Title of talk: Measuring Local Shear Stresses in Wormlike Micelle Flow

Simple liquids respond proportionally to stress, while complex fluids do not. Complex fluids can moreover exhibit non-uniform responses to stress, as was recently demonstrated with soap solutions like shampoo. These solutions comprise long wormlike aggregates or micelles of soap molecules that self-assemble. Wormlike micelle solutions can form jets of high velocity bounded by slower-moving flow when an applied stress stretches and partially breaks the micelles. We use a simple model that predicts non-uniformities in the stress of the flow to explain this unusual flow of wormlike micelles.

To test this model, we use traction force microscopy to quantify the local stresses in the flow. A flow channel was constructed such that one surface consisted of a soft, elastic gel embedded with fluorescent markers. The fluorescent marker displacement provides information on both the direction and magnitude of the local stresses. Non-interfering fluorescent markers were also added to the fluid to track the flow throughout the channel via particle image velocimetry. We find that the higher velocity in the jet corresponds to lower shear stresses and conversely, lower velocity in the slower-moving regions corresponds to higher shear stresses