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The interaction of nonlinear lee waves with shear and boundary layers

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Lee waves are generated when a stratified fluid flows over isolated topography. We study experimentally the properties of the internal wave field induced by steady flow past an isolated hemispherical obstacle in a recirculating stratified shear flume tank. The complete steady span-wise averaged wave field is determined using the synthetic schlieren technique. The induced wave field is strongly nonlinear, and appears to be excited not only at the obstacle, but also by the disordered flow downstream of the obstacle. We investigate the effect of boundary layers and vertical velocity shear on the wave field, paying particular attention to the amplitude and spectrum of the wave field. We find that boundary layers act as sponge layers absorbing wave energy, while we measure quantitatively the extent to which vertical velocity shear can lead to either reflection or critical level absorption.