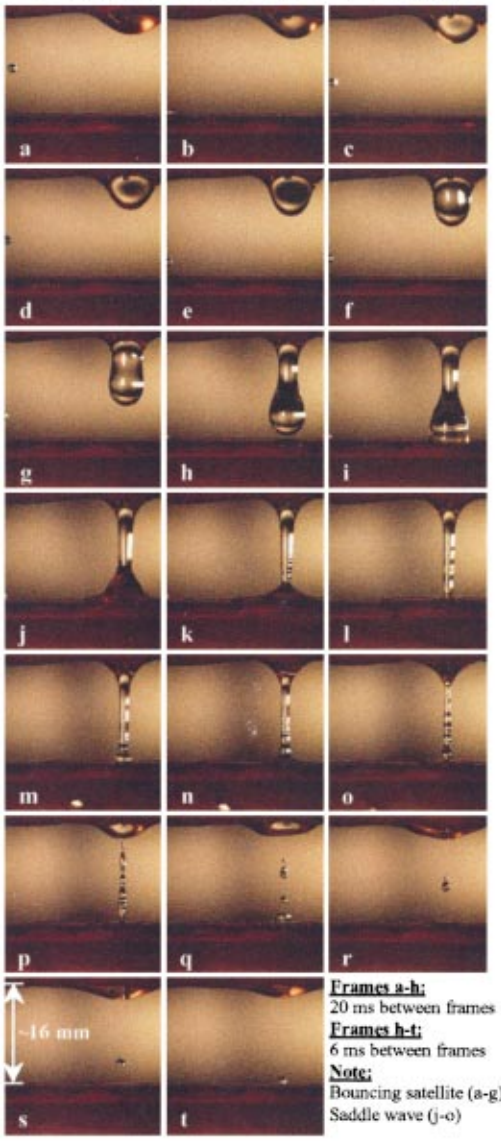
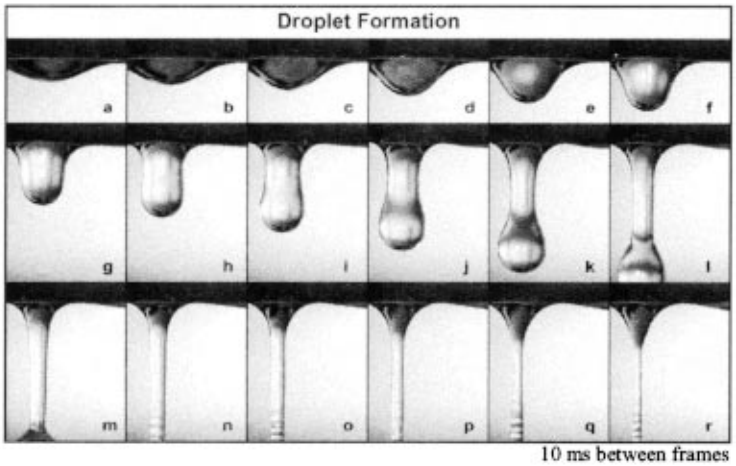
Aqueous Lithium Bromide (55 wt%) Falling Over 15.9 mm OD Copper Tube Bank

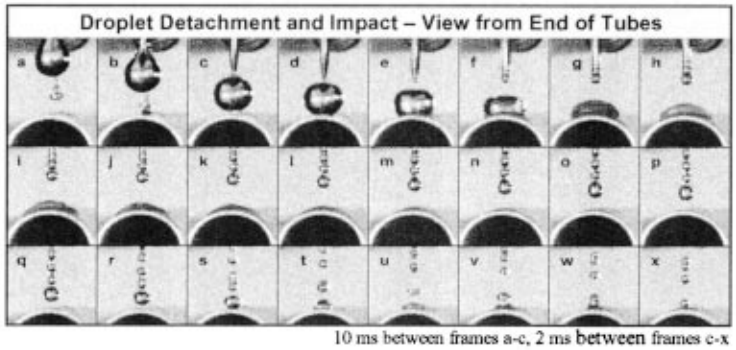


Frames a-h:
20 ms between frames
Frames h-t:
6 ms between frames
Note:
Bouncing satellite (a-g)
Saddle wave (j-o)

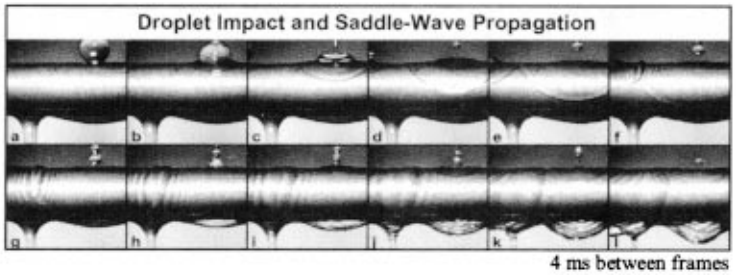
Water Falling Over 12.7 mm OD Brass Tube Bank (25.4 mm between tubes)



10 ms between frames



10 ms between frames a-c, 2 ms between frames c-x



4 ms between frames

BEHAVIOR OF AQUEOUS LITHIUM-BROMIDE DROPS IN HORIZONTAL TUBE BANKS

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Liquid films falling over banks of internally cooled horizontal tubes are frequently used to absorb a surrounding vapor, particularly when the heat of absorption is high and when high transfer rates and low pressure drops are required, as in absorption heat pump systems. Recent studies have shown that, in systems utilizing water/lithium-bromide, the droplets contribute significantly to the total absorption rate. It is thought that the droplets can affect absorption rates both directly, by absorption on their continuously evolving surface, and indirectly, by waves on the liquid film caused by droplet formation, detachment, and impact. The video frames presented here illustrate the complex details of the droplet flow modes have been previously unaccounted for in mathematical models. By revealing the surface shape evolution and flow features, these images provide a basis for more accurately predicting the coupled heat and mass transfer rates.

The tube bank shown comprises 9 copper tubes (15.9 mm OD, 15.9 mm tube-to-tube gap). LiBr solution (55%-wt) flowed at $Re_\Gamma = 4\Gamma/\mu = 120$, where Γ = mass-flow-rate/(2×tube length) and μ = viscosity. The system was at 24 °C and 1 atm with no vapor flow and no surfactant. The images were captured with 1024x1024 pixel resolution at 500 frames per second. Similar flow phenomena for the flow of water over a bank of 6 tubes (OD 12.7 mm, 25.4 mm tube-to-tube gap) are also shown.