

CPP 1 SYMPOSIUM: Dynamics of multi-component fluids I

Zeit: Freitag 10:00–11:00

Raum: TU C243

Hauptvortrag

CPP 1.1 Fr 10:00 TU C243

Direct visual observation of thermal capillary waves — •DIRK AARTS¹, MATTHIAS SCHMIDT², and HENK LEKKERKERKER¹ — ¹Van 't Hoff Laboratory for Physical and Colloid Chemistry, Debye Institute, Utrecht University, Padualaan 8, 3584 CH Utrecht, The Netherlands — ²Soft Condensed Matter, Debye Institute, Utrecht University, Princetonplein 5, 3584 CC Utrecht, The Netherlands

At rest the interface between any two fluids, like that between a liquid and its vapour, appears to be smooth. Yet thermal excitations inevitably give rise to statistical fluctuations of the local interface position, as first predicted about a century ago within the concept of capillary waves. The phenomenon has been studied since in a wide range of liquids with light and X-ray scattering and plays a prominent role in modern theories of interfaces. Here we report the direct visual observation of thermal capillary waves in real space. We study a phase separated colloid-polymer suspension with laser scanning confocal microscopy (LSCM) tracing both the statics and dynamics of its free fluid-fluid interface. Surprisingly, experimental correlation functions validate the capillary wave model down to almost the particle level. Furthermore, they allow obtaining the (ultra-low) interfacial tension and the capillary length and time. Moreover, the real space technique enables us to verify the long-standing theoretical prediction that capillary waves induce the spontaneous break-up of thin liquid films and thus are of key importance in the process of droplet coalescence.

CPP 1.2 Fr 10:30 TU C243

Local orientations of fluctuating fluid interfaces — •KLAUS MECKE^{1,2} and SIEGFRIED DIETRICH² — ¹Institut für theoretische Physik, Universität Erlangen — ²Max-Planck-Institut für Metallforschung, Stuttgart

Thermal fluctuations cause the local normal vectors of fluid interfaces to deviate from the vertical direction defined by the flat mean interface position. This leads to a nonzero mean value of the corresponding polar tilt angle which renders a characterization of the thermal state of an interface. Based on the concept of an effective interface Hamiltonian we determine the probability distribution functions for the metric of the interface and for the tilt angle which allows us to calculate its mean value and its mean square deviation. We compare the temperature dependences of these quantities as predicted by the simple capillary wave model, by an improved phenomenological model, and by the microscopic effective interface Hamiltonian derived from density functional theory. The mean tilt angle discriminates clearly between these theoretical approaches and emphasizes the importance of the variation of the surface tension at small wave lengths. Also the tilt angle two-point correlation function is determined which renders an additional structural characterization of interfacial fluctuations. Various experimental accesses to measure the local orientational fluctuations are discussed.

CPP 1.3 Fr 10:45 TU C243

Non Brownian suspensions: pattern formation and rheology — •ANKE LINDNER, CHRISTOPHE CHEVALIER, and ERIC CLEMENT — PMMH, Ecole Supérieure de Physique et de Chimie Industrielles, 10, rue Vauquelin, 75231 Paris Cedex 05, France

We study the injection of a simple fluid into a non Brownian suspension. To do so we use a specific model system: a so called iso-dense suspension, where particles and solvent have the same density. For these mixtures gravity does not play a role and thus no sedimentation occurs allowing to adjust the volume fraction of particles over a wide range. When studying pattern formation in a linear Hele-Saw cell filled with the above mentioned suspension two limiting cases are found: for low volume fractions one observes the classical Saffman-Taylor instability. For high volume fractions the granular system is jammed corresponding to a porous media invaded by a viscous fluid. In-between one observes a crossover from a complex fluid like behaviour to a weak porous media with flow induced rearrangements of the pores. The observed patterns, caused by the injection of the simple fluid, are discussed as a function of the rheological properties of the suspension