Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A shocking viscous gravity current FREDERIK DAUCK, JOHN LISTER, University of Cambridge — We analyse propagation of a viscous gravity current over a layer of different fluid, but with the same density. Exact similarity solutions are found with two free parameters: a non-dimensional flux Q and the viscosity ratio m. The theory predicts a jump discontinuity, or shock, at the nose of the current for $m > m_{crit}$, which develops kinematically due to the hyperbolic nature of the interfacial height equation. The jump is identified as a novel form of under-compressive shock, resulting from a non-concave relative flux function and the total height variations. Small non-zero density differences regularise this system, and a local travelling-wave solution near the nose justifies the shock conditions for the jump height as a function of m. Our results obtained compare well to experimental data, both in terms of the predictions of radial extent and of the overall shape. In some circumstances, the front becomes unstable.

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Date submitted: 01 Aug 2017 Electronic form version 1.4