CPP 22 Colloids

Zeit: Dienstag 11:15–12:30 Raum: TU C243

CPP 22.1 Di 11:15 TU C243

Mixtures of Colloids and Liquid Crystals — •Doris Vollmer[1], Beate Ullrich[1], Gerald Hinze[2], and Andy Schofield[3] — [1]MPI für Polymerforschung, Mainz — [2]Inst. Physik. Chemie, Univ. Mainz, Mainz — [3]School of Physics, The University of Edinburgh, Edinburgh, UK

We studied three-dimensional particle networks that form upon cooling of suspensions of polyacrylmethacrylate colloids (PMMA) in liquid crystal (5CB) through the isotropic-nematic transition. By polarization microscopy we determined the velocity of the particles during the transition. Rheological data suggest that network formation depends only weakly on particle size within the range of 100-800nm. NMR and calorimetry indicate the presence of isotropic material down to 10K below the bulk transition temperature and smearing of the specific heat curve, strongly reminiscent of the effect of alcanes on phase transition kinetics. We suggest that alcane impurities may alter the temperature and time range of phase transition and, due to coexisting isotropic and nematic regions and wetting of the particles with isotropic material, promote rearrangement of the colloids in networks. During subsequent cooling/heating cycle, networks were only partially reversible and exhibited consiberable memory effects even with periods of several hours above transition temperature. Repeated cooling led to compactification and further increase of storage and loss moduli.

CPP 22.2 Di 11:30 TU C243

Equation of state of polyelectrolyte multilayer- coated colloids — •Monique Dubois[1], Annette Meister[2], Monika Schönhoff[1,3], Thomas Zemb[2], and Helmuth Möhwald[1] — [1]Max-Planck-Institut für Kolloid- und Grenzflächenforschung, D-14424 Potsdam/Golm — [2]LIONS, DRECAM/SCM, Bat 125, CEA Saclay, F-91191 Gif sur Yvette Cedex — [3]Institut für Physikalische Chemie, WWU Münster, Corrensstr.30, D-48149 Münster

Establishing the equation of state means establishing the relation between osmotic pressure (water activity), temperature and density in a fluid. This method is the most general way to measure the interaction potential between colloids without artefacts. We establish here for the first time a full equation of state for polyelectrolyte- coated colloids. Coated colloids prepared with six and seven polyelectrolyte layers, respectively, are equilibrated under osmotic stress, via dialysis equilibrium in the absence of added salt. Interparticle distances are analysed by USAXS and chemical analysis. We show in this report that three regimes can be clearly distinguished in the equation of state: a gravitational regime, an expanded brush regime and an interpenetrating brush regime, with the terminating layer acting as an extended brush. Physical origins of these three distinct regimes are discussed in the context of corresponding electrostatic models taking into account the brush repulsion and counterion pressure contributions.

CPP 22.3 Di 11:45 TU C243

Study of Transport Phenomena in (Charged) Colloids: A Hybrid MD-LB Simulation Method — •Apratim Chatterji and Jürgen Horbach — Institut für Physik, Johannes Guutenberg-Universität Mainz, Staudinger Weg 7, D-55099 Mainz, Germany

We present a hybrid computational scheme for the simulation of (charged) colloidal dispersions where the colloids are propagated via molecular dynamics (MD) while they are coupled to a Lattice-Boltzmann (LB) fluid to model the hydrodynamic mass and momentum transport. We consider explicitly a system of spherical macroions, counterions and coions in the framework of the primitive model. We study electrokinetic effects by measuring the effective charge of a macroion, surrounded by counterions and coions, moving in an electric field. Moreover, we present translational and rotational diffusion constants as a function of the colloid packing fraction for neutral and charged colloidal systems.

CPP 22.4 Di 12:00 TU C243

Capillary waves in a model colloid-polymer mixture — •Richard Vink, Jürgen Horbach, and Kurt Binder — Institut für Physik, Johannes Gutenberg-Universität Mainz, Staudinger Weg 7, D-55099 Mainz, Germany

It is well-known that colloid-polymer mixtures phase separate under certain conditions. This then leads to the formation of two phases, separated by an interface. Interesting physics occurs in the interface region. The interface is not flat, but displays wave-like fluctuations known as capillary waves. Recently, it became possible to directly observe these fluctuations in experiments.

In this talk, I will discuss how capillary waves can be studied in a computer simulation of a simple colloid-polymer mixture (the AO model).First, I will describe how the interface is extracted from the simulation data. Next, a Fourier analysis of the interface will be presented. For small wavevectors, the quadratic q-dependence of the capillary spectrum, as predicted by capillary wave theory, is confirmed. For higher wave-vectors, pronounced deviations appear, which seem to reflect the most dominant bulk fluctuations. More precisely, our simulations indicate that in the limit of large wave-vectors, the capillary spectrum and the bulk static structure factor are essentially the same.

CPP 22.5 Di 12:15 TU C243

Effective capillary interaction of colloidal particles at fluid interfaces — •Martin Oettel[1], Alvaro Dominguez[1,2], and Siegfried Dietrich[1] — [1]Max–Planck–Institut für Metallforschung, Heisenbergstr. 3, D–70569 Stuttgart, Germany — [2]Fisica Teorica, Dept. FAMN, Apartado 1065, E-41080 Sevilla, Spain

We present an analysis of the effective force between two smooth spherical colloids floating at a fluid interface due to deformations of the interface. The results hold in general and are applicable independently of the source of the deformation provided the capillary deformations are small so that a superposition approximation for the deformations is valid. We conclude that an effective long–ranged attraction is possible if the net force on the system does not vanish. Otherwise, the interaction is short–ranged and cannot be computed reliably based on the superposition approximation. As an application, we consider the case of like–charged, smooth nanoparticles and electrostatically induced capillary deformation. The resulting long–ranged capillary attraction can be easily tuned by a relatively small external electrostatic field, but it cannot explain recent experimental observations of attraction if these experimental systems were indeed isolated.

[1] M. Oettel, A. Dominguez and S. Dietrich, cond-mat/0411329.