# SFB 910 Symposium

# “Control of driven colloidal systems”

**Friday, 16th July 2021, 15:00 s.t.**
**via Zoom**
Please contact henning.reinken@itp.tu-berlin.de
for the link/Meeting ID.

Technische Universität Berlin
Straße des 17. Juni 135, 10623 Berlin

**15:00** **Acoustically propelled microparticles: dynamics and control**

Prof. Raphael Wittkowski *(Universität Münster)*

**15:50** **Steering and deforming droplets on substrates with switchable wettability**

Josua Grawitter *(TU Berlin)*

**16:25** **Emergence of collective motion in two-dimensional colloidal systems with delayed feedback**

Robin Kopp *(TU Berlin)*

Guests are welcome!

Sabine Klapp Andreas Knorr

http://www.itp.tu-berlin.de/sfb910/

# Abstracts

### Acoustically propelled microparticles: dynamics and control

**Prof. Raphael Wittkowski** *(Universitaet Münster)*

Among the various existing types of motile artificial microparticles, acoustically propelled ones are particularly advantageous. For example, their propulsion mechanism is biocompatible, the particles can move in various types of liquids, they can permanently be supplied with energy, and by tuning the acoustic field the particles' propulsion can be modulated in space and time. These features make such particles an ideal candidate for the realization of future applications of active particles in materials science and medicine. However, the dynamics of these particles is poorly known and understood so far. In this talk, I will give an overview about the current knowledge on the dynamics of acoustically propelled microparticles, covering the motion of individual particles and their collective dynamics. The talk will also address approaches for controlling the collective dynamics of such particles, which is a prerequisite for several potential applications including, e.g., targeted drug delivery.

### Steering and deforming droplets on substrates with switchable wettability

**Josua Grawitter** *(TU Berlin)*

Interfaces between fluids and photo-switchable substrates provide a unique mechanism to precisely manipulate liquid droplets by creating and adapting a heterogeneous wettability landscape. Because droplets respond to changes in wettability, such interfaces provide a means to keep the droplets in non-equilibrium and thereby induce new states of dynamic wetting.

We present a boundary element method to determine the Stokes flow inside a droplet with its curved free surface and its flat interface at the substrate, where we apply the Navier boundary condition to permit motion of the contact line. In our approach we use the Cox-Voinov law [1] and introduce the velocity of the contact-line as a side condition. Using the implemented method, we study how droplets respond to specific spatiotemporal wettability patterns that either move or deform the droplet. Here, we present first studies of the spatio-temporal deformation dynamics induced by oscillating wettability along the contact line and of directed motion initiated by traveling wettability patterns. We specifically investigate how to design the patterns in order to maximize droplet speed.

### Emergence of collective motion in two-dimensional colloidal systems with delayed feedback

**Robin Kopp** *(TU Berlin)*

In recent years, delayed feedback in colloidal systems has become an active and promising field of study, key topics being history dependence and the manipulation of transport properties. Here we study the dynamics of a two-dimensional colloidal suspension, subject to time-delayed feedback. To this end we perform overdamped Brownian dynamics simulations, where the particles interact through a Weeks-Chandler-Andersen potential. Furthermore, each particle is subject to a Gaussian, repulsive feedback potential, that depends on the difference of the particle position at the current time and the particle position at an earlier time. We observe the emergence of collective motion characterized by a nonzero mean velocity. After quantitatively studying this phenomenon, we also provide a possible explanation combining single-particle and mean-field-like effects.

[1] O. V. Voinov, Fluid Dyn. 11, 714 (1976)