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Role of up-down asymmetry in the break-up of an underwater bubble MONTE RINEBOLD, College of Idaho, DANIEL C. HERBST, WENDY W. ZHANG, University of Chicago — We examine the effect of up-down asymmetry on the axisymmetric break-up of an underwater bubble. Previous works have assumed that the neck shape is always symmetric about the minimum. However, because of hydrostatic pressure, a slight initial up-down asymmetry is in practice always present. In addition, recent experiments by Keim & Nagel show that the evolution of this asymmetry exhibits complex variations over time and with respect to the gas composition. Our simulations show that, in the idealized regime where the interior flow is negligible, an initial up-down asymmetry, however large, decays rapidly. As an example, starting with an initial neck shape comprised of an upper cone with an opening angle of 60° joined smoothly onto a lower cone with an opening angle of 150°, the magnitude of the asymmetry reduces 20 fold as the minimum radius decreases by a factor of 10. This reduction proceeds in a distinctive form: the vertex region of the large cone sharpens while the small cone persists without significant change. As a result, the final up-down symmetric profile retains a memory of the small initial angle but not the large one. Since our simulation tracks only the effect of the exterior flow, this result also suggests that the complex variation observed is created by an interplay of interior gas flow at late times and exterior flow at early times.

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