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Interaction of Fully-Nonlinear Internal Solitary Waves of Opposite Polarity

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Previous studies have suggested that fully nonlinear internal solitary waves (ISWs) are very soliton-like as the interaction of two ISWs results in only very small changes in amplitude of the interacting ISWs and in the production of a very small amplitude wave train. Previous studies have, however, considered ISWs with the polarity predicted by the sign of the quadratic nonlinear coefficient of the KdV equation. The Gardner equation, which is an extension of the KdV equation that includes a cubic nonlinear term, has ISWs of two polarities (i.e., waves of depression and elevation) when the cubic coefficient of the Gardner equation is positive. These waves are soliton solutions of the Gardner equations. In this talk I will discuss the interaction of ISWs of opposite polarity in continuous asymmetric three layer stratifications. Regions in parameter space where ISWs of opposite polarity exist will be discussed and I will demonstrate via fully nonlinear numerical simulations that the interaction of ISWs of opposite polarity waves are far from soliton-like: their interaction can result in very large changes in wave amplitude and may produce a very complicated wave field with multiple large ISWs, a large linear wave field and breather-like waves.