Posters

Kaveh Bashiri, Universität Bonn
Gradient flow approach to local mean-field spin systems
It is well-known that many diffusion equations can be recast as Wasserstein gradient flows. Moreover, in recent years, by modifying the Wasserstein distance appropriately, this technique has been transferred to further evolution equations and systems. In this paper we establish such a gradient flow representation for evolution equations that depend on a non-evolving parameter. These equations are connected to a local mean-field interacting spin system. We then use this gradient flow representation to prove a large deviation principle for the empirical process associated to this system. This is done by using a criterion that was established by Max Fathi in 2016. Finally, the corresponding hydrodynamic limit is shown by using an approach that was initiated by Sandier and Serfaty in 2004.

Kistosil Fahim, Montanuniversität Leoben
Rough paths perturbation of the equation of semilinear Volterra equations
In the classical theory of thermodynamics, thermal signals prop- agate with infinite speed, local actions and cumulative behaviour are neglected; the history, even the very recent history is not taken into account. A way to introduce a memory is first to introduce a so called memory function. By this memory function β the history will be taken into account by taking a averaging the past with β and leads to a so-called Volterra equation. The theory of rough path introduced by Terry Lyons in his seminal work as an extension of the classical theory of controlled differential equations. In this work we show existence and uniqueness of mild solution for an infinitesimal semilinear Volterra equations driven by a rough path perturbation. The first step one needs regularity estimates and of the convolution term driven by a rough path. In this work we give some maximal regularity results of the Ornstein Uhlenbeck process with memory term driven by a rough path using the Nagy Dilation Theorem.

Daniela Flimmel, Charles University, Prague
Limit theory for Horvitz-Thompson type statistics of a weighted Voronoi tessellation
We observe a realization of a stationary generalized weighted Voronoi tessellation of $\mathbb{R}^d$ within a bounded window W. Given a geometric characteristic of the typical cell, we use the minus-sampling technique to construct an unbiased estimator of the average value of this geometric characteristic. Under mild conditions on the weights of the cells, we establish variance asymptotics and the asymptotic normality of the unbiased estimator as $W \nearrow \mathbb{R}^d$ using the stabilization method. Moreover, the weak consistency is shown for this estimator. Joint with Joseph E. Yukich and Zbyněk Pawlas.

Fabio Frommer, Johannes Gutenberg-Universität Mainz
The Henderson problem
The inverse Henderson problem of statistical mechanics is the theoretical foundation for many bottom-up coarse-graining techniques for the numerical simulation of complex soft matter physics. This inverse problem concerns classical particles in continuous space which interact according to a pair potential depending on the distance of the particles. Roughly stated, it asks for the interaction potential given the equilibrium pair correlation function of the system. In 1974 Henderson proved that this potential is uniquely determined in a canonical ensemble and he claimed the same result for the thermodynamical limit of the physical system. Here we provide a rigorous proof of a slightly more general version of the latter statement using Georgii's variant of the Gibbs variational principle.

Alexander Hinsen, WIAS Berlin

The White Knight model - A spatial geometric infection model

In order to model a D2D telecommunication system, we model a spatial system of devices on a random street system in $\mathbb{R}^2$ forming an ad-hoc communication system. We study the propagation of malware and efficiency of countermeasures in form of an multi-state interacting particle system. Depending on the speed of the malware, the competing processes undergoes a phase transition in terms of survival of the infection. We are able to proof this phase transition for random rebooting (contact process) and the 'White Knight' model: an active countermeasure where a so called Goodware actively spreads through the system competing against the malware. This model was also labelled 'chase-escape' by Durrett ('18).

Challenges regarding this model involve missing attractiveness in the parameters and multiple layers of randomness. The project is a joint work with Benedikt Jahnel(WIAS) and Wolfgang König (WIAS/TU).

Christian Hirsch, University of Mannheim

Large deviations in quantum quasi-1D Coulomb systems

We prove a large deviation principle for a large system of interacting Brownian bridges in a toroidal region growing in one dimension. The particles repel each other according to Coulomb forces. A key mathematical challenge is the extension of the method applied by T. Leblé and S. Serfaty in the classical setting to the quantum context of interacting diffusions. Via the Feynman-Kac formula, this large deviation principle provides a variational formula for the free energy per unit volume associated with the Maxwell-Boltzmann statistics. Based on joint work with S. Jansen and P. Jung.

Kateřina Koňasová, Charles University, Prague

Classification task in the context of replicated point patterns

Classification task, one of the fundamental tasks in machine learning and also in statistics, aims to classify a new observation to the one of the k possible classes. We propose a non-parametric approach to solving the classification task in the context of replicated point patterns using the kernel regression method. In this case a semimetric based on functional summary characteristics is considered as a dissimilarity measure. Performance of this method will be illustrated by means of simulation study. Joint work with Jiří Dvořák (Charles University, Prague)

Nevena Marić, University of Missouri-St.Louis

A branching random walk with barriers

We consider a branching random walk (BRW) on $\mathbb{R}$ that can not evolve past two symmetric barriers. Initially there is an individual located at the origin. It produces a Poisson number of children that are uniformly distributed in its neighborhood of the unit size (the second generation is distributed as a Poisson Point Process on $[-1, 1]$ with rate $\lambda/2$). Every new individual produces the offspring in its own neighborhood following the same law and independently of other siblings. Suppose that the process can not evolve past points $-L$ and L ($L \in \mathbb{R}$). This is actually a one dimensional model of reproduction of plants in a strictly limited habitat. We study how the barriers affect phase transition in the BRW and the limiting distribution in the super-critical case. Similar processes with only one barrier were studied in different settings by many authors: Bérard and J.-B. Gouéré (2011), Biggins et al. (1991), Derrida and Simon (2007), Jaffuel (2012). For the two barriers case using multi-type branching processes in conjunction with coupling techniques we are able to find the critical density λ_c in case $L = 1$.

Joint work with Cristian F. Coletti Universidade Federal de ABC, Brazil and Pablo M. Rodriguez Universidade de São Paulo - São Carlos, Brazil.

Michael Olesik, Jagiellonian University, Krakow
Super droplets and Ostwald ripening
Ostwald ripening is a phenomenon occurring in liquid sols and resulting in the growth of larger droplets at the expense of smaller ones, and hence in the broadening of the size spectrum of particles. To depict examples of Ostwald-ripening-like behaviour in the context of atmospheric clouds, we will present simulations performed using a basic adiabatic cloud parcel model with moving-sectional representation of particle spectrum. We will discuss simulations of the evolution of the radii of particles during an ascent from below cloud base up till a level where supersaturation approaches an asymptotic value. Depending on the updraft velocity driving the adiabatic cooling, on the particle concentration and on the solubility of particles, the simulations depict either the spectrum-narrowing picture or the Ostwald-ripening spectrum broadening situation involving deactivation of particles.

Tommaso Cornelis Rosati, HU Berlin
Ergodicity for KPZ Equation
We prove some large-times properties of the KPZ equation, a model for asymmetric growing interfaces, on finite volume. We show that solutions synchronize almost surely and exponentially fast around a stationary solution and we prove that a one force, one solution principle holds. We use elementary tools from the theory of random dynamical systems and positive operators.

Marco Seiler, University of Göttingen
Contact process in a time evolving edge random environment
Lately, there has been a lot of interest in interacting particle systems on evolving random graphs respectively in time evolving random environments. We study a contact process on a connected graph with bounded degree in a general time evolving edge random environment described by an autonomous Markov process with on and off states. Infections in the contact process only occur with rate λ along an edge connecting two vertices if the edge is currently turned on. Deaths occur as usually independently at a constant rate 1. We will give an explicit graphical representation for this model and a comparison argument with a branching process. This provides in some special cases a bound on the infection rate below for which extinction is certain.

Filip Seitl, Charles University, Prague
Exploration of Gibbs-Laguerre tessellations for 3D stochastic modeling
Random tessellations generated by Gibbs point processes are investigated. The motivation comes from the materials research where the 3D grain structure of polycrystalline metals is of the interest. The Gibbs-Voronoi tessellations in 2D were examined in previous works. We will deal with a twofold extension of this concept, namely to Gibbs-Laguerre tessellation in 3D. The existence of this model is examined. The choice of the energy function of the underlying Gibbs point process reflects desired geometrical characteristics of grains. Simulations using MCMC are tractable. The model is applied to statistical reconstruction based on a real data specimen of a polycrystal.

Gabor Toth, FernUniversität in Hagen
Multiple Groups in a Curie-Weiss Model with applications to voting theory
We present a Curie-Weiss model with two groups of spins. Coupling within and between groups can be homogeneous or heterogeneous. We show two-dimensional laws of large numbers and central limit theorems under the high-temperature regime. Using these results we calculate the optimal weights each member of a council should receive in order to minimise the so called democracy deficit.

Clare Wallace, Durham University

Statistics of phase boundaries via renewal approximation

In the two-dimensional Ising model in the low-temperature regime, macroscopic droplet interfaces in the large-system scaling limit, under fixed magnetisation, converge to Wulff shapes. In order to approximate locally the shape of the phase boundary, we use skeletons, which we study by a renewal scheme. We show that, under appropriate conditions, the height function of the renewal scheme converges to the trajectories of the Brownian motion and that this convergence persists under conditioning on additive functionals such as the terminal height and the total area beneath the curve.

Alexander Zass, Universität Potsdam

Existence of Gibbsian fields via entropy methods

In 1988, Hans-Otto Georgii introduced a new method of proving the existence of an infinite-volume Gibbs measure, that uses the specific entropy as a "Lyapunov function".

Drawing inspiration from examples in stochastic geometry, we use this approach in the framework of *marked* Gibbs point processes, and present an existence result for long range interactions.