Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Nonlinear wavetrains in viscous conduits[1] MICHELLE MAIDEN, MARK HOEFER, University of Colorado Boulder — Viscous fluid conduits provide an ideal system for the study of dissipationless, dispersive hydrodynamics. A dense, viscous fluid serves as the background medium through which a lighter, less viscous fluid buoyantly rises. If the interior fluid is continuously injected, a deformable pipe forms. The long wave interfacial dynamics are well-described by a dispersive nonlinear partial differential equation. In this talk, experiments, numerics, and asymptotics of the viscous fluid conduit system will be presented. Structures at multiple length scales are discussed, including solitons, dispersive shock waves, and periodic waves. Modulations of periodic waves will be explored in the weakly nonlinear regime with the Nonlinear Schrödinger (NLS) equation. Modulational instability (stability) is identified for sufficiently short (long) periodic waves due to a change in dispersion curvature. These asymptotic results are confirmed by numerical simulations of perturbed nonlinear periodic wave solutions. Also, numerically observed are envelope bright and dark solitons well approximated by NLS.

[1]This work was partially supported by NSF CAREER DMS-1255422 (M.A.H.) and NSF GRFP (M.D.M.).

Michelle Maiden
University of Colorado Boulder

Date submitted: 01 Jul 2016 Electronic form version 1.4