# CPP 18: Complex Fluids and Soft Matter 1 (joint session DY/CPP)

Time: Wednesday 9:00–10:30 Location: DYa

CPP 18.1 Wed 9:00 DYa

**Flow structure of marangoni-contracted sessile droplets** — O. Ramirez[1], M.A. Hack[2], W. Kwiecinski[3], E.S. Kooij[3], T.J. Seegers[2], J.H. Snoeijer[2], and •S. Karpitschka[1] — [1]MPI for Dynamics and Self-Organization, Göttingen, Germany — [2]Physics of Fluids Group, University of Twente, Enschede, Netherlands — [3]Physics of Interfaces Group, University of Twente, Enschede, Netherlands

A droplet of two miscible liquids should spread over a high-energy surface until complete wetting. However, if one component is more volatile and has a higher surface tension, a quasi-stationary non-vanishing apparent contact angle can be observed. This is caused by the enrichment of the residual component near the contact line and the associated surface tension gradient. A hydrodynamic-evaporative model, using a long-wave approximation for the droplet coupled to diffusion limited evaporation predicts a balance between Marangoni and capillary flows and a power law between the apparent contact angle and the ambient humidity [Karpitschka et al., Langmuir (2017)]. This explanation differs from a recent model, where the low surface tension of a precursor around the droplet is held responsible [Benusiglio et al., Soft Matter (2018)]. A discrimination between possible mechanisms requires experimental resolution of the flow in the drop. We present uPIV measurements and relate them to the apparent shape of the drop, for aqueous solutions of various short chain carbon diols. Depending on the surface activity of the diol, its concentration, and the ambient humidity, we observe different regimes, indicating that multiple mechanisms lead to the observed angles.

CPP 18.2 Wed 9:20 DYa

**Coalescence of liquid droplets in a quasi 2D liquid film** — •Christoph Klopp, Ralf Stannarius, and Eremin Alexey — Institute of Physics, Otto von Guericke University, Department of Nonlinear Phenomena, 39106 Magdeburg

Coalescence of droplets plays a crucial role in nature and modern technology. Various experimental and theoretical studies explored droplet dynamics in 3D and on 2D solid or liquid substrates [1-3].

Here, we demonstrate coalescence of isotropic droplets in thin quasi 2D liquids, an overheated smectic A films. We investigated their dynamics experimentally and measured the shape deformation during the whole merging process using high-speed imaging. This system is a unique example, where the lubrication approximation can be directly applied, and the smectic membrane plays the role of the precursor film. Our studies reveal the scaling laws of the coalescence time depending on the droplet size and the material parameters. We also compared our results with existing models for liquid lens coalescence on liquid and solid surfaces.

[1] J. D. Paulsen et al., Coalescence of bubbles and drops in an outer fluid, Nat. Commun. 5, 3182 (2014)

[2] D. G. A. L Aarts et al., Hydrodynamics of Droplet Coalescence, Phys. Rev. Lett. 95, 164503 (2005)

[3] N. S. Shuravin et al., Coalescence of viscous two-dimensional smectic islands, Phys. Rev. E 99, 062702 (2019)

CPP 18.3 Wed 9:40 DYa

**Designing Pickering Emulsions for Catalysis: Influence of Nanoscale Particle Properties on Microscale Droplets** — •Sebastian Stock[1], Annika Schlander[1], Kai Spanheimer[1], Maresa Kempin[2], Ariane Weber[3], Reinhard Schomäcker[3], Anja Drews[2], Marcus Gallei[4], and Regine von Klitzing[1] — [1]TU Darmstadt, Darmstadt, Germany — [2]HTW Berlin, Berlin, Germany — [3]TU Berlin, Berlin, Germany — [4]Saarland University, Saarbrücken, Germany

Pickering Emulsions (PEs) describe emulsions stabilized by (nano) particles. The aim of the work was to design PEs as a reaction environment for catalytic reactions. As a model reaction the hydroformylation of 1-dodecene was investigated. Due to the PEs high stability separation methods with outstanding energy efficiency are applicable e. g. the separation of the oil phase by nanofiltration. Many microscopic and macroscopic PE properties are determined in a large degree by the nanoscale properties of the particles. In order to distinguish the impact of particle surface charge both positively and negatively charged silica spheres were produced. This was achieved by adequate surface modification. The resulting nanoscale particle properties concerning size, shape, charge, and hydrophobicity were investigated via Transmission Electron Microscopy (TEM), $\zeta$-potential and sessile drop measurements, the effect on the microscopic emulsion properties were studied with microscopy and the PEs reaction behavior including yield and stability was evaluated.

**Invited Talk** CPP 18.4 Wed 10:00 DYa

**When surface viscosities rule: Bubble relaxation and thin film wrinkling** — •Kirsten Harth — Institut für Physik, Otto von Guericke Universität Magdeburg, Universitätsplatz 2, 39106 Magdeburg

The dynamics of liquid drops and gas bubbles in a surrounding fluid is a classic field of fluid mechanics, studied for over a century. The mathematical problem can be complex already for the case of clean fluid-fluid interfaces, characterized solely by a constant surface tension. However, applications such as ink-jet printing, emulsion characterization or typical biologically inspired systems usually deal with more complex interfacial properties, e.g., adsorbed fluid or contaminant films. Those can completely dominate the overall shape dynamics.

Merged centimeter-sized soap bubbles or rupturing micrometer-thick soap films are a simple yet ideal model system for surface-tension based relaxation. Replacing the soap film by a more complex membrane, nanometer-thin liquid crystalline films in our case, introduces qualitatively new effects due to reorganization of the membrane upon surface area reduction. The talk highlights two aspects: First, the consequences of an effective interfacial viscosity for the relaxation dynamics, known also from interfacial fluid films or adsorbed surfactant layers. Second, out-of-plane bulging and dynamic wrinkling of the interfacial membrane in response to external stress. Experiments will be accompanied by a theoretical / numerical analysis.