal gravity wave tunnelling through a weakly stratified region is analysed. Generated by a vertically oscillating circular cylinder, internal gravity waves partially reflect from and transmit through a weakly stratified region. Using a non-intrusive optical technique called "synthetic schlieren," the wave amplitude and structure can be measured and the transmission coefficient is computed as the ratio of the transmitted and incident energy of the waves. Using an appropriate superposition of plane waves to reproduce the structure of the incident wave beam, the theoretical transmission coefficients are calculated using the experimentally measured background density profiles. We form a corresponding weighted sum of transmission coefficients and so predict the transmission of the beam. These results are compared with experimental measurements.

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