Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Self-similarity in particle laden flows at constant volume[1]
MATTHEW MATA, UCLA, NATALIE GRUNEWALD, Univ. Bonn, RACHEL LEVY, Harvey Mudd College, THOMAS WARD, NCSU, ANDREA BERTOZZI, UCLA — We consider constant volume thin film slurries on an incline. Clear fluids in this geometry are known to have a front position that moves according to a $t^{1/3}$ scaling law, based on similarity solution analysis [Huppert, Nature, 1982]. We investigate the same dynamics for particle laden flow using a recently proposed lubrication model for the slurry and physical experiments. Our analysis includes the role of a precursor in the model. We conclude that in the lubrication model, the height of the precursor significantly influences the speed of the fluid front, independent of particles settling in the direction of flow. By comparing theory with experiments we conclude that the $t^{1/3}$ scaling law persists, to leading order, for slurry flows with particle settling. However additional physics is needed in the existing lubrication models to quantitatively explain departures from clear-fluid self-similarity due to particle settling.

[1]This research was supported by ONR grant N000140610059, NSF grants ACI-0321917, DMS-0601395, and DMS-0502315, the UC Lab Fees Research Program, and DFG grant GR 3391/1-1.

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Date submitted: 07 Aug 2009 Electronic form version 1.4