PHYSICAL MATHEMATICS SEMINAR

Nonlinear Dynamics in Viscoelastic Jets

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ABSTRACT:

Instabilities in free surface continuous jets of non-Newtonian fluids, although relevant for many industrial processes, remain less understood in terms of fundamental fluid dynamics. Inviscid, and viscous Newtonian jets have been studied in considerable detail, both theoretically and experimentally. Instability in viscous jets leads to regular periodic coiling of the jet, which exhibits a non-trivial frequency dependence with the height of the fall. I will present results from a systematic study of the effect of viscoelasticity on the dynamics of continuous jets of worm-like micellar surfactant solutions of varying viscosities and elasticities. We observe complex nonlinear spatio-temporal dynamics of the jet, and uncover a transition from periodic to quasi-periodic to a multi-frequency, broad-spectrum dynamics. Beyond this regime, the jet dynamics smoothly crosses over to exhibit the "leaping shampoo" or the Kaye effect. This enables us to view seemingly disparate jet dynamics as one coherent picture of successive instabilities and transitions between them.

TUESDAY, FEBRUARY 17, 2009
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)

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