

Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Abrupt

thickening of soap films TUAN TRAN, PINAKI CHAKRABORTY, GUSTAVO GIOIA, NIGEL GOLDENFELD, University of Illinois at Urbana-Champaign — In steady-state experiments with soap films flowing vertically downward under gravity (Goldburg et al., preceding paper), Goldburg has observed a curious phenomenon. If the height of the film is more than about 1 m, the film becomes thinner and thinner in the direction of the flow, but then it thickens abruptly at a certain distance from the top, and it remains constant thereafter. The flows in these experiments are low Reynolds-number flows and the thickness of the film depends only on the distance from the top. Based on lubrication theory, we obtain an ODE for $h(x)$, where h is the thickness of the film and x is the distance from the top. Via computational and theoretical analyses of this ODE, we make detailed predictions and show that these predictions (a) compare well with the experimental measurements and (b) provide an explanation for the abrupt thickening observed by Goldburg et al.

Tuan Tran
University of Illinois at Urbana-Champaign

Date submitted: 07 Aug 2007

Electronic form version 1.4