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Stability of Gravity–Capillary Lumps[1] T.R. AKYLAS, YEUNWOO CHO, MIT — Lumps are fully localized nonlinear waves of permanent form. In the classical water-wave problem, such waves are possible only when both gravity and surface tension are present. Shallow- water lumps, in particular, are known to arise in the strong- surface-tension regime and have been studied extensively. Here, we are concerned with a new class of lumps, found recently on water of finite or infinite depth. These lumps bifurcate at the minimum gravity–capillary phase speed and, in the small-amplitude limit, resemble locally confined wavepackets with envelope corresponding to the ground state of a steady elliptic– elliptic Davey–Stewartson (EEDS) equation system. We examine the stability of lumps of this type. We find that exchange of stabilities occurs when the energy is stationary as a function of the wave speed. This criterion predicts that small-amplitude lumps are unstable while finite-amplitude lumps are stable. Numerical simulations indicate that the instability results in the formation of a finite-amplitude lump, thus interpreting the focusing singularity (wave collapse) predicted by the EEDS equations.

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