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Liquid interfaces in viscous straining flows: numerical studies of the selective withdrawal transition WENDY ZHANG, MARKO KLEINE BERKENBUSCH, University of Chicago, ITAI COHEN, Cornell University — In selective withdrawal, the interface between two liquid layers is pulled apart by an imposed withdrawal flow. The shape transition creates a sharp hump on the interface, with the minimum hump radius of curvature far smaller than the characteristic lateral length-scale. Previous measurements [Cohen & Nagel Phys. Rev. Lett. 2002] on equal-viscosity layers suggest the sharp hump is created via an approach towards a steady-state singular shape which is cut off at a small length-scale. In contrast, an analogous shape transition in drop emulsification has been shown to occur via a saddle-node bifurcation, without an approach towards a singular shape. Here we present a numerical model of the selective withdrawal experiment and examine the dynamics near the transition with higher resolution. Our numerical results are consistent with previous measurements, but the increased resolution enables us to identify the shape transition as a saddle-node bifurcation. The transition does not involve approach towards a singular shape. (We thank Sidney R. Nagel for helpful discussions.)

Wendy Zhang
University of Chicago

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