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Nonlinear dynamics of coiling, and mounding in viscoelastic jets[1] TRUSHANT MAJMUDAR, THOMAS OBER, GARETH MCKINLEY, Massachusetts Institute of Technology — Free surface continuous jets of non-Newtonian fluids, although relevant for many industrial processes like bottle filling, remain poorly understood in terms of fundamental fluid dynamics. Here we present 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, and model yield-stress fluids. We systematically vary the height of the drop and the flow rate in order to study the effects of varying geometric and kinematic parameters. We observe that for fluids with higher elastic relaxation times, folding is the preferred mode. In contrast, for low elasticity fluids we observe complex nonlinear dynamics consisting of coiling, folding, and irregular meandering as the height of the fall increases. Beyond this regime, the jet dynamics smoothly crosses over to exhibit the "leaping shampoo" or the Kaye effect. Upon increasing the flow rate to very high values, the "leaping shampoo" state disappears and is replaced by a pronounced mounding or "heaping". A subsequent increase in the flow rate results in finger-like protrusions to emerge out of the mound and climb up towards the nozzle. This novel transition is currently under investigation and remains a theoretical challenge.

[1]Procter and Gamble

Trushant Majmudar
Massachusetts Institute of Technology

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