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Dynamics of flexible molecules in thinning fluid filaments PAULO E. ARRATIA, GABRIEL JUAREZ, University of Pennsylvania — Newtonian liquids that contain small amounts (∼ppm) of flexible polymers can exhibit viscoelastic behavior in extensional flows. In this talk, we report the results of experiments on the thinning and breakup of polymeric fluids in a simple microfluidic device. We aim to understand the stretching dynamics of flexible polymers by direct visualization of fluorescent DNA molecules, a model polymer. A Boger fluid, composed of 100 ppm polyacrylamide and 85% w/w glycerol, is seeded with stained lambda—DNA molecules ($< 10\%$ v/v) imaged by high speed epifluorescence microscopy. We observe that the strong flow in the thinning fluid threads provide sufficient forces to stretch the DNA molecules away from their equilibrium coiled state. The distribution of stretch lengths, however, is very heterogeneous due to molecular individualism and initial conditions. Once the molecules are stretched to their full length and aligned with the flow, they translate along the fluid thread as rigid rods until the point of pinch off. After pinch off, both the fluid and molecules return to a relaxed state.

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