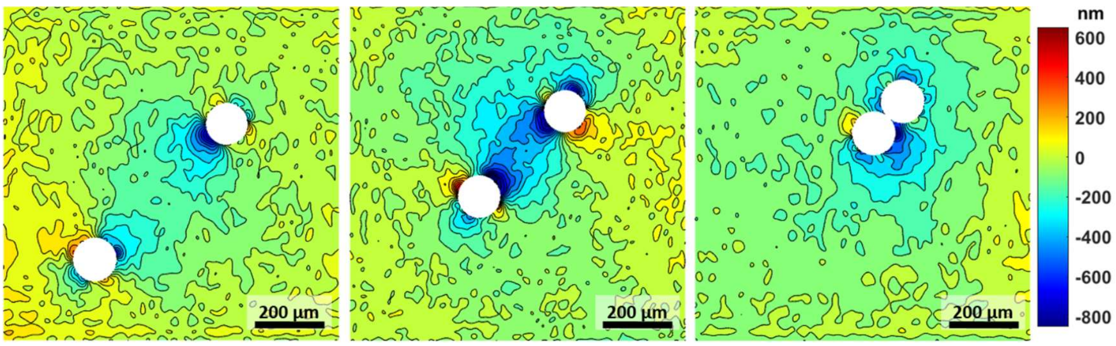
Institut für Strömungslehre und Wärmeübertragung

Bachelor / Master Thesis

Interfacial deflections at capillary adsorbed particles

The interest for microparticles at fluid interfaces has considerably increased in the last decades. Once adsorbed at interfaces, such particles provide strong stabilization and have the advantage to be more environmental friendly than classical surfactants that cannot be easily recovered by simple filtration. Thus, they have been used to produce new materials such as super stable foams or bijels but also to reversibly encapsulate fluids in the form of coated droplets. Yet, the mechanical properties of these complex multi-phase assemblies remain poorly understood, which currently limits their usage to academic niches.

One key aspect is that the particle trapping causes interfacial deflections, which give rise to complex capillary interactions. The latter govern the dynamics of particle self-assembling and the cohesion of resulting rafts. Yet, to date, the experimental characterization of the contact line mostly relies on optically trapped particles or shock freezing of the liquid(s), and remains therefore limited to quasi-static regimes and isolated particles. In this work, we propose a new approach, based on heterodyne interferometry that enables to resolve interfacial deflections with unequalled combination of temporal and spatial resolution (filed patent 51419 EP). The method has already been successfully applied to some particles and should be further employed to investigate the effects of particle size and surface treatment. Isolated and grouped particles should be considered to unravel the self-assembling dynamics. Further “fresh” and “old” particles should be imaged to shed light onto potential particle raft ageing.



Measured interfacial deflections around two silanized glass beads and their evolution during pair formation with interferometric method developed in-house. A few seconds lapse between two consecutive images.

Tasks
- Setting up the interferometric device and imaging fresh/old, isolated/grouped particles at interfaces
- Analyzing experimental data (image analysis based on existing routines)
- Interpreting the results and write the corresponding scientific documentation.

We offer
- A scientific supervision of high quality in an international and dynamic work atmosphere
- The possibility to co-author a peer-reviewed scientific publication or a conference contribution
- Access to all the required facilities of the Institute

The master project will be accomplished at the Institute of Fluid Mechanics and Heat Transfer (Institut für Strömungslehre und Wärmeübertragung). The project can start any time. If interested, please contact Dr. Carole Planchette, Tel. 0316 873-7357, Email carole.planchette@tugraz.at