Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Fingering instabilities for a thin liquid film flowing down the outside of a vertical cylinder[1] SCOTT MCCUE, LISA MAYO, TIMOTHY MORONEY, Queensland University of Technology — The flow of a thin film of viscous fluid down an inclined plane is well-studied, with much progress made by applying the lubrication approximation to derive a governing evolution equation for the film height. This equation is a fourth-order pde with a nonlinear degenerate diffusion term. Here we generalise this approach to apply for the problem of a thin film flowing down the outside of a vertical cylinder. In this context, a recent linear stability analysis of Smolka & SeGall [1] provides a relationship between the growth rate and wavenumber of each mode, predicting the number of fingers that form on the surface of the cylinder as a function of the fluid properties and the cylinder's radius. To complement these results, we solve the full nonlinear problem numerically and analyse the manner in which nonlinear modes grow and interact for longer times. We also consider the problem of a single large droplet spreading and sliding down the vertical cylinder, studying the effect that the cylinder curvature has on the flow.

[1] L.B. Smolka and M. SeGall, "Fingering instability down the outside of a vertical cylinder," Phys. Fluids **23**, 092103 (2011)

[1]We acknowledge support from the ARC Linkage Project LP100200476.

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Date submitted: 08 Aug 2012 Electronic form version 1.4