Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Scaling during drop formation of Newtonian and complex fluids BRAYDEN WAGONER, SUMEET THETE, MICHAEL HARRIS, OSMAN BASARAN, School of Chemical Engineering, Purdue University — Free surface flows such as drop formation and filament breakup are ubiquitous in applications as diverse as ink jet printing, crop spraying, and spray coating. In these flows, a finite time singularity arises at the instant the filament pinches off. The interplay between the dominant forces in the vicinity of the pinch-off singularity determines the temporal variation of the radial and axial scales during capillary thinning of filaments and is key to understanding the underlying dynamics. In experiments, the radial scale is readily determined by measuring the variation of the minimum filament radius with time remaining until pinch-off. Inferring the temporal variation of the axial scale is, however, more challenging. Here, we present a new method for inferring the axial scale during capillary pinch-off. The accuracy of the experimental measurements of the radial and axial scales is validated by demonstrating that they accord with well-known predictions from theory and simulations of capillary pinching of Newtonian filaments. Furthermore, we show that the novel method for determining the axial scale can be used to gain insights into pinch-off dynamics of complex fluids where theoretical and computational understanding is lacking.

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Date submitted: 01 Aug 2017 Electronic form version 1.4