CPP 42: Colloids and Complex Liquids I

Time: Thursday 11:00–12:45 Location: H39

Topical Talk CPP 42.1 Thu 11:00 H39

Local dynamics near the 2D-Glass Transition in Binary Colloidal Mixtures — •Georg Maret, Florian Ebert, Sylvain Mazoyer, and Peter Keim — Department of Physics, University of Konstanz, D-78457 Konstanz, Germany

Micron sized colloidal particles in suspension are ideal model systems to study structural and dynamic properties of condensed matter at 'atomic' scales. This is illustrated by video microscopy experiments on binary mixtures of superparamagnetic colloids which are pinned at the flat horizontal air/water interface[1]. Their pair potential is tuned by an external magnetic field which drives the 2D system from the liquid to the glassy state. We observe competing local crystallites[2], particle motion coupled to cage motion and intra-cage hopping[3] as well as dynamic heterogeneities which are correlated with the local structural order and the corresponding energy landscape[4].

[1] F.Ebert, P.Dillmann, G.Maret, P.Keim, Rev.Sci.Instrum. 80, 083902(2009)

[2] F.Ebert, P.Keim, G.Maret, EPJE 26, 161(2008), EPJE 29, 311(2009)

[3] S.Mazoyer, F.Ebert, G.Maret and P.Keim, EPL, (2009), in print

[4] S.Mazoyer, F.Ebert, G.Maret and P.Keim, (2009) submitted

CPP 42.2 Thu 11:30 H39

Aggregation phenomena in two-dimensional systems of dipolar colloids with shielded interactions — •Anton Smessaert and Sabine H. L. Klapp — Institut für Theoretische Physik, TU Berlin, 10623, Germany

Employing Molecular Dynamics (MD) simulations we investigate aggregation phenomena and phase separation in a suspension of dielectric colloidal particles in an external field. The system is two-dimensional and the colloids are modeled as soft spheres with induced dipoles. The interaction of the dipoles is shielded in the framework of the Debye-Hückel theory [1]. For comparison we use a shifted dipole-dipole interaction supplemented by a soft sphere potential.

One part of our study is a detailed cluster analysis based on the MD simulations. Also, we employ a second order virial expansion to explore the possibility of a condensation phase transition.

Our results illustrate the influence of the interaction-range on the clustering and phase transition.

[1] S. Tsonchev, G.C. Schatz and M.A. Ratner, Chem. Phys. Lett. **400**, 221-225 (2004)

CPP 42.3 Thu 11:45 H39

Building complex arrays of colloidal particles by tuning their interactions with charged surfaces — •Christoph Hanske[1], Andreas Fery[1], and Alexander Wittemann[2] — [1]Department of Physical Chemistry II, University of Bayreuth, Universitätsstraße 30, 95440 Bayreuth, Germany — [2]Department of Physical Chemistry I, University of Bayreuth, Universitätsstraße 30, 95440 Bayreuth, Germany

Recently two-dimensional and three-dimensional mesostructures of colloidal particles have attracted the attention of material scientists due to their photonic properties. Whereas classical methods of particle deposition usually yield hexagonally ordered layers, more complex patterns are desired to vary the optical properties of the obtained materials. In order to control the interactions between particles and substrates, tailor-made colloids with a glassy core carrying a soft shell of polyelectrolyte brushes were synthesized. These particles are responsive to external stimuli like ionic strength or pH-value. Variation of these parameters does not only allow tuning the shape of the particles in solution, but also their interaction with charged surfaces. Formation of complex structures was accomplished by selective particle deposition on substrates chemically patterned by classic or lithography-free microcontact printing. In this contribution we will discuss decisive parameters governing the assembly into structured arrays which open up new avenues for building photonic materials.

CPP 42.4 Thu 12:00 H39

Role of surface charges on structure formation in confined colloidal solutions — •Stefan Grandner and Sabine H. L. Klapp — Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstraße 36, D-10623 Berlin, Germany

The impact of surface charges on structural effects in confined, charged colloidal suspensions is addressed in grand-canonical Monte-Carlo simulations using a corse-grained model (DLVO). These investigations are motivated by Colloidal-Probe Atomic-Force-Microscope experiments where enhanced amplitudes of the structural forces are obtained for increased surface charges. Whereas various established approaches of the interaction between macroions and charged walls did not reproduce this behavior, we could verify it within linearized Poisson-Boltzmann theory using a modified fluid-wall interaction which takes additional wall counterions into account [1]. The main difference to former models is the wall charge dependence of the wall screening parameter yielding a non-monotonic behavior of the repulsion. Furthermore we explore the impact of charged walls on particle ordering [2], where we expect nontrivial consequences on the lateral order of the layered suspension as compared to uncharged surfaces [3].

[1] S. Grandner, Y. Zeng, R. v. Klitzing, and S. H. L. Klapp, J. Chem. Phys. **131**, 154702 (2009). [2] B. Fazelabdolabadi, J. Y. Walz, and P. R. Van Tassel, J. Phys. Chem. B **113**, 13860 (2009). [3] S. Grandner and S. H. L. Klapp, J. Chem. Phys. **129**, 244703 (2008).

CPP 42.5 Thu 12:15 H39

1, 2, and 3D Organization of Colloidal Nanoparticles — •Nicolas Pazos-Perez[1], Alexandra Schweikart[1], Adrea Fortini[2], Matthias Schmidt[2], Ramon Alvarez-Puebla[3], Luis M. Liz-Marzan[3], and Andreas Fery[1] — [1]Department of Physical Chemistry II, University of Bayreuth, Germany — [2]Department of Theoretical Physics II, University of Bayreuth, Germany — [3]Department of Physical Chemistry, University of Vigo, Spain

Colloidal crystal structures have been widely studied due to their extraordinary optical, electronic, magnetic... properties which are structure dependent. Thus, a big effort has been put in developing new methods which allow a fine control over the formation of colloidal crystals. This work presents a novel method to organize colloids into 1, 2 and 3D linear arrays in a macro scale range. This technique is based on the use of a pre-patterned polymeric stamp which provides a network of channels acting as confinement regions for the particles during the drying process. Additionally, Monte Carlo simulations were performed to study the obtained colloidal crystals morphologies. In both cases, simulation and experimental, we found a broad range of morphologies depending on the initial suspension concentration which differ from the bulk. Moreover, we demonstrate that such nanoparticulated arrays made of gold can be used for Surface Enhanced Raman Scattering (SERS) detection.

CPP 42.6 Thu 12:30 H39

Sedimentation equilibrium of colloidal platelets in an aligning magnetic field — •Matthias Schmidt[1,2] and Hendrik Reich[3] — [1]Theoretische Physik II, Universität Bayreuth, D-95440 Bayreuth, Germany — [2]H. H. Wills Physics Laboratory, University of Bristol, Royal Fort, Tyndall Avenue, Bristol BS8 1TL, United Kingdom — [3]Deutscher Wetterdienst, Frankfurter Str. 135, D-63067 Offenbach, Germany

We consider colloidal platelets under the influence of gravity and an external aligning (magnetic) field. The system is studied using a fundamental measures density functional theory for model platelets of circular shape and vanishing thickness. In the gravity-free case the bulk phase diagram exhibits paranematic-nematic phase coexistence that vanishes at an upper critical point upon increasing the strength of the aligning field. Equilibrium sedimentation profiles display a paranematic-nematic interface, that moves to smaller (larger) height upon increasing the strength of gravity (the aligning field). The density near the bottom of the system decreases upon increasing the strength of the aligning field. Using a simple model for the birefringence properties of equilibrium states, we simulate the colour variation with height, as can be observed in samples between crossed polarizers.