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Breakup of Bubbles or Drops by Capillary Waves Induced by Coalescence or Other Excitations FENG HUA ZHANG, Singapore-MIT Alliance, National University of Singapore, Singapore, PETER TABOREK, Department of Physics and Astronomy, University of California, Irvine, USA, JUSTIN BURTON, James Franck Institute, University of Chicago, Chicago, USA, BOO CHEONG KHOO, Singapore-MIT Alliance, National University of Singapore, Singapore, SIGGI THORODDSEN, King Abdullah University of Science and Technology, Saudi Arabia — Capillary breakup of a bubble or drop by various excitations is ubiquitous in both nature and technology. Examples include coalescence with another bubble or drop, wetting on a solid surface, impact on a solid surface, detachment from a nozzle, or vibrations driven by acoustic, electrical, or magnetic fields. When the excitation ceases, capillary forces on the surface naturally drive the deformed bubble or drop to recover its spherical shape. However, when the viscosity is small, this recovery can lead to nonlinear oscillations of the interface and a singularity in the flow. Here we use high-speed imaging to investigate the coalescence of bubbles and drops of various sizes. In many cases, coalescence leads to pinch-off events and the formation of the satellite and sub-satellite. Our experiments use pressured xenon gas in glycerol/water mixtures so that the density ratio and viscosity ratio can be varied over many orders of magnitude. We characterize the generation, propagation, and convergence of capillary waves, the formation time and sizes of satellites, and the dynamics of two-fluid pinch-off as a function of the density ratio and viscosity ratio. The work shall benefit the wide-spread applications and fulfill the scientific and public curiosities.

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