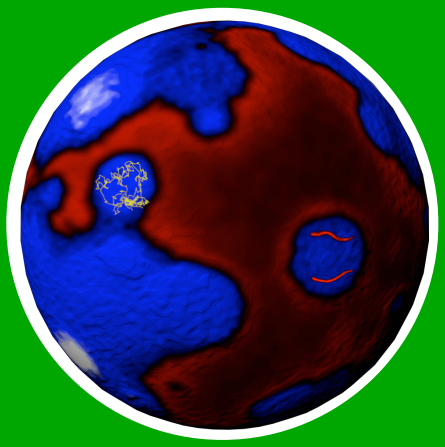

Sächsische Forschergruppe
"From Local Constraints to Macroscopic Transport"

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Faculty of Physics and Earth Science
University of Leipzig
Linnéstrasse 5, Leipzig

Exploring the non-equilibrium: A semiflexible polymer and a microswimmer under Poiseuille flow

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Microfluidics has evolved as a powerful tool for technological applications that require to transport small amounts of fluid on the micron scale, to mix fluids, and to also sort dispersed particles. For basic research, the employed microchannels offer the possibility to study systems under controlled confinement and in non-equilibrium when a Poiseuille flow is applied.

The talk addresses two situations how systems behave in confinement and under Poiseuille flow. I first address recent experiments on single actin filaments [1]. They measured a center-of-mass distribution with a bimodal shape, where the polymer is depleted at the centerline and close to the walls of a microchannel. We simulate this typical non-equilibrium effect and use a Smoluchowski equation to demonstrate that the bimodal shape is strongly determined by deterministic drift currents across the channel, in contrast to diffusive currents which are more important for flexible polymers.

In the second example I demonstrate how microswimmers behave in a microchannel. This mimics, for example, a swimming microorganism in blood vessels. I present simulations for a model swimmer called squirmer but also discuss analytical predictions. In particular, I show that for strong Poiseuille flow, the motion of the microswimmer can be mapped onto the dynamics of a non-linear oscillator.

[1] D. Steinhauser, *Actin filaments and bundles in flow*, Ph.D. thesis, University of Göttingen (2008).