SFB TR6
Physics of Colloidal Dispersions in External Fields

GEMEINDE BRIEF 2010
No. 5 / June 2010

Editorial

Welcome to the fourth issue of the annual SFB TR6 Gemeindebrief. This newsletter is a forum to present the recent research highlights and scientific activities of the collaborative research centre SFB TR6. It is directed both to researchers in the network and to other scientists interested in the physics of colloidal dispersions. The newsletter also includes a short personalia section and information about SFB TR6 and soft matter conferences, schools and workshops.

Those who want to know more about the SFB TR6 are invited to visit our web page: www.sfb-tr6.de

Hartmut Löwen, Brigitte Schumann

Report about the kick-off workshop of the SFB TR6

This three-day symposium (1.3.-3.3.2010) took place in the Gustav-Stresemann-conference centre in Bonn, the same location known from the CODEF conferences. Talks were given from the SFB projects and three external speakers: 1) M. Bonitz (Kiel) who is member of the SFB TR 24 and introduced to the physics of complex plasma, 2) H. Tanaka (Tokyo) who explained a possible link between structure and dynamics in glasses, and 3) W. Zimmermann (Bayreuth) who talked about fluctuations in shear suspensions and fluids in thermogradients. A stimulating poster session took place as well. Finally, a member meeting of the SFB TR6 was held here on Monday evening.

New SFB TR6 secretary

Since August 1, 2010 Brigitte Schumann is the new secretary of the SFB TR6. The former student assistant is the successor of Sybille Böhm, the last secretary of the SFB TR6, in the Heinrich-Heine University Düsseldorf. We wish her all the best for her future and thank her for her effort in the SFB TR6 .

In this issue

Scientists at work



Special workshop of young researchers of the SFB TR6

Both the fifth and sixth workshop of young researchers of the SFB TR 6 were organized by Dr. Martin Oettel and held in Mainz (Schloss Waldthausen) in September 18-19, 2008 and in November 26-27, 2009. In the latter workshop there were also quite a number of young researchers from the SFB TR 24 "Fundamentals of Complex Plasmas" which further fertilized the cooperation between the SFB TR 6 and the SFB TR 24 based on the scientific link between charged colloids and complex plasmas.

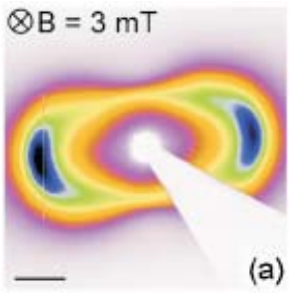
ELOPTO 2010 (Mainz)

The 12th International Symposium on Colloidal and Molecular Electrooptics (ELOPTO 2010) took place at Waldthausen castle near Mainz March 14-17, 2010. This conference was organized by Thomas Palberg (together with Matthias Ballauff and Dietmar Pörschke) and had about 70 participants from 17 countries. The SFB TR 6 sponsored this meeting and the principal investigators A. van Blaaderen, G. Auernhammer and G. Nägele were among the speakers.

Selected scientific results

Experimental Realization of Biaxial Liquid Crystal Phases in Colloidal Dispersions of Boardlike Particles

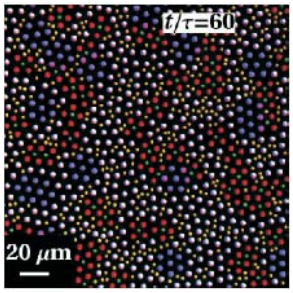
E. van den Pol, A.V. Petukhov, D. M. E. Thies-Weesie, D.V. Byelov, and G. J. Vroege, Phys. Rev. Lett. 103, 258301 (2009)



Biaxial nematic and biaxial smectic phases were found in a colloidal model system of goethite (α-FeOOH) particles with a simple boardlike shape and short-range repulsive interaction. The macroscopic domains were oriented by a magnetic field and their structure was revealed by small angle x-ray scattering. This presented x-ray scattering pattern was selected for the journal cover.

Ultra-fast quenching of binary colloidal suspensions in an external magnetic field

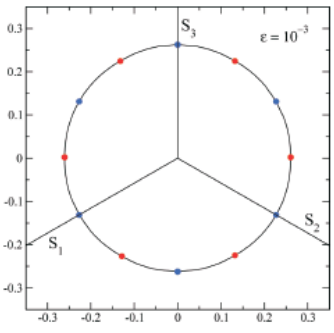
L. Assoud, F. Ebert, P. Keim, R. Messina, G. Maret, H. Löwen, Phys. Rev. Letters 102, 238301 (2009)



An ultrafast quench is applied to binary mixtures of superparamagnetic colloidal particles confined at a two-dimensional water-air interface by a sudden increase of an external magnetic field. This quench realizes a virtually instantaneous cooling which is impossible in molecular systems.

Glass rheology: From mode-coupling theory to a dynamical yield criterion

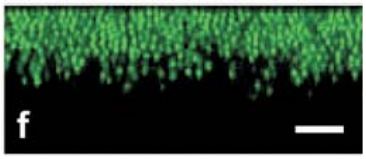
J.M. Brader, T. Voigtmann, M. Fuchs, R.G. Larson, and M.E. Cates Proc. Natl. Acad. Sci. (USA) 106, 15186 (2009)



A schematic model for the constitutive rheology of glasses is presented. The resulting tensorial structure of the schematic model satisfies applicable invariance laws for the nonlinear flow of materials without inertia, such as colloidal suspensions. As a concrete example, we have calculated the full dynamic yield stress manifold by addressing a family of steady flows that interpolate between planar and uniaxial elongation. The resulting yield surface is quite similar, but not identical, to the empirical form of von Mises that has been widely used to model static yield and plasticity in solids. The theory thus gives a first-principles justification for this empirical law. More generally, our work offers promise for a better understanding of the physics of plasticity based on statistical mechanical principles applied to amorphous, isotropic solids.

Multi-particle-collision dynamics simulations of sedimenting colloidal dispersions in confinement

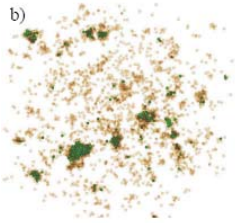
A. Wysocki, C. P. Royall, R. Winkler, G. Gompper, H. Tanaka, A. van Blaaderen, H. Löwen, Faraday Discussions, 144, 245-252 (2010)



The sedimentation of an initially inhomogeneous distribution of hard-sphere colloids confined in a slit is simulated using the multi-particle collision dynamics scheme which takes into account hydrodynamic interactions mediated by the solvent. The simulation data are in good agreement with real-space microscopy experiments.

Precursor-mediated crystallization process in suspensions of hard spheres

T. Schilling, H. J. Schöpe, M. Oettel, G. Opletal, I. Snook, Phys. Rev. Lett. 2010 (in press)



We report on a large scale computer simulation study of crystal nucleation in hard spheres. A combined analysis of real- and reciprocal-space data, shows that the system crystallizes by a two step process. This process is similar to what is observed in colloid-polymer mixtures and protein solutions. However, in these systems it is usually attributed to the presence of a meta-stable critical point. Hard spheres do not have such a complex phase diagram. Nevertheless they show two-step crystallization.

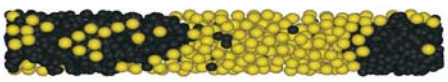
Phase behavior of a de-ionized binary mixture of charged spheres in the presence of gravity

N.J. Lorenz, H.J. Schöpe, T. Palberg, J . Chem. Phys. 131, 134501 (2009)

The bulk phase behaviour of a binary charged sphere mixture of size ratio 0.57 was observed to be eutectic with a large residual miscability in the solid state. The microstructure and crystal morphology was dominated by of facetted equilibrium crystals enriched in small sphere, overgrowing roundish, rough crystals enriched in large spheres.

Rounding of Phase Transitions in Cylindrical Pores

D. Wilms, A. Winkler, P. Viranau, K. Binder, Phys. Rev. Lett. 2010 (in press)



Computer simulations of colloid-polymer mixtures in cylindrical confinement show the existence of two distinct rounded transitions, if the cylinder lenght L exeeds by far its diameter: the transition from multi-domain to a single domain state explains the hitherto mysterious "hysterisis critical point".

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Special among SFB TR6 guests

06/2009 **M.E. Cates** (Edinburgh) visits Mainz.
06/2009 **D.A. Weitz** (Harvard) visits Düsseldorf.
09/2009 **W. van Megen** (Melbourne) visits Mainz.
10/2009 **B. Cichocki** (Warsaw) visits Jülich.
10/2009 **T. Ohta** (Edinburgh) visits Düsseldorf.
11/2009 **S. Sengupta** (Kolkata) visits Mainz.
5/2010 **I. Snook** (Melbourne) visits Mainz & D'dorf.
6/2010 **M. Lozada-Cassou** (Mexico City) visits D'dorf.

New researchers in the SFB TR6 since 2009

G. Auernhammer	(project B7)
J. Brader	(project A6)
F. Schmid	(project B9)
A. Petukhov	(project D6)
D. Vanmaekelbergh	(project B8)
T. Voigtmann	(project A7)
H. H. Wensink	(project D3)

The project proposal B9 of **Friederike Schmid** on Computer simulations of charged colloids in alternating electric fields was approved for funding starting on July 1st, 2010.

upcoming

Viscous Liquids III (30.03. - 02.04.2011) Vincei (Italy)
organized by T. Voigtmann (Konstanz), F. Sciortino (Rome), E. Zaccarelli (Rome)

The third international workshop Dynamics in Viscous Liquids is jointly organized by the SFB TR6 and the Accademia Nazionale dei Lincei, in Rome, Italy. The workshop will be held from March 30 to April 2, 2011, in the villa of the Italian Academy of Sciences close to Vatican City, in Rome. All participants are encouraged to submit 1-page descriptions of their work prior to the conference (deadling is November 15, 2010). A scientific programme committee (composed of internationally acknowledged experts, among them a number of TR6 PI's) will then decide in a one-day meeting which contributions are allocated oral or poster contributions. This particularly encourages young researchers and the exchange of novel research ideas among various disciplines concerning the slow dynamics of liquids, colloidal suspensions under external forces, etc.

SFB TR6 Summer School (Sept. 27 - Oct. 09, 2010)
"Physics of colloidal suspensions and granular media"
organized by E. Clément (Paris), G. Maret (Konstanz), H. Löwen (Düsseldorf)

Granular media are dense packings of macroscopic particles, often of irregular shape (sand, pile of rice, steel beads etc..) which may or may not be suspended in a liquid. Here gravity is dominant but, due to shaking, levitation or poring, complex dynamics and flow behaviour may occur. In this school an attempt will be made to bring together leading experts in both fields and to discuss similarities and differences in their physical properties and theoretical description. About 28 lecturers were invited from both fields (colloids and granulates), 8 of them from the SFB TR6 and registrations of about 85 participants were received.

Calls of SFB members to other universities


Tanja Schilling


Christos N. Likos


Annette Schmidt

Tanja Schilling has assumed on January 1, 2010, a Professorship at the Faculty of Physics of the University of Luxembourg, Christos Likos on June 1, 2010, a Professorship at the Faculty of Physics of the University of Vienna, Austria and Annette Schmidt on April 1, 2010, a Professorship at the University of Cologne.

prizes and honors

K. Binder (Mainz) was honored with the Lennard-Jones Prize of the Royal Society of Chemistry in 2009.

Florian Ebert was honored with the Nycomed-Price of the University of Konstanz which is endowed with 5000 Euro for his outstanding PhD thesis on superparamagnetic colloidal particles which are explored in the project C2.