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Pinch-off of axisymmetric squashed underwater bubbles DANIEL C. HERBST, WENDY W. ZHANG, University of Chicago — Up until now, theoretical and computational studies of bubble pinch-off have assumed for simplification that the neck near break-up is nearly cylindrical, and that the surrounding water flows inwards radially. In this regime, azimuthal perturbations, however small initially, give rise to vibrations that dominate the collapse. Here we use a boundary integral simulation to investigate the surface evolution starting from initial states in the opposite limit, where the neck shape is composed of two cones with large opening angle. We also compare simulation results near the minimum against predictions from a leading-order expansion that is valid for strongly squashed neck shapes, in contrast to previous slender-neck expansions. We derive the instantaneous condition that the exterior flow must satisfy in order for the shape to evolve without changing the opening angle. The simulation shows that this condition is unstable. The small component of vertical flow present initially grows in magnitude and always acts to make the neck more slender. Thus all initial states evolve towards a dynamics that supports memory-encoding vibrations.

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