SFB/TRR 21 - Seminar
22. April 2009, Tübingen

Charles Reichhardt
(Theoretical Division, Los Alamos National Laboratory, USA)

Realizing Novel Collective Particle Dynamics on Periodic Substrates: From Superconductors to Bacteria

I present an overview of different types of novel collective dynamical systems that can be realized in systems of collectively interacting particles in the presence of an ordered substrate. For superconducting vortices, we find that interesting gating and jamming phenomena can occur for periodic pinning arrays coexisting with channel type geometries and crossed dc drives. Colloidal particles interacting with periodic optical trap arrays can exhibit both a polarized switching effect similar to liquid crystals and a martinsitic switching where the system can change its global symmetry. Finally, I show that asymmetric periodic substrates can be used to create a ratchet effect in swimming bacteria, making it possible to create topotaxis systems which opens a new avenue for creating dynamical nanostructures.

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Universität Tübingen, Raum D4 A19
Auf der Morgenstelle 14, 72076 Tübingen

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