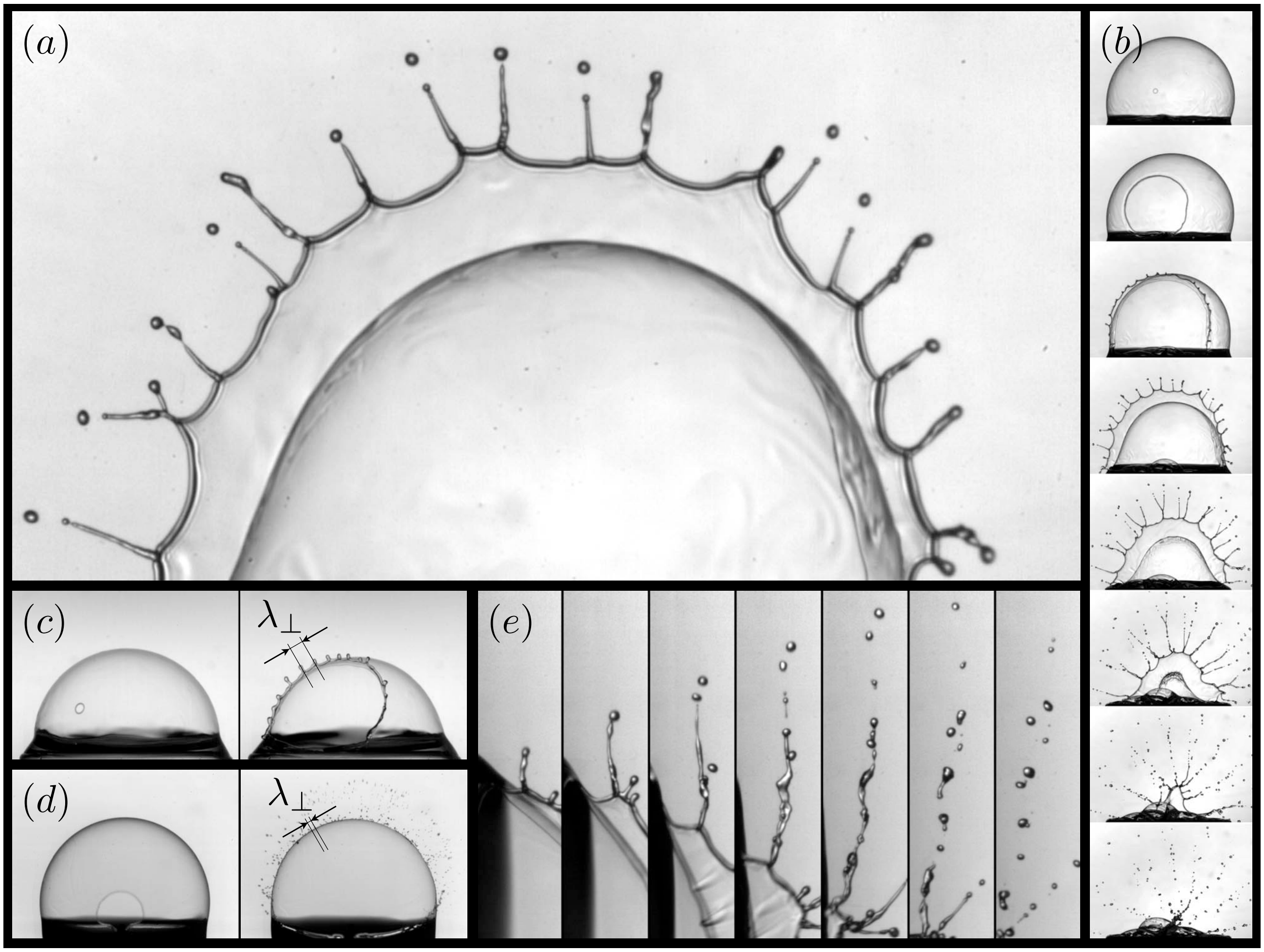

FIG. 1.

Bursting bubbles

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A young bubble is a piece of bare spherical liquid shell of radius R, with uniform thickness h, formed from an air volume rising underneath a water pool. It bursts by nucleating a hole, opening at the constant tangential velocity $V=\sqrt{2\sigma/\rho h}$ balancing inertia with surface tension forces, and collecting liquid in its rim. The centripetal acceleration $\gamma = V^2/R$ exerted on the rim perpendicular to the shell surface induces its Rayleigh–Taylor destabilization whose wavelength $\lambda_\perp \sim \sqrt{\sigma/\rho\gamma}$ scales as the geometrical mean of the only two lengthscales characterizing the bubble,

$$\lambda_\perp \sim \sqrt{Rh}. \qquad (1)$$

Examples shown here include: [Fig. 1(a)] a snapshot of the rim instability and ligaments expulsion from the full bursting sequence [Fig. 1(b)] of a $R=10$ mm radius bubble. $\Delta t=2$ ms between frames. Two water bubbles with distinct thicknesses h lead to different wavelengths $\lambda_\perp$: [Fig. 1(c)] $R=14$ mm, $\Delta t=5$ ms between frames and $\lambda_\perp=2$ mm; and [Fig. 1(d)] $R=11.5$ mm, $\Delta t=1.33$ ms between frames and $\lambda_\perp=0.8$ mm.

Ligaments emerge from the rim unstable crests and are stretched by centrifugation. They ultimately break by a capillary instability setting the resulting drop size distribution in the spray, as seen in Fig. 1(e). The distribution width is fixed by the relative ligament radius corrugations.[1] The drops thus formed are called "film drops."[2] They originate in nature from bubbles entrained below breaking waves,[3] and are believed to contribute significantly to the net water evaporation from the sea.[4]

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