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Intrusions on a density interface PAUL LINDEN, University of California, San Diego, HYONG-BIN CHEONG, Pukyong National University, JEROEN KEUNEN, Eindhoven University of Technology, STUART DALZIEL, University of Cambridge — An accurate theoretical prediction of the speed of an intrusion propagating along the interface between two uniform layers has defied analysis for the past 25 years. Theories by Holyer & Huppert (1980) and, more recently, Sutherland, Kyba & Flynn (2004) give only approximate agreement with experiments. We describe an experimental and numerical study of an intrusion and show that, except when the density of the intrusion is the depth-weighted mean of the layer densities, the interface ahead of the intrusion is displaced vertically. We predict this vertical displacement, which takes the form of an upstream-propagating long wave, and use the predicted value to determine the intrusion speed. For the case when the interface is undisturbed the intrusion propagation speed is a minimum. We develop an energy argument that describes the observed variation of the intrusion speed from this minimum speed as a function of the intrusion and layer densities and the ratio of the layer depths. We also show that if, and only if, the layer depths are equal, the speed of the intrusion is *independent* of the density of the intrusion.

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