DY 45 Soft Matter

Time: Thursday 14:30–16:00 Room: SCH 251

DY 45.1 Thu 14:30 SCH 251

Coil-globule and globule-globule transition of a three-dimensional, flexible homopolymer — •Thomas Strauch, Federica Rampf, Kurt Binder, and Wolfgang Paul — Institute for Physics, Johannes Gutenberg University, 55099 Mainz Germany

We present simulation results for the phase behavior of a flexible homopolymer using the Wang-Landau sampling algorithm. The chain is modeled with the bond-fluctuation model with an attractive square well interaction between the monomers. For finite chain length the model shows a two stage collapse, from the coil state to the globular state followed by a crystallization at temperatures beneath the θ-temperature. In a recently published investigation by F. Rampf, W. Paul and K. Binder on this model, it was shown that for interaction range $\sqrt{6}$ the coil-globule phase transition and the crystallization phase transition coincide in the thermodynamic limit.

In order to check the general validity of this phase behavior we investigated a system with longer interaction range, which should stabilize the liquid phase because of entropic effects. We show that in our model with interaction range of $\sqrt{10}$ the liquid phase will exist also in the thermodynamic limit. The transition temperatures do not coincide.

The crystal structure in the ground state displays a mixture of hexagonal and cubic packing.

DY 45.2 Thu 14:45 SCH 251

Surface segregation of conformationally asymmetric polymer blends — •Semjon Stepanow and Andrei Fedorenko — Martin-Luther-Universität Halle, Fachbereich Physik, D-06099 Halle

We have generalized the Edwards' method of collective description of dense polymer systems in terms of effective potentials to polymer blends in the presence of a surface. With this method we have studied conformationally asymmetric athermic polymer blends in the presence of a hard wall to the first order in effective potentials. For polymers with the same gyration radius R_g but different statistical segment lengths l_A and l_B the excess concentration of stiffer polymers at the surface is derived as $\delta\rho_A(z=0) \sim (l_B^{-2} - l_A^{-2})\ln(R_g^2/l_c^2)$, where l_c is a local length below of which the incompressibility of the polymer blend is violated. For polymer blends differing only in degrees of polymerization shorter polymers enrich the wall.

DY 45.3 Thu 15:00 SCH 251

Structures and elastic properties for 2-d model colloidal crystals in confined geometry — •Andrea Ricci — Institut fuer Physik, J Gutenberg Universitaet Mainz

A model for colloidal particles confined between two parallel boundaries separated a distance D is simulated by Monte Carlo, for the two-dimensional (2-d) case at densities where the bulk 2-d is well in crystalline phase. While the positional order is enhanced for a suitably corrugated boundary potential, for a planar boundary potential, positional ordering normal to the walls is enhanced ("layering") but destroyed parallel to the walls: the behavior of the system is more 1-d like. Due to the layering the orientational order is always present. It is also discussed how, for different T above the bulk melting point, the ordering induced by the walls decays towards the bulk values when we move to the inner part of the system.

If D does not fit the lattice parameter we observe, in both cases of walls considered, formation of misfits.

DY 45.4 Thu 15:15 SCH 251

Magnetooptics with capped colloids — •Larysa Baraban, Florian Merkt, Björn Biehler, Paul Leiderer, and Artur Erbe — Universität Konstanz, Fachbereich Physik, 78457 Konstanz, Deutschland

Colloidal suspensions are fascinating examples of soft matter, but also model systems for studying the behavior of atoms and molecules. In most cases, the colloidal particles used for these investigations have spherical symmetry. Here we present the fabrication and characterization of magnetically *anisotropic* particles.

Metallic bi-layers (Ni, Au) are evaporated on top of silica colloids, thus generating hemispheric magnetic "caps". In order to detect the magnetization of particles we use the magneto-optic (m-o) Faraday effect. Capped particles are placed on a reflecting surface (usually aluminum or silver), evaporated on a m-o active garnet film (YIG). Their magnetic moments induce a distribution of the magnetic field in the m-o film; therefore the Faraday rotation changes from point to point. Reflected by the mirror, polarized light carries information about the local magnetization in the YIG.

As expected, the magnetization of capped colloids displays hysteresis-like behavior. From these data we evaluate the initial magnetic moment and magnetic moment in the saturation regime. The remanent magnetization and coercivity of magnetic particles are estimated as well.

As a possible application, this technique can be used to check the magnetic monodispersity of big particles arrays by a single magnetooptic measurement.

DY 45.5 Thu 15:30 SCH 251

Optimal cell approach to osmotic properties of finite stiff-chain polyelectrolytes — •Christian Holm[1,2] and Dmytro Antypov[3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Johann Wolfgang Goethe University, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Max-Planck-Institut für Polymerforschung, Ackermannweg 10, 55128, Mainz, Germany — [3]Department of Materials Science and Metallurgy, Pembroke St., Cambridge, CB2 3QZ, UK

We propose a self-consistent geometry optimized cell model approach to study osmotic properties of stiff-chain polyelectrolyte solutions. In contrast to the usual monotonic Poisson-Boltzmann prediction, the osmotic coefficient is a non-monotonic function of concentration with a pronounced minimum. In the dilute regime, a lower degree of polymerization is found to reduce significantly the counterion condensation. Despite its simplicity, the single-chain cell model yields the same osmotic behavior as a corresponding many-body bulk system up to a dense semi-dilute regime.

[1] D. Antypov, C. Holm, manuscript submitted

DY 45.6 Thu 15:45 SCH 251

Surface dynamics of capillary waves close to the glass transiton - Experiments with static and dynamic x-ray scattering — •Christian Gutt[1,2], Henning Sternemann[2], Michael Paulus[2], Simone Streit[2], Anders Madsen[3], Michael Sprung[4], and Metin Tolan[2] — [1]Hasylab at DESY, Notkestrasse 85, 22607 Hamburg — [2]Experimentelle Physik I, Universität Dortmund — [3]ESRF, Grenoble, France — [4]Advanced Photon Source, ANL, Argonne, IL

Liquid surfaces are subject to thermally excited capillary waves which produce a surface roughness of a few Angstrom. Our surface scattering experiments with synchrotron radiation address the question of how these hydrodynamic surface modes become arrested close to the bulk glass transition. For this purpose x-ray reflectivity, grazing incidence diffraction and x-ray photon correlation spectroscopy experiments have been performed. The experiments cover a broad temperature range from room temperature down to temperatures close to the bulk glass transition at 180K. We were able to measure the temperature dependent surface roughness [1], the static height-height correlation function on a length-scale of nanometers and the dynamic structure factor of the capillary wave fluctuations. The results are compared with theoretical predictions on the freezing behavior of capillary waves at the glass transition [2].

[1] M. Sprung et al. Phys.Rev. E 70, 051809 (2004) [2] J. Jäckle and K. Kawasaki, J.Phys.:Condens.Matter 7, 4351 (1998)