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Repeated bubble breakup and coalescence in perturbed Hele-Shaw channels ALICE THOMPSON, ANDRES FRANCO-GOMEZ, ANDREW HAZEL, ANNE JUEL, University of Manchester — The introduction of an axially-uniform, centred constriction in a Hele-Shaw channel leads to multiple propagation modes for both air fingers and bubbles, including symmetric and asymmetric steadily propagating modes along with oscillations. These multiple modes correspond to a non-trivial bifurcation structure, and relate to the plethora of steadily propagating bubbles and fingers which exist in the Saffman-Taylor system. In both experiments and depth-averaged computations, a very small centred occlusion can be enough to trigger bubble breakup, with a single large centred bubble splitting into two smaller bubbles which propagate along each side of the channel. We present numerical simulations for the depth-averaged model, implementing geometric criteria for pinchoff and coalescence in order to track the bubble before and beyond breakup. We find that the two-bubble state is itself unstable, with finger competition causing one bubble to move ahead; the trailing bubble then moves across the channel to merge with the leading bubble. However, the story is not always so simple, enabling complicated cascades of splitting and merging bubbles. We compare the general dynamical behaviour, basins of attraction, and the details of merging and splitting, to experimental observations.

Alice Thompson
University of Manchester

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