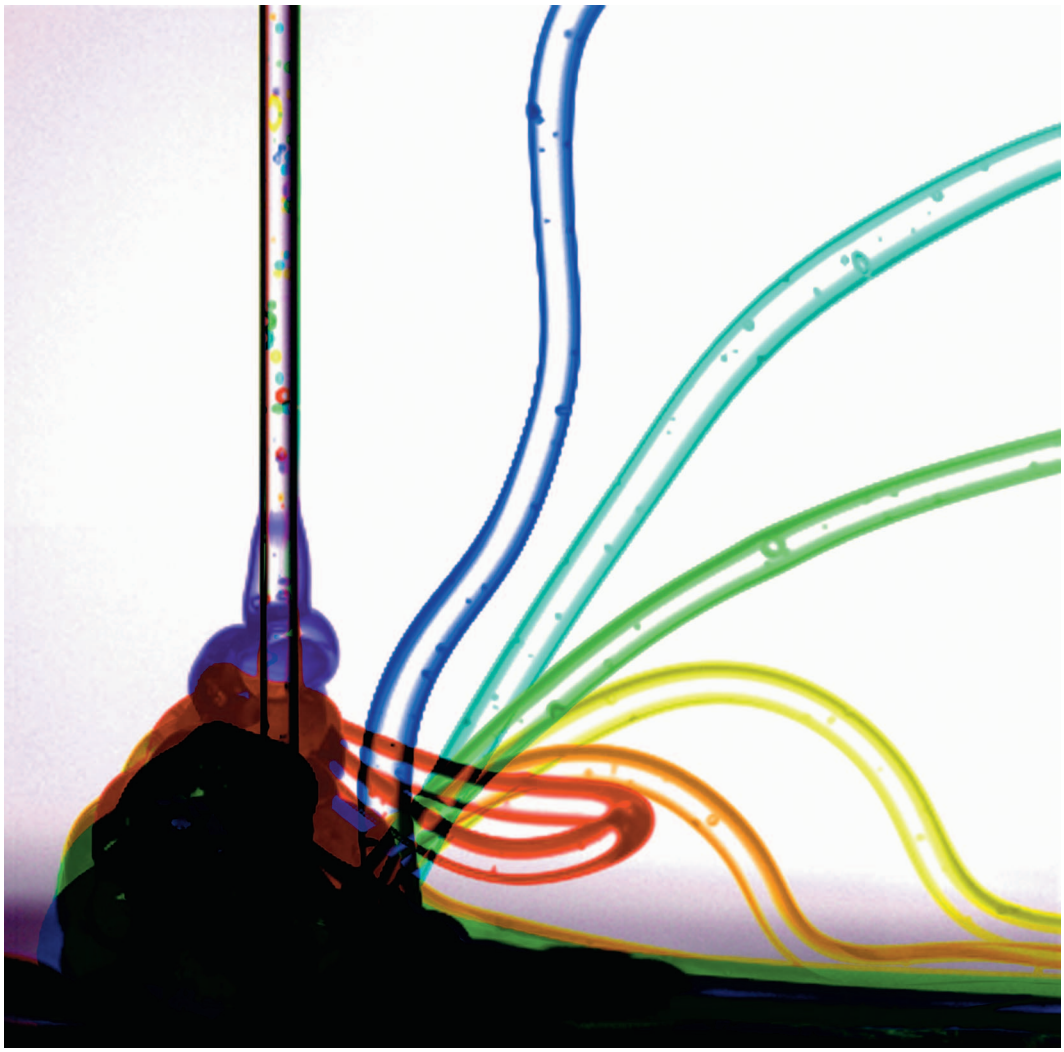

FIG. 1. (Color) A thin stream of shampoo is poured from a height of 20 cm and recorded with a high-speed camera. At first, the fluid will curl and wrinkle as any highly viscous fluids such as honey, syrup, or silicone oil would do, forming a viscous heap. At some instant, due to a favorable geometry, the incoming jet will slip away from the heap. While for a viscous Newtonian fluid such a slip would only lead to a small disturbance in the wrinkling or coiling pattern, in the shear-thinning shampoo the resulting high shear rate forms a low viscosity interface leading to an expelled jet at low inclination. Meanwhile, the incoming jet will exert a vertical force on the viscous heap forming a dimple. The dimple deepens because of the sustained force exerted onto it by the incoming jet thereby erecting the outward going jet. The inclination of the streamer steepens until it hits the incoming jet and disturbs or even interrupts the in-flow, thereby halting the Kaye effect. This figure shows six frames from a high-speed visualization at 1000 frames per second. The individual frames with an interframe time of 150 ms are superimposed in false color representation (enhanced online).

Leaping shampoo

Michel Versluis, Cor Blom, Devaraj van der Meer, Ko van der Weele, and Detlef Lohse
Physics of Fluids Group, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands
(Received 27 June 2007; published online 26 September 2007)
[DOI: 10.1063/1.2775411]

Shear-thinning fluids exhibit surprisingly rich behavior. One example is the Kaye effect, which occurs when a thin stream of shampoo is poured into a dish of the fluid.[1] As pouring proceeds a small stream of shampoo occasionally leaps upward from the heap. This surprising effect, which lasts only a second or so, is named after its first observer, who could offer no explanation for this behavior.[2]

We show that the Kaye effect is a continuous flow phenomenon.[3] We reveal its physical mechanism (formation, stability, and disruption) through high-speed imaging, see Fig. 1. The measurements are interpreted with a simple theoretical model[3] including only the shear thinning behavior of the liquid; elastic properties of the liquid play no role. We show that the Kaye effect can be stable and that it can be directed. We even exclude the necessity of a rigid backing surface by demonstrating a stable Kaye effect on a thin soap film.[3]

[1] See http://pof.tnw.utwente.nl/3_research/3_gallery.html for a video of the Kaye effect of leaping shampoo.
[2] A. Kaye, "A bouncing liquid stream," Nature **197**, 1001 (1963).
[3] M. Versluis, C. Blom, D. van der Meer, K. van der Weele, and D. Lohse, "Leaping shampoo and the stable Kaye effect," J. Stat. Mech.: Theory Exp. **P07**, 007 (2006).

