T_CSUH Special Seminar

Texas Center for Superconductivity at the University of Houston

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"Colloids in External Fields: Crystallization, Melting, and Dynamics"

April 3, 2006
Room 102, Houston Science Center
12:00 noon – 1:00 p.m.

Abstract

Colloidal assemblies are ideal model systems in which to study basic equilibrium and non-equilibrium phenomena relevant to a wide range of condensed matter systems. Additionally, there are a variety of technological applications for self-organizing colloid structures, including photonic band gap materials and patterned nanostructures. Here we study the statics and dynamics of colloids interacting with external fields. When the fields are used to create a periodic substrate, we find a variety of novel crystalline states that we term "colloidal molecular crystals." These have interesting multi-step melting transitions and can be used to realize a variety of canonical statistical mechanics models physically. When the substrate is dynamic, we show that novel dynamical phases arise and lead to ratchet effects, which can be used to create new types of logic gates and new fractionation techniques. Many of these results have recently been realized experimentally for colloids interacting with periodic optical arrays.

Brief Bio

Charles Reichhardt studied physics (1889-1993) at the University of California, Irvine and received his Ph.D. at the University of Michigan in 1998. As Postdoctoral Researcher he worked (1998-2003) at the University of California, Davis. He was a Visiting Scientist (2000-2003) at Argonne National Laboratory and a Richard P. Feynman Distinguished Postdoctoral Fellow (2000-2002) at Los Alamos National Laboratory. Dr. Reichhardt's interests focus on computational studies in condensed matter: soft matter, nanophysics, solid state, and complex systems.

As Technical Staff Member his current research focuses on systems with many degrees of freedom where collective and competing interactions can give rise to highly complex and organized structures and dynamics. Some particular systems that he and his collaborators study include vortex lattices in superconductors, assemblies of granular particles, charge ordering in soft matter materials such as colloids and polymers, charge ordering in hard condensed matter systems such as stripe, bubble, and Wigner crystal phases in quantum Hall systems and cuprate superconductors, elastic interfaces, supercooled liquids and glasses, biological systems and networks of interacting adaptive agents.

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