Recent jets and drops

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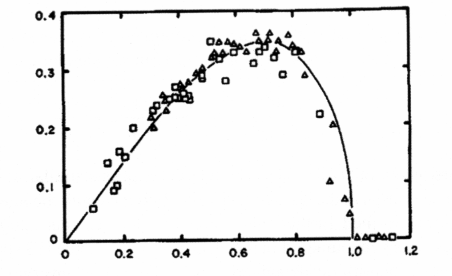
Reviews

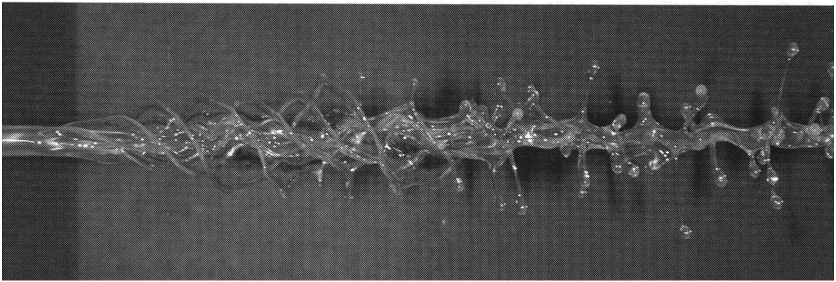
- *Breakup of Liquid Sheets and Jets* by S. P. Lin (CUP 2003) (286 pages)
- *Physics of liquid jets* by Jens Eggers and Emmanuel Villermaux (2008) Rep. Prog. Phys. 71, 036601 (79 pages)

Rayleigh (inviscid) growth rates



Spinning jet

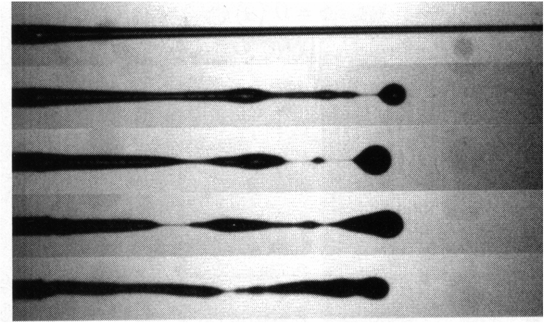
$\mu = 2.3\,10^{-4}\,\mathrm{Pa\,s}$, $\gamma = 27\,10^{-3}\,\mathrm{N/m}$, $v = 2.2\,\mathrm{m/s}$, $\omega = 346\,\mathrm{s}^{-1}$



Kubitachek & Weidman (Nov 2007) PoF

Jet of suspended particles

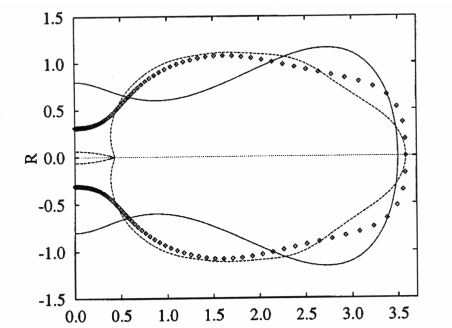
Particles 200μm, jet 1.6mm, $Re = 0.4$, $\phi = 0,\ 0.05,\ 0.1,\ 0.2,\ 0.3$

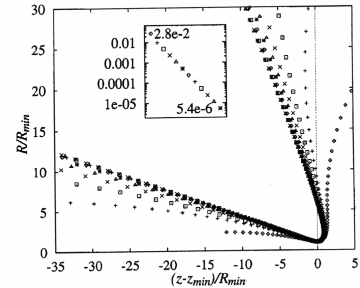


Furbank & Morris (2004) PoF

Jet pinch off

Inviscid numerics



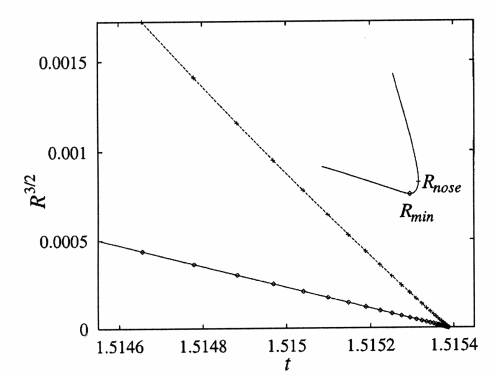


Self-similar shape: double cone

Day, Hinch & Lister (1998) PRL

Jet pinch off
Numerics, Inviscid

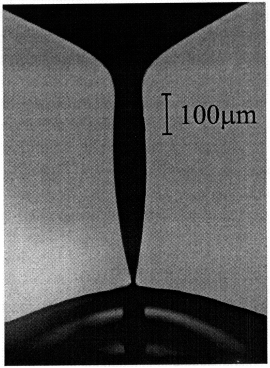
Scaling $\rho \partial u/\partial t = -\nabla p$ & $p = \gamma/r$ gives $\quad R \propto \left[\gamma (t_* - t)^2/\rho\right]^{1/3}$

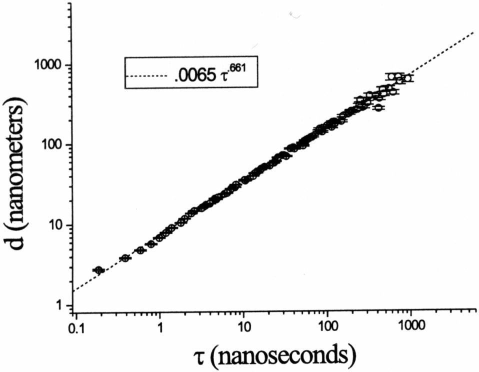


Day, Hinch & Lister (1998) PRL

Jet pinch off

Experiments





Radius measured by electrical conduction through Hg.

Burton, Rutledge & Taborek (2004) PRL

Jet pinch off

The viscous-inertial-capillary length:

$$\ell = \mu^2/(\gamma\rho)$$

0.3nm (Hg), 12nm (water), 96μm (83% glycerol)

Inviscid

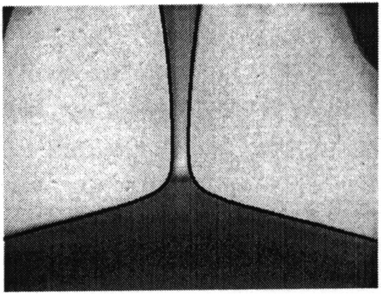
$$r > \ell : \quad R(t) \propto (t_* - t)^{2/3}$$

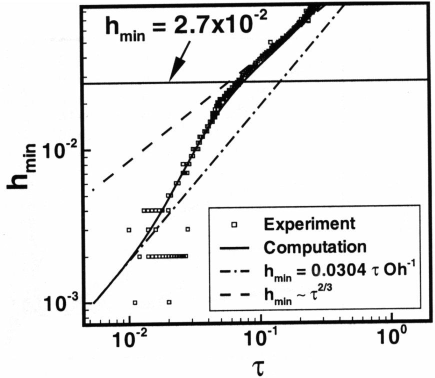
Viscous

$$r < \ell : \quad R(t) \propto (t_* - t)$$

Inertial-viscous pinchoff experiment

Experiments with 83% glycerol, transistion at 96μm

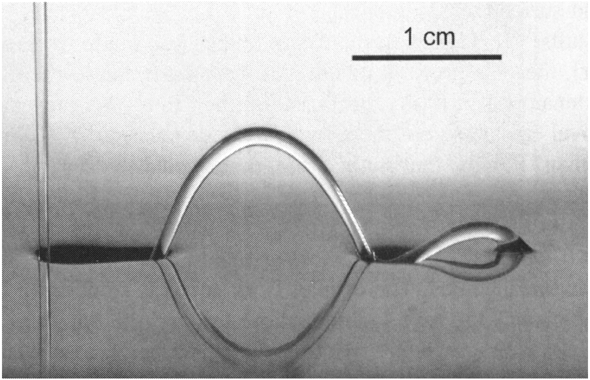




Chen, Notz & Basaran (2002) PRL

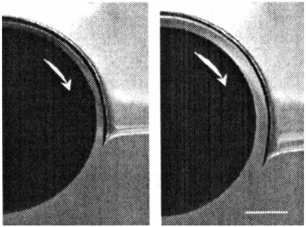
Jet into a moving bath

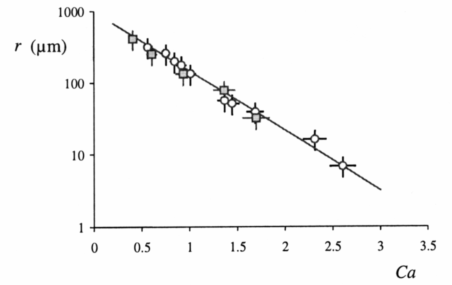
$V_{\mathrm{bath}} = 15.7$ cm/s, $\mu = 106$ mPa s, $Q = 0.35\,\mathrm{cm}^3/\mathrm{s}$, $H = 5.0$cm



Thrasher, Jung, Pang & Swinney (Sept 2007) PoF

'Jet' into a stationary bath



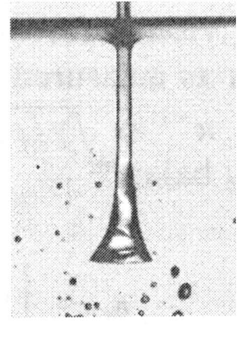


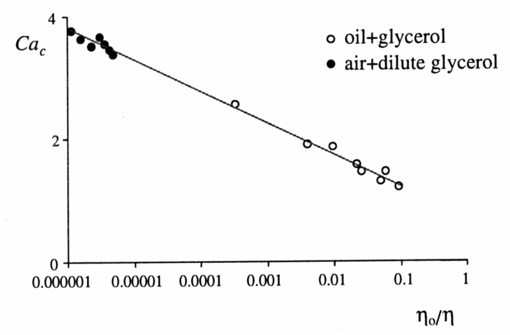
Radius of tip from force balance $8\pi\mu U/\ln(d/r_c) = 2\gamma$

Lorenceau, Restango & Quere (2003) PRL

Maximum velocity before entrain air $Ca_c \propto \ln(\mu_a/\mu_l)$

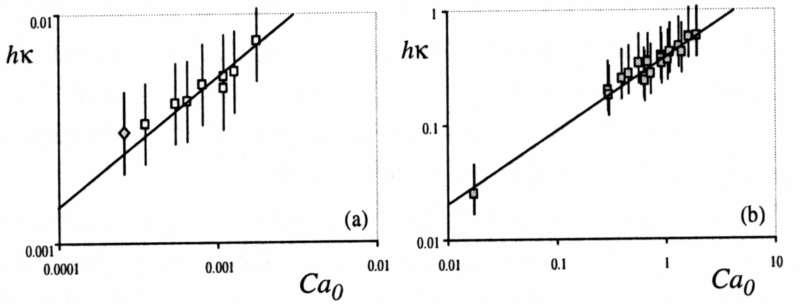
Eggers (2001) PRL





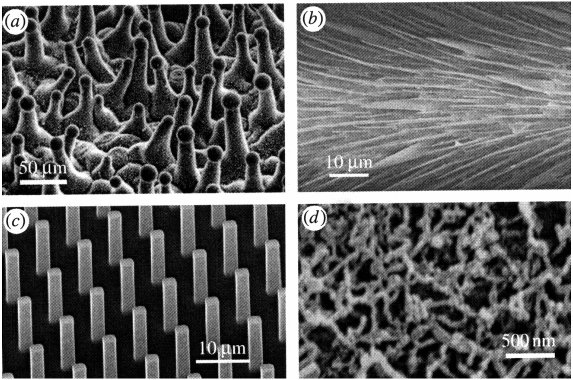
Lorenceau, Restango & Quere (2003) PRL

Thickness h of entrained air film $\quad h = 0.5\sqrt{\gamma/\rho g}\, Ca^{2/3}$



Lorenceau & Quere (2004) PRL

Rough superhydrophobic surfaces

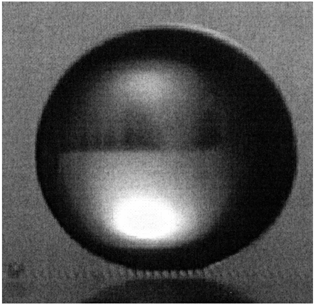


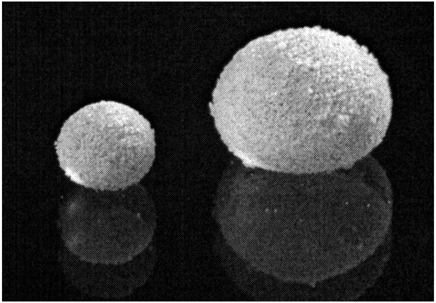
(a) Magnolia leaf, (b) hairs on water strider, (c) etched, (d) sponge

Quere & Reyssat (May 2008) Phil Trans RS

Rough superhydrophobic surfaces

Millimetric drop on microposts



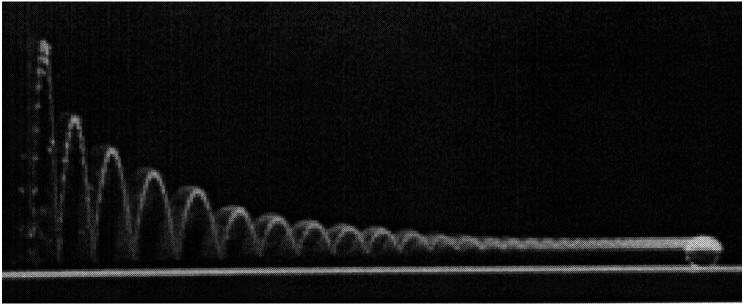


Water drop coated with lycopodium powder on glass

Quere & Reyssat (May 2008) Phil Trans RS

Bouncing drops

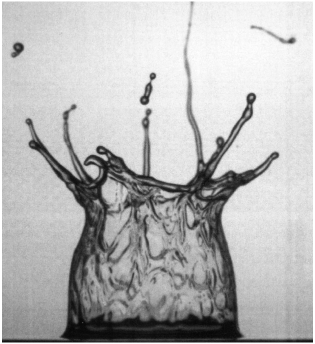
Water drop 0.4mm coated with lycopodium powder on glass



Richard & Quere (2002) Europhys Lett

Splashing elastic drops

$V = 7.5$ m/s impact of 0.2 ml of aqueous drop of 350mM sodium salicylate onto 2 mm aqueous film of 350mM cetyltrimethylammonium bromide, which together produce highly elastic worm-like micellar fluid



Grumstrup & Belmonte (Sept 2007) PoF

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- *Gouette, bulles, perles et ondes* by Pierre-Giles de Gennes, François Brochard-Wyart & David Quéré (Belin 2002)