Disordered and non-equilibrium soft matter

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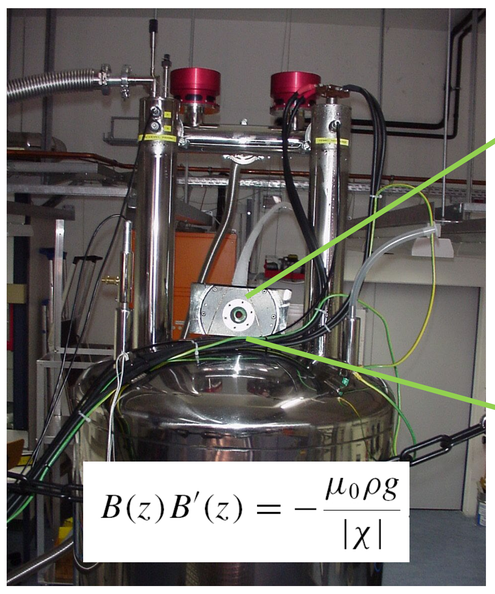
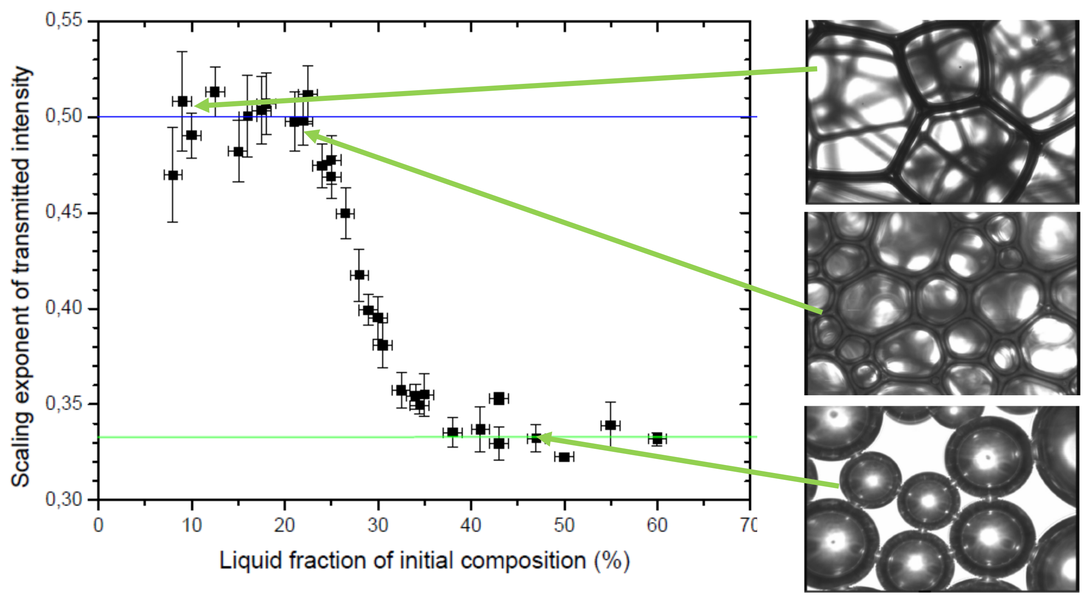
Levitated non-equilibrium systems

Many non-equilibrium systems are forced to a stable point by gravity. We couteract gravity by a compensating body force in diamagnetic levitation. Thus samples of diamagnetic materials levitate stably for days or weeks, similar to the space station.

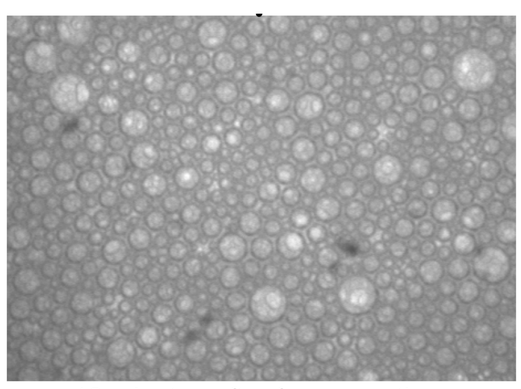


Strawberry levitating in a field of 18 T

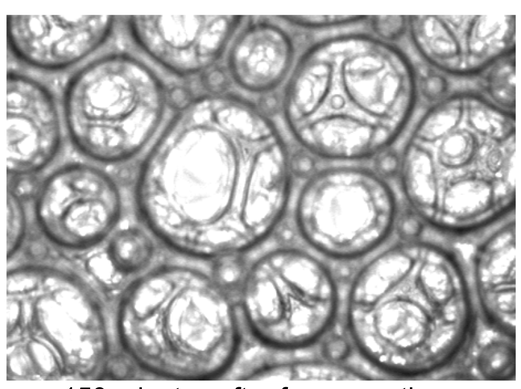
For instance when observing the foam of a drink, fluid flow due to gravity creates a gradient of varying liquid fraction with very different structural properties. These can be studied separately when levitating the foam.



At liquid fractions of 25%, where close packing of spheres is reached, the foam goes through a phase transition. The structural characterisation of this transition together with ist rheological properties is what you will study in this project.



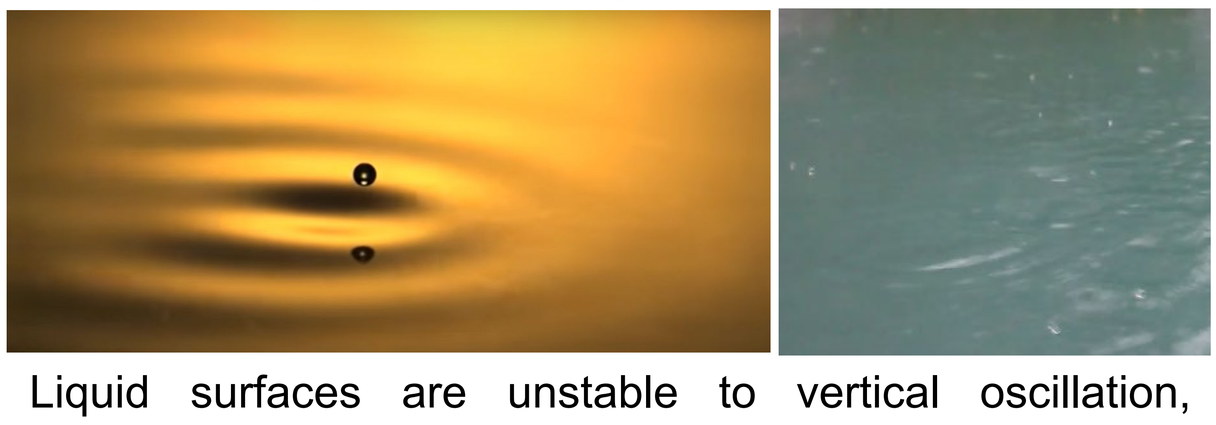
10 minutes after foam creation



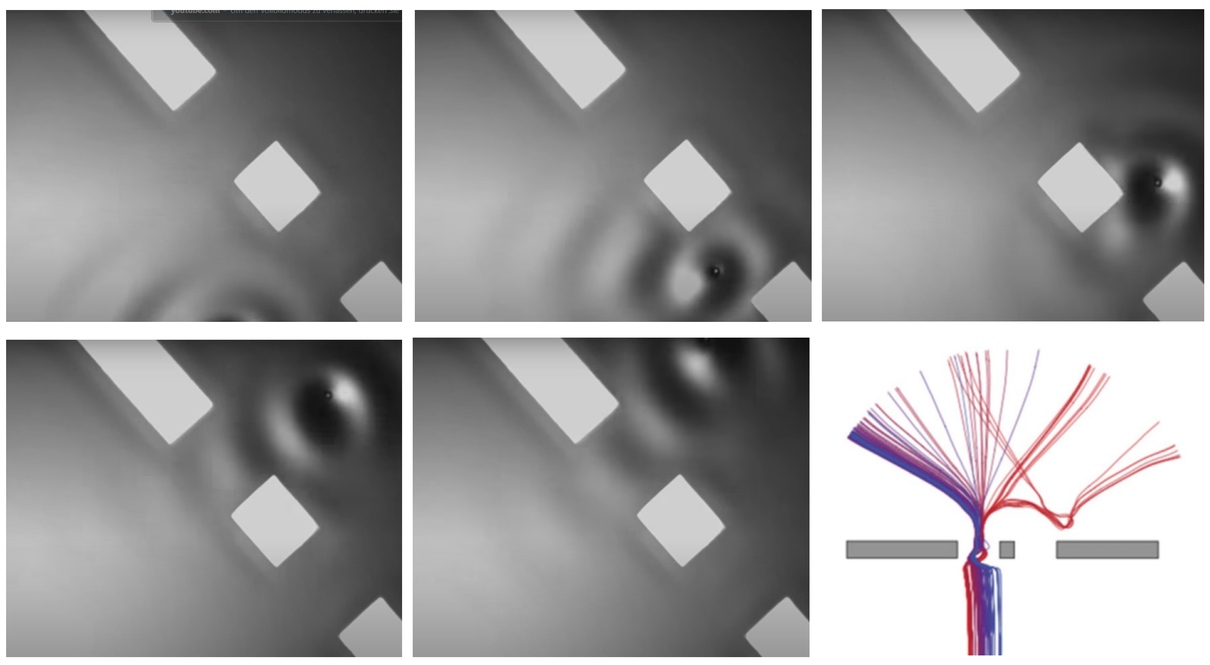
150 minutes after foam creation

Plotted above is the growth exponent of foam bubbles, which can for instance be determined from direct imaging of the surface of the foam.

Macroscopic Wave-particle duality



Liquid surfaces are unstable to vertical oscillation, showing standing wave patterns know as Faraday instability. Close to this instability, droplets of the same liquid can travel across the surface, by creating such a wave, which guides the motion of the droplet.
Such droplets can thus demonstrate aspects of wave particle duality at the macroscopic stage, such as single particle interference. This project sets up such a demonstration experiment.



Optical properties of photonic glasses

Light transport in photonic glasses describes optical properties of colouration based on interference of multiply scattered light. This can be well described theoretically depending on the size of scatterers, their refractive index and their distribution. This project extends work on ploystyrene to titania with a higher refractive index.