Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Nonlinear interfacial dynamics and mechanisms of liquid transport in a gas-liquid core-annular flow[1] LONG LEE, University of Wyoming, ZANE BECKWITH, ROBERTO CAMASSA, EUGENE DUMITRESCU, University of North Carolina, RICHARD PARKER, University of Chicago, UNC RTG FLUIDS GROUP TEAM — An experimental and theoretical study of two-phase core-annular flow in a cylindrical pipe is carried out with purpose of illustrating fundamental mechanisms of mucus propulsion by air flow in lung airways. A highly viscous fluid lining the inner wall of the pipe is driven by high pressure air flow at constant volumetric flux. We derive a nonlinear evolution equation based on the lubrication approximation for the interface under a certain closure turbulence model for the air flow. We study numerically the interface evolution of an initially axisymmetric disturbance of the annular film of viscous liquid and compare with the preliminary data collected from the experimental setup. The mean thickness of the liquid layer in the experiment can be predicted using this model, and the existence of the ring-like waves observed in the experiments is confirmed by the interfacial dynamics of the model.

[1]NSF DMS RTG

Richard McLaughlin
University of North Carolina

Date submitted: 04 Aug 2008 Electronic form version 1.4