Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Deformation of soap films pushed through tubes at high velocity[1]

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The behaviour of soap films pushed through tubes at large velocities, up to several m/s, is investigated. The film shape deviates from its equilibrium configuration perpendicular to the walls and gets curved downstream. A simple model relates the radius of curvature of the film to the friction in the lubrication films touching the wall. For highly soluble surfactants above the cmc, the scaling proposed by Bretherton in 1961 holds up to surprisingly high velocities, at which the capillary and Weber numbers are no longer small parameters. A limit of stability of the film, beyond which the films burst or evolve unsteadily, is predicted, and captures quantitatively the observations. In contrast, an unsteady motion is obtained for unsoluble surfactant, governed by strong Marangoni effects. The new questions raised by our results on the dissipation in soap films are discussed and comparison with numerical simulations are proposed.

[1] *Deformation of soap films pushed through tubes at high velocity*, B. Dollet, I. Cantat. J. Fluid. Mech. **652** p.529-539 (2010).

[1]I.C. acknowledges support from the Institut Universitaire de France.

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Date submitted: 15 Jun 2010 Electronic form version 1.4