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Bubble Coalescence at the Free Surface¹ DANIEL SHAW, LUC DEIKE, Department of Mechanical and Aerospace Engineering, Princeton University — Bubble coalescence at a free surface occurs in our daily lives at the surface of drinks as well as at the surface of the ocean. While coalescence inside water has been largely investigated, the studies at the free surface remain scarce. In this talk, we study experimentally the coalescence of two bubbles at a free surface. Three primary regimes are identified. During an ‘attraction’ phase, the bubbles accelerate together due to the capillary distortion of the free-surface. As the bubbles draw near, the resistance provided by the fluid between them increases and slows the advancing bubbles. This ‘drainage’ regime begins when the relative velocity of the bubbles start decreasing and ends when the film is ruptured. ‘Confluence,’ the third regime, is dominated by the rapid expansion of the neck separating the newly united air pockets. A balance of capillary, inertial, and viscous forces determine the dynamics of the newly-formed interface. Unlike coalescence in a bulk outer-fluid, the asymmetry created by the presence of the free surface alters previous models and presents new challenges for both measuring and modeling coalescence.

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