"Driven Soft Matter: Non-Equilibrium Phenomena in External Fields"

Sébastien Manneville

“Experimental investigation of shear banding in wormlike micelles”

Under simple shear some complex fluids may separate into bands of widely different viscosities. This phenomenon is known as “shear banding” and involves inhomogeneous flows where macroscopic bands bearing different shear rates coexist in the sample. In the last decade, “wormlike micelle” solutions have emerged as a model system to study shear banding. Depending on the concentration, these self-assembled surfactant systems constituted of long, cylindrical, semiflexible aggregates undergo a shear-induced transition from a viscoelastic state of entangled micelles to a state of highly aligned micelles. In this talk, we will describe two velocimetry techniques, based on dynamic light scattering and ultrasonic velocimetry, respectively, which may be used in combination with conventional rheometry to investigate shear banding with high spatial and temporal resolutions. Experimental results will be presented, where shear-banded flows of wormlike micelles are shown to involve complex spatiotemporal behaviors and apparent wall slip. Such observations, confirmed by recent measurements from other groups, raise lots of open questions that we shall address in the last part of the talk.