Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Free-surface flow driven by a deforming boundary FREDERIK BRASZ, Princeton University, JOHN LISTER, ITG, DAMTP, University of Cambridge, CRAIG ARNOLD, Princeton University, ARNOLD GROUP COLLABORATION — We present an analytical solution for flow in a liquid layer driven by a deforming boundary. An initially flat wall undergoes a sinusoidal deformation with small amplitude relative to wavelength, imparting momentum to the fluid. Initially, the flow is directed away from the crests and slows with the slowing of the boundary motion. A domain perturbation method is used to reveal that even when the boundary stops moving, nonlinear interactions with the free surface leave a remnant momentum, and this momentum is directed back toward the crests, a precursor to jet formation. This scenario arises in a laser-induced printing technique in which an expanding blister imparts momentum into a liquid film to form a jet. This analysis provides insight into the physics underlying interactions between deforming boundaries and free surfaces, in particular the dependence on the thickness of the liquid layer relative to the deformation wavelength. Numerical simulations are used to verify the theory and show its range of validity.

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Date submitted: 02 Aug 2013 Electronic form version 1.4