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Transition to disorder: the effects of elasticity on thin film flow inside a tube[1] JEFFREY OLANDER, ROBERTO CAMASSA, G.M. FOREST, H. REED OGROSKY[2], University of North Carolina — Previous studies of non-Newtonian flows driven up a tube by a high volume flux flow of air have suggested that a transition to disordered core-annular wave dynamics occurs when the liquid becomes elastic. Understanding this transition may shed light on the behavior of mucus in the human trachea. We present results from experiments of thin-film liquid flows of a Newtonian fluid and a non-Newtonian, dilute mixture of oligomers. These so-called Boger fluids are elastic, non-thixotropic liquid solutions made by dissolving a non-Newtonian solute in a Newtonian base. We compare, through video analysis, the wave dynamics of the Boger fluid to those of its Newtonian base under identical inflow conditions. We describe observed differences between the Newtonian and non-Newtonian cases. Finally, quantitative comparisons of wave properties and liquid mass transport are discussed.

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