

# Universität zu Köln

Mathematisch-Naturwissenschaftliche Fakultät

Kickoff meeting — UoC Forum

“Classical and quantum dynamics of interacting particle systems”



Friday, December 8, 2017

Room 203, Mathematical Institute

University of Cologne

**Weyertal 86 — 90**

50931 Köln

## Program

10:00 — 10:10 Opening

10:10 — 10:55 Margherita Disertori (U Bonn)

Some open problems in equilibrium statistical mechanics.

I will review some tools to study equilibrium Gibbs measures in the non integrable case and give a couple of examples directly connected to my research.

10:55 — 11:15 Coffee Break

11:15 — 12:00 Christian Maes (KU Leuven)

Pattern formation induced by a nonequilibrium medium.

We study the induced interaction between multiple probes locally interacting with driven colloids and trapped in a toroidal geometry. The effective binary forces between the probes break the action-reaction principle. We demonstrate how in the stationary nonlinear nonequilibrium regime these interactions induce stability of a crystal-like pattern, where the probes are equidistant, when the probe-colloid interaction is either completely attractive or completely repulsive. In this talk we also connect the subject with some major problems of nonequilibrium statistical mechanics, and in particular with research interests of the Leuven group in mathematical physics. [Joint work with Karel Netocny (Prague)]

14:30 – 15:15 Kaveh Bashiri (U Bonn)

From gradient flows in the space of probability measures to hydrodynamic limits.

It is well known that diffusion equations can be characterized by gradient flows in the space of probability measures equipped with the geometry of the Wasserstein distance. Moreover, in recent years, by modifying the Wasserstein distance appropriately, this technique has been transferred to further evolution equations such as the Boltzmann equation. In this talk we show how to do it for evolution equations that depend on a non-evolving parameter. Such equations are connected to a system of SDEs that interact with each other through this parameter. We then show how to apply this gradient flow representation to prove the hydrodynamic limit for the empirical process associated to this system of SDEs. Finally, if time permits, we can moreover discuss how it should be possible to prove large deviation principles from this representation.

15:15 – 16:00 Andreas Schadschneider (UoC)

Driven Diffusive Systems – From Theory to Applications and Back.

We review the activities in our group which range from fundamental research on driven diffusive systems to applications in the area of vehicular traffic and pedestrian dynamics. Especially we try to show that the flow of information can go in both directions. Physics-inspired approaches have been used to develop models for highway and urban traffic as well as for the motion of pedestrian crowds. They can be used in applications, e.g. in the form of an evacuation assistant or traffic forecasting. On the other hand, the analysis of empirical data from traffic measurements or laboratory experiments with pedestrian crowds can give insight into fundamental properties of systems far from equilibrium.

16:00 – 16:20 Coffee Break

16:20 – 17:05 Peter Mörters (UoC)

Emergence of condensation in complex systems.

A complex system undergoes condensation if a positive fraction of an observed quantity concentrates in a single state, asymptotically as time goes to infinity. The aim of my project is to understand the dynamics of condensation, ie. how a condensate can build up, or emerge, in a stochastic system. I will report on some recent progress in collaboration with Volker Betz (Darmstadt), Steffen Dereich (Münster) and Cecile Mailler (Bath).

17:15 Wine & Cheese (Seminarraum 2)