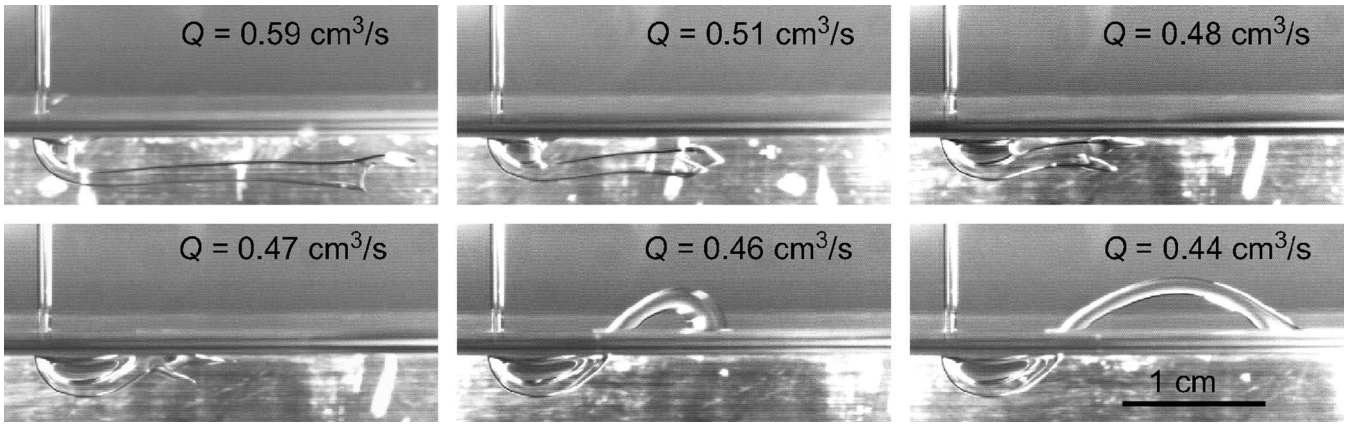

FIG. 1. Jet bouncing spontaneously as the flow rate Q rapidly decreases. Conditions: μ=361 mPa s, H=4.2 cm, and V_{bath}=5.2 cm/s. The relative times of each image are 0, 0.46, 0.66, 0.71, 0.82, and 0.90 s. The white splotches below the surface are bright reflections from the aluminum background (figure enhanced online).

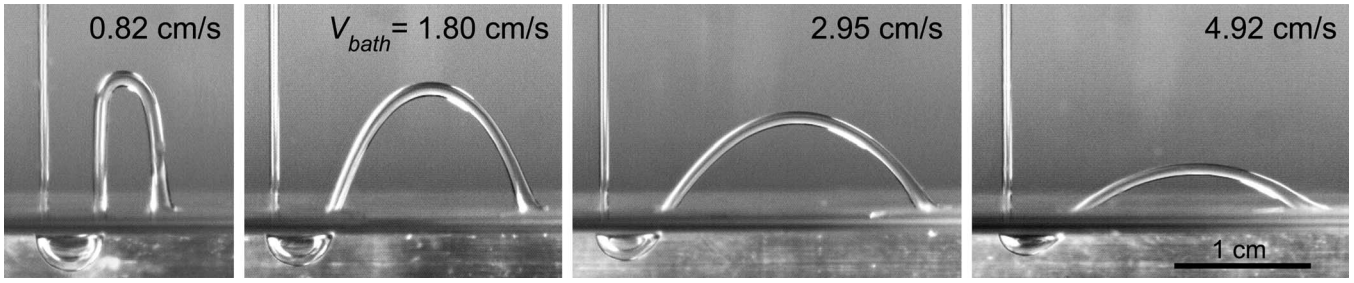

FIG. 2. Jet's dependence on bath velocity V_{bath}. Conditions: μ=361 mPa s, Q=0.24 cm^3/s, and H=4.2 cm.

Bouncing of a jet off a Newtonian liquid surface

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(Received 18 June 2007; published online 26 September 2007)
[DOI: 10.1063/1.2775410]

In a collision between a falling liquid jet and a bath of the same liquid, coalescence usually occurs immediately. However, if there is relative horizontal motion between the jet and the bath, we found that the jet can bounce.[1] In these images, a jet of silicone oil of flow rate Q and viscosity μ is falling from height H to a bath of the same liquid, which is moving to the right with velocity V_{bath}. Figure 1 is a time sequence of a jet spontaneously starting to bounce during a rapid decrease in the jet's flow rate. The images show both above and below the surface; the surface is a dark, horizontal line. Before the jet begins to bounce, it entrains a thin, cylindrical film of air into the bath. As the flow rate decreases, the length of the cylindrical film decreases until the jet bounces; the jet and bath are separated by a lubricating layer of air. Figure 2 shows that the rebound is nearly vertical at small bath velocities and becomes more oblique with larger bath velocities. Figure 3 displays a jet bouncing twice. The

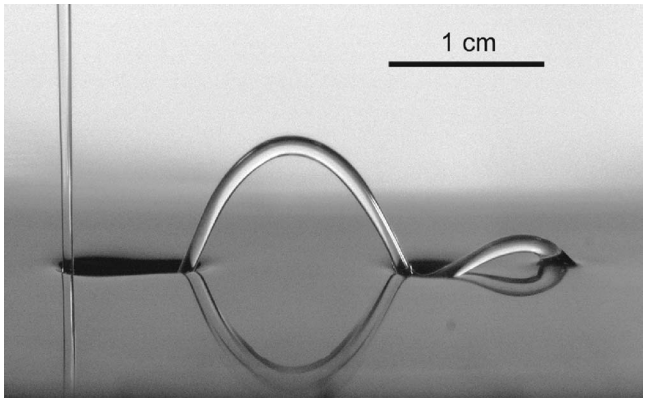

FIG. 3. Double bouncing jet. Conditions: μ=106 mPa s, Q=0.35 cm^3/s, H=5.0 cm, and V_{bath}=15.7 cm/s.

bouncing phenomenon was observed over a broad range of viscosity, jet velocity, jet radius, and bath velocity. This experiment can easily be done at home by pouring mineral oil into a pan of mineral oil.[1]

[1]M. Thrasher, S. Jung, Y. K. Pang, C.-P. Chuu, and H. L. Swinney, "The bouncing jet: A Newtonian liquid rebounding off a free surface," arXiv:0707.1721v1 (2007).

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