The physics of effervescence : from bubble bursting to sea spray distribution

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Abstract

When a bubble reaches an air-liquid interface, it ruptures, projecting tiny droplets in the air (see top sequence of attached figure). Across the oceans, an estimated 10ˆ{18} to 10ˆ{20} bubbles burst every second, and form the so called {sea spray}, a major player in earth's climate system.
Based on the model experiment and simulation of a single bubble bursting in simple liquids, we propose scaling laws for the drop size and velocity. We unravel experimentally the intricate roles of bubble shape, capillary waves, gravity, and liquid properties. In particular, we show how damping action of viscosity produces faster and smaller droplets.
Finally, we compute the distribution of jet drops formed by a range of bubbles present under a breaking wave which compares well against laboratory experiments. We discuss the applicability of the proposed formulation in the context of sea spray generation function.

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