CPP 45: Colloids and Complex Liquids III - External Fields

Time: Thursday 17:15–18:00 Location: ZEU 114

CPP 45.1 Thu 17:15 ZEU 114

Structure formation and dynamics of dipolar colloids in rotating fields — •Sebastian Jäger and Sabine H. L. Klapp — Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

We investigate suspensions of colloidal dipolar particles that are exposed to external rotating fields. Given suitable system parameters these systems form layered structures. We are mainly interested in the dynamics of the colloidal particles and the question for which field strengths and frequencies layer formation occurs. To explore these matters, we employ computer simulations, most notably Brownian (Langevin) dynamics simulations, which we supplement by semi-analytical considerations. In particular, we propose a simple theory that describes layer formation in a density functional framework [1].

[1] S. Jäger and S. H. L. Klapp, in preparation.

CPP 45.2 Thu 17:30 ZEU 114

Meniscus of a ferrofluid around a vertical cylindrical wire carrying electric current — •Kathrin May, Thomas John, and Ralf Stannarius — Institut für Experimentelle Physik, Otto-von-Guericke-Universität Magdeburg

We investigate quantitatively a common presentation experiment in ferrofluids - the shape of a meniscus in the field of a current-carrying wire. Neglecting the surface tension, the height of the free surface profile of the ferrofluid can be determined to $h \propto r^{-2}$, where r is the distance to the center of the wire [1]. The influence of the surface tension has been discussed theoretically in [2]. Here we compare these results with experimental data. All material parameters are known, therefore no fitting parameters are used in comparisons. The significant differences between the model in [1] and experimental results can be explained by the influence of the surface tension.

[1] R. E. Rosensweig, Ferrohydrodynamics, Dover Publications, New York, 1997.

[2] Th. John et al., J. Magn. Magn. Mater. 309, 31 (2007).

CPP 45.3 Thu 17:45 ZEU 114

Ground states of ferrofluid monolayers in the presence of an external magnetic field — •Taisia Prokopieva[1,2], Victor Danilov[1], Sofia Kantorovich[1,2], and Christian Holm[2] — [1]Ural State University, Lenin av. 51, Ekaterinburg, 620000, Russia — [2]Institute fuer Computerphysik, Universitaet Stuttgart, Pfaffenwaldring 27, 70569, Stuttgart, Deutschland

We study the system of magnetic dipolar particles the centres of which are confined in one plane. Particles themselves are free to rotate, thus forming a so called quasi-2D monolayer system [Klokkenburg et al, Phys. Rev. Lett., 2006]. Computer simulations and theoretical studies of these systems were actively performed in the last years both at room temperatures [Kantorovich et al, PCCP, 2008] and at the ground state [Prokopieva et al, Phys. Rev. E, 2009]. All these works however did not consider the possibility to control the structural transitions in such a system by the direction and intensity of the external magnetic field. The latter opens a wide range of new effects. Here we present the combination of Monte Carlo simulated annealing and theoretical modeling to describe the response of a ferrofluid monolayer to the applied magnetic field at low temperature. Our investigations show the dominant role of the magnetic correlations within the monolayer plane, which we characterise in terms of initial magnetic susceptibilities.