WWU
MÜNSTER

Dynamics, random media and universality of complex physical systems

August 26-30, 2019
Münster

Organizing Committee:

Gerold Alsmeyer
Steffen Dereich
Zakhar Kabluchko
Matthias Löwe
Chiranjib Mukherjee

living.knowledge
WWU Münster

MM
Mathematics
Münster
Cluster of Excellence

General information

Venue. *Registration*: Ground floor of the SRZ (Orléans-Ring 12, cf. Map A) on Monday. *Lecture room*: SRZ 217 (2. floor). You can find all the information on the homepage of the conference.

Wi-Fi access. If you are part of the eduroam community, you may connect to the network "eduroam" as usual. Otherwise you can connect to the SSID "GuestOnCampus" and start any web browser. You will automatically be redirected to the login page. Confirm the terms of use and click on "log in for free". 1 GB data volume is available per device and day. Please note that the connection is not encrypted.

Talks. If you do not object, we will collect your talk in a Dropbox folder that can be accessed via

`http://go.wwu.de/1lwze`

If your presentation needs a **projector**, please try to send a copy of your slides **the last day before your talk** to chiranjib.mukherjee@uni-muenster.de.

Coffee break/Lunch. In the lounge (2. floor of SRZ) you can get coffee and snacks during the coffee breaks. There are a couple of restaurants for lunch in the vicinity:

- Canteen - Mensa am Ring, Domagkstraße 61 (most convenient option, even if not the most idyllic place)
- Ristorante Milano (Italian), Wilhelmstraße 26 (closed on Monday)
- Il Gondoliere (Italian), Von-Esmarch-Straße 28 (closed on Monday)
- Buddha Palace (Indian), Von-Esmarch-Straße 18
- La Gondola D'oro (Italian), Hüfferstraße 34
- A2 am See (German), Annette-Allee 3

- Bakenhof (Hotel + Restaurant), Roxeler Str. 376
- Royals & Rice (Vietnamese), Frauenstraße 51

Conference dinner. The conference dinner takes place on Wednesday at 6.30pm at the Mövenpick Hotel (Kardinal-von-Galen-Ring 65, cf. Map B).

Public transportation. You can check the bus schedule on the website of Stadtwerke-Münster (in German and English), or use Google maps.

Free afternoon on Wednesday. There will be a free afternoon on Wednesday and here are some suggestions: Go see the castle, its garden and/or the included botanic garden. Visit a museum, e.g. the LWL Museum of Art and Cultural History or the Picasso-Museum. Have a walk around the Aasee lake or make yourself familiar with European history at the Historical City Hall where the peace of the Thirty Years' War was negotiated. Further information will follow during the conference.

Questions. In case of further questions, please ask Chiranjib Mukherjee:
Email: chiranjib.mukherjee@uni-muenster.de

Acknowledgements

The conference is funded by the German Research Foundation (DFG) and the Cluster of Excellence "Mathematics Münster" (MM).

Schedule

Monday, August 26

08:30-09:00 Registration

09:00-09:50 **Sourav Chatterjee**: Average Gromov hyperbolicity and the Parisi ansatz

09:50-10:40 **Nicola Kistler**: From Parisi to Boltzmann

10:40-11:10 Coffee

11:10-12:00 **Yvan Velenik**: Interfaces in planar Ising and Potts models: a review

12:00-14:00 Lunch

14:00-14:50 **Silke Rolles**: Recent results on vertex-reinforced jump processes

14:50-15:40 **René Schilling**: Domains of (state-dependent) fractional Laplacians and function spaces

15:40-16:10 Coffee

16:10-17:00 **Nina Gantert**: Mixing times for exclusion processes with open boundary

17:00-17:50 **Frank Aurzada**: Persistence probabilities of autoregressive processes

18:30 wine and cheese reception in the lounge (2. floor of SRZ)

Tuesday, August 27

09:00-09:50 **Wolfgang König**: Eigenvalue order statistics and mass concentration in the parabolic Anderson model

09:50-10:40 **Ralph Neininger**: Process valued complexity measures of algorithms

10:40-11:10 Coffee

11:10-12:00 **Michael Kupper**: Scaling Limits under Wasserstein Uncertainty

12:00-14:00 Lunch

14:00-14:50 **Jean-Dominique Deuschel**: Isomorphism theorems for Ginzburg-Landau fields

14:50-15:40 **Volker Betz**: The phase transition for random loop models on trees

15:40-16:10 Coffee

16:10-17:00 **Robert Seiringer**: The polaron at strong coupling

17:00- 17:50 **Pablo Ferrari**: Gaussian random permutation and the boson point process

Wednesday, August 28

08:45-09:35 **Benjamin Gess**: Stochastic PDE with nonlinear, conservative noise - Applications and the existence of stochastic flows

09:35-10:25 **Francis Comets**: Space-time fluctuation of the Kardar-Parisi-Zhang equation in $d \geq 3$

10:25-11:15 **Claudio Landim**: A one-dimensional non-local singular SPDE

11:15-11:40 Coffee

11:40-12:30 **S.R.S. Varadhan**: The Polaron measure: its existence and properties

12:30-14:00 Lunch

14:00 Free afternoon

18:30 Conference dinner, Mövenpick Hotel

Thursday, August 29

09:00-09:50 **Márton Balázs**: Measures, hills, and hydrodynamics

09:50-10:40 **Leonid Mytnik**: On the speed of a front for stochastic reaction-diffusion equations

10:40-11:10 Coffee

11:10-12:00 **Erwin Bolthausen**: A new approach for the replica symmetric formula of the perceptron

12:00-14:00 Lunch

14:00-14:50 **Alejandro Ramírez**: Exponential decay for the exit probability from slabs of random walk in random environment

14:50-15:40 **Amine Asselah**: Moderate Deviation for the volume of the range of a transient random walk

15:40-16:10 Coffee

16:10-17:00 **Stephan Luckhaus**: The general homogenization limit, two scale convergence, and interpolation lemmata

17:00- 17:50 **Franz Merkl**: Dislocation lines in three-dimensional solids at low temperature

Friday, August 30

08:45-09:35 **Nathanaël Berestycki**: A characterisation of the Gaussian free field

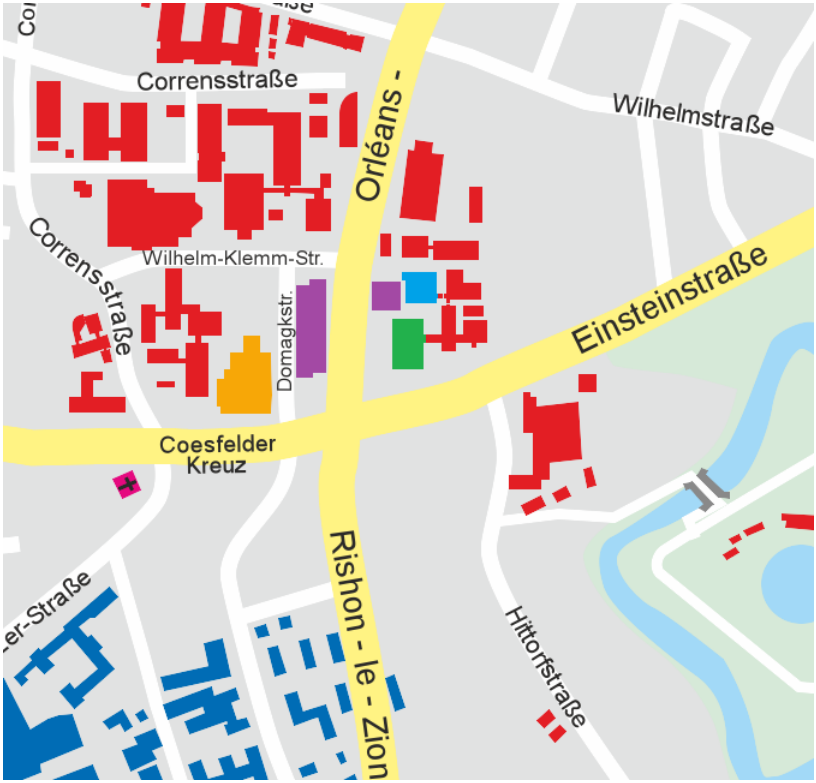
09:35-10:25 **Sunder Sethuraman**: On microscopic derivation of a mean-curvature flow

10:25-11:15 **Giambattista Giacomin**: On disorder relevance for pinning models

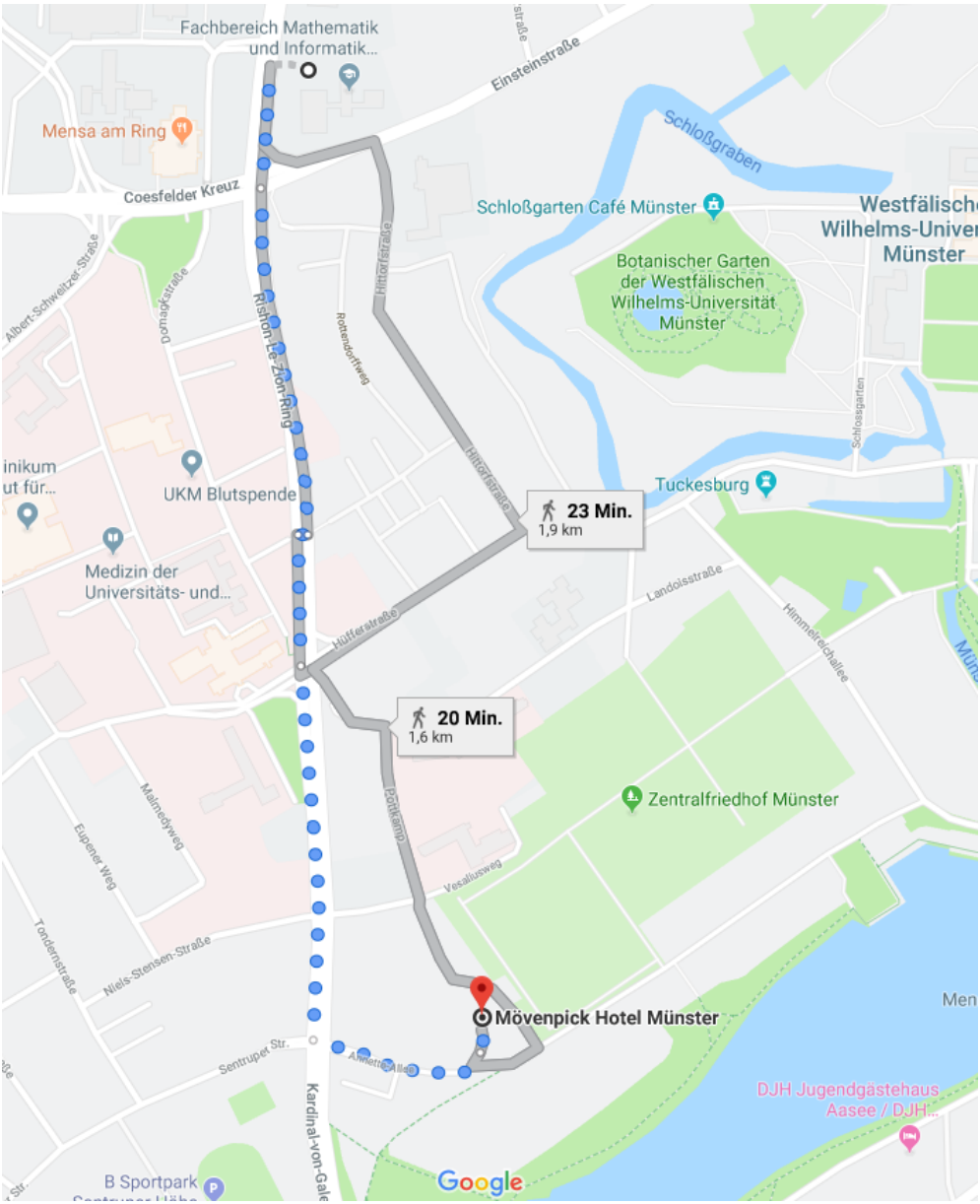
11:15-11:40 Coffee

11:40-12:30 **Stefano Olla**: Kinetic and hydrodynamic limits for a chain of harmonic oscillators with a point Langevin heat bath

Maps and locations



Map A: Lecture building, canteen, SRZ, parking lot.



Map B: Route to Mövenpick Hotel.

Book of abstracts

Moderate Deviation for the volume of the range of a transient random walk

Amine Asselah Thu 14:50

Abstract. We obtain estimates for the downward deviation for the volume of the range of a random walk in dimension 3 and in $d > 4$. The method we have developped allow to treat also other observable like the capacity of the range. This is joint work with Bruno Schapira.

Persistence probabilities of autoregressive processes

Frank Aurzada Mon 17:00

Abstract. We study the probability that a stochastic process has a long excursion (persistence probability). In particular, we focus on autoregressive processes. First, we discuss results on the existence of an exponential decay rate (persistence exponent) and its dependence of the parameters of the autoregressive process. Second, we present a perturbation technique that allows to compute a series expansion of the persistence exponent in the parameter of the autoregressive process. The first part is joint work with Sumit Mukherjee (Columbia) and Ofer Zeitouni (Weizmann Institute). The second part is joint work with Marvin Kettner (Darmstadt).

Measures, hills, and hydrodynamics

Márton Balázs Thu 09:00

Abstract. 1-dimensional interacting particle systems have a well-known surface growth representation, so we decided to try them on modeling real-life surface evolution phenomena. The ones we picked were geomorphological processes that shape hill slopes in nature. The restriction that hills do not seem to grow indefinitely or vanish altogether quickly turned our

attention to blocking measures of particle systems. I will explain how this idea arose, how one can use blocking measures to predict the shapes of hills, and what type of scaling fits naturally this scenario. I will also explain a bit about hydrodynamics around blocking measures, with special attention to the boundaries. (Joint work with Jacob Calvert, Particia Goncalves and Katerina Michaelides)

A characterisation of the Gaussian free field

Nathanaël Berestycki Fri 08:45

Abstract. The planar Gaussian free field arises as a universal scaling limit for a broad range of models from statistical physics. In this work we prove that any random distribution satisfying conformal invariance, a form of domain Markov property and a fourth moment condition must be a multiple of the Gaussian free field. We will also discuss several open problems concerning the situation beyond the Gaussian case. Joint work with Ellen Powell (ETH) and Gourab Ray (Victoria).

The phase transition for random loop models on trees

Volker Betz Tue 14:50

Abstract. We show the existence of a sharp phase transition from non-existence to existence of infinite loops for the random loop model on d-regular trees, for all dimensions $d \geq 3$, and for all values of the parameter u controlling the preference for crosses or bars. Furthermore, we give a recursive scheme to obtain an expansion of the critical parameter in powers of $1/d$, which in principle is explicit but whose combinatorial complexity grows very quickly. We were able to explicitly obtain the first 6 terms (the first two were previously found by Ueltschi and Bjornberg by other means), and observed that (as functions of u) they seem to have a very interesting structure. This is joint work with Johannes Ehlert and Benjamin Lees.

A new approach for the replica symmetric formula of the perceptron

Erwin Bolthausen Thu 11:10

Abstract. The perceptron is a neural net which plays a considerable role in the recent development of artificial intelligence. For its very simplest version, a formula for the memory capacity had been derived in a non-rigorous way by Derrida and Gardner. This is based on rather sophisticated replica methods. Rigorous proofs for a number of types of the perceptron have been obtained by Scherbina and Tirozzi, and by Talagrand, based on a version of the cavity method. We present a new approach which is based on an analysis of the TAP equations which had, for the perceptron, been introduced by Mézard. (Joint work with Shuta Nakajima, Nagoya University).

Average Gromov hyperbolicity and the Parisi ansatz

Sourav Chatterjee Mon 09:00

Abstract. Gromov hyperbolicity of a metric space measures the distance of the space from a perfect tree-like structure. The measure has a "worst-case" aspect to it, in the sense that it detects a region in the space which sees the maximum deviation from tree-like structure. I will speak about an "average-case" version of Gromov hyperbolicity, which detects whether the most of the space, with respect to a given probability measure, looks like a tree. The main result is that if this average hyperbolicity is small, then the space can be approximately embedded in a tree. The proof uses a weighted version of Szemeredi's regularity lemma from graph theory. As an application, I will give a construction of hierarchically organized pure states in any model of a spin glass that satisfies the Parisi ultrametricity ansatz. (Joint work with Leila Sloman.)

Space-time fluctuation of the Kardar-Parisi-Zhang equation in $d \geq 3$ in weak disorder

Francis Comets Wed 09:35

Abstract. The Kardar-Parisi-Zhang (KPZ) equation enjoys a huge popularity as the default model of stochastic growth in $(d+1)$-dimensions. When $d=1$, it has now seen a huge upsurge of interest in the recent years and a vast amount of deep mathematical results are now available. On the other hand, despite being ill-posed for larger dimensions, the KPZ equation still remains relevant for random surface growth and has its own appeal even in the so-called small disorder regime – a distinguishing attribute of this equation in higher dimensions. While recent progress has also been made in $d=2$, in the present talk we will report on some works pertaining to the case $d \geq 3$. The relevant equation is

$$\frac{\partial}{\partial t} h_\varepsilon = \frac{1}{2}\Delta h_\varepsilon + \left[\frac{1}{2}|\nabla h_\varepsilon|^2 - C_\varepsilon\right] + \beta \varepsilon^{\frac{d-2}{2}} \xi_\varepsilon$$

Here $\beta > 0$ is a parameter called the disorder strength, $\xi_\varepsilon = \xi \star \phi_\varepsilon$ is a spatially smoothened (at scale ε) Gaussian space-time white noise and C_ε is a divergent constant as $\varepsilon \to 0$. When β is sufficiently small and $\varepsilon \to 0$, $h_\varepsilon(t,x) - \mathfrak{h}_\varepsilon(t,x) \overset{\mathbb{P}}{\to} 0$ where $\mathfrak{h}_\varepsilon(t,x) = \mathfrak{h}(\xi^{(\varepsilon,t,x)})$ and $\mathfrak{h}$ is a non-degenrate random variable, or the *limiting free energy* in the weak disorder regime and $\xi^{(\varepsilon,t,x)}$ stands for the diffusively rescaled, time-reversed and spatially translated white noise, which possesses the same law as that of ξ. In the talk we focus on the convergence of the *space-time process*

$$\left(\varepsilon^{1-\frac{d}{2}}[h_\varepsilon(t,x) - \mathfrak{h}_\varepsilon(t,x)]\right)_{x\in\mathbb{R}^d, t>0} \overset{(d)}{\to} \left(\mathscr{H}(t,x)\right)_{x\in\mathbb{R}^d, t>0} \qquad \text{(A)}$$

Here

$$\mathscr{H}(t,x) = \gamma(\beta) \int_0^\infty \int_{\mathbb{R}^d} \rho(\sigma + t, y - x)\, \xi(\sigma, z) \mathsf{d}\sigma\, \mathsf{d}z$$

is a centered Gaussian field (with $\rho(\sigma,x)$ being the standard heat kernel) and $\mathscr{H}$ is also the (real-valued) solution of the *non-noisy heat equation*

$\partial_t \mathscr{H} = \frac{1}{2}\Delta\mathscr{H}$ with a *random initial condition* $\mathscr{H}(0,x)$ given by a *Gaussian free field* on $\mathbb{R}^d$. Joint work with Clément Cosco (Paris) and Chiranjib Mukherjee (Münster).

Isomorphism theorems for Ginzburg-Landau fields

Jean-Dominique Deuschel Tue 14:00

Abstract. We derive certain identities in law relating functionals of convex gradient fields to the local times of corresponding random walks in the associated Helffer-Sjöstrand representation. When restricting these identities to Gaussian measures, one recovers classical isomorphism theorems due to Dynkin, Ray-Knight and Le Jan. We apply these results to prove the existence of mass gaps for a class of anharmonic models with suitable single-spin distribution, thus extending results of Brydges, Fröhlich and Spencer. This is a joint work with P.-F. Rodriguez.

Gaussian random permutation and the boson point process

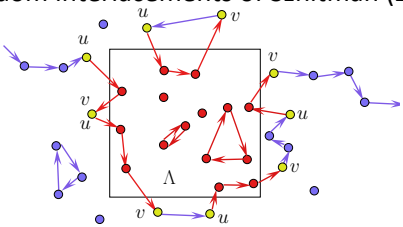
Pablo Ferrari Tue 17:00

Abstract. We construct an infinite volume spatial random permutation (χ, σ), where $\chi \subset \mathbb{R}^d$ is a point process and $\sigma : \chi \to \chi$ is a permutation (bijection), associated to the formal Hamiltonian

$$H(\chi,\sigma) = \sum_{x\in\chi} ||x - \sigma(x)||^2.$$

The measures are parametrized by the density ρ of points and the temperature α. Feynman (1953) related spatial random permutations with boson systems and proposed that Bose-Einstein condensation occurs at point density ρ_c above which infinite cycles appear in the corresponding random

permutation. For $\rho \leq \rho_c$ we define a Gaussian loop soup, a Poisson process of finite unrooted random walk loops with Gaussian increments, analogous to the Brownian loop soup of Lawler and Werner (2004). We also construct Gaussian random interlacements, a Poisson process of double-infinite trajectories of random walks with Gaussian increments analogous to the Brownian random interlacements of Sznitman (2010).



For $d \geq 3$ and $\rho > \rho_c$ we define (χ, σ) as the superposition of independent realizations of the Gaussian loop soup at density ρ_c and the Gaussian random interlacements at density $\rho - \rho_c$, called Gaussian random permutation at density ρ and temperature α. The resulting measure is Gibbs for the Hamiltonian H and the point marginal χ has the same distribution as the boson point process introduced by Macchi (1975) in the subcritical case and by Tamura-Ito (2007) in the supercritical case. Joint work with Inés Armendáriz and Sergio A. Yuhjtman.

Mixing times for exclusion processes with open boundary

Nina Gantert Mon 16:10

Abstract. We study mixing times for the exclusion process with open boundaries with homogeneous jump rates in the bulk and various boundary conditions. Based on joint work in progress with Evita Nestoridi and Dominik Schmid.

Stochastic PDE with nonlinear, conservative noise - Applications and the existence of stochastic flows

Benjamin Gess Wed 08:45

Abstract. In this talk we will revisit the problem of the generation of random dynamical systems by solutions to stochastic PDE. Despite being the starting point of a dynamical systems approach to stochastic dynamics in infinite dimensions, most known results are restricted to stochastic PDE driven by affine linear noise, which can be treated via transformation arguments. In contrast, in this talk we will address instances of stochastic PDE with nonlinear noise, with particular emphasis on porous media equations driven by conservative noise. This class of stochastic PDE will be shown to appear in a number of applications raging from fluctuating hydrodynamics, large deviations around hydrodynamic limits to geometric flows.

On disorder relevance for pinning models

Giambattista Giacomin Fri 10:25

Abstract. A natural question attacked since the 50s is the effect of disorder on phase transitions and critical phenomena. Disorder has typically a smoothing effect, possibly even to the point of completely smearing the transition. An approach, based on the renormalization group, lead in the 70s to a remarkably simple criterion, the *Harris criterion*, that predicts whether a system is insensitive to the introduction of a small amount of disorder (in the sense that in this case phase transition persists, and the critical exponents are expected to be the same). Disorder in this case is called *irrelevant* and if the Harris criterion fails the disorder is either called *marginal* or *relevant*, with no general prediction on what it may happen to the transition. I will give an overview on recent progress obtained on relevant disorder cases for random polymers and interfaces with pinning potentials. Details will be given in a special case.

Eigenvalue order statistics and mass concentration in the parabolic Anderson model

Wolfgang König Tue 09:00

Abstract. We study the non-negative solution $u = u(x,t)$ to the Cauchy problem for the parabolic equation $\partial_t u = \Delta u + \xi u$ on $\mathbb{Z}^d \times [0,\infty)$ with initial data $u(x,0) = 1_0(x)$. Here Δ is the discrete Laplacian on $\mathbb{Z}^d$ and $\xi = (\xi(z))_{z\in\mathbb{Z}^d}$ is an i.i.d. random field with doubly-exponential upper tails. We prove that, for large t and with large probability, most of the total mass $U(t) = \sum_x u(x,t)$ of the solution resides in a bounded neighborhood of a site Z_t that achieves an optimal compromise between the local Dirichlet eigenvalue of the Anderson Hamiltonian $\Delta + \xi$ and the distance to the origin. The processes $t \mapsto Z_t$ and $t \mapsto \frac{1}{t}\log U(t)$ are shown to converge in distribution under suitable scaling of space and time. Aging results for Z_t, as well as for the solution to the parabolic problem, are also established. In the proof, we prove and use the characterization of eigenvalue order statistics for $\Delta + \xi$ in large boxes and the exponential localisation of the corresponding eigenvectors. (Based on joint works with Marek Biskup (UCLA) and Renato dos Santos (NYU Shanghai).)

From Parisi to Boltzmann

Nicola Kistler Mon 09:50

Abstract. I will present a novel framework for the analysis of (mean field) disordered systems, variational in nature and abiding to the principles of classical statistical mechanics, which allows to clarify a number of enigmas posed by the Parisi theory. Time permitting, I will also discuss some of the inconsistencies of the alternative approach to spin glasses initiated by Thouless, Anderson, and Palmer. Joint with Götz Kersting, Adrien Schertzer (Frankfurt) and Marius A. Schmidt (Basel).

Scaling Limits under Wasserstein Uncertainty

Michael Kupper Tue 11:10

Abstract. TBA

A one-dimensional non-local singular SPDE

Claudio Landim Wed 10:25

Abstract. We examine the one-dimensional non-local singular SPDE

$$\partial_t u \;=\; -\,(-\Delta)^{1/2} u - :\sinh(\lambda u):\, + \xi\ ,$$

where $\lambda \in \mathbb{R}$, $(-\Delta)^{1/2}$ is the fractional Laplacian of order $1/2$ and ξ is the space-time white noise in $\mathbb{T} \times \mathbb{R}^+$.

The general homogenization limit, two scale convergence, and interpolation lemmata

Stephan Luckhaus Thu 16:10

Abstract. The concept of general homogenization limits goes back to De Giorgi and can - combined with a version of two scale convergence developed by C. Vogt, U. Hornung et al and later popularized by Damlamian & Cioranescu - be also applied to the stochastic case. The similarity and the difference of the key interpolation estimates with the derivation of free energies for Gibbs Gradient measures in Kotecky & Luckhaus will be explained. To show the versatility of the method the case of non-variational elliptic equations (thesis of M. Baldus) will be explained.

Dislocation lines in three-dimensional solids at low temperature

Franz Merkl Thu 17:00

Abstract. The talk is based on joint work with Roland Bauerschmidt, Diana Conache, Markus Heydenreich, and Silke Rolles, arXiv:1811.12812, to appear. We propose a model for three-dimensional solids on a mesoscopic scale with a statistical mechanical description of dislocation lines in thermal equilibrium. The model has a linearized rotational symmetry, which is broken by boundary conditions. We show that this symmetry is spontaneously broken in the thermodynamic limit at small positive temperatures.

On the speed of a front for stochastic reaction-diffusion equations

Leonid Mytnik Thu 09:50

Abstract. We study the asymptotic speed of a random front for solutions to stochastic reaction-diffusion equations with strong multiplicative noise proportional to σ. We show existence of the speed of the front and derive its asymptotics as σ goes to infinity. This is a joint work with C. Mueller and L. Ryzhik.

Process valued complexity measures of algorithms

Ralph Neininger Tue 09:50

Abstract. In this talk complexity measures of algorithms and data structures are considered which are linked to stochastic processes. Randomness comes either from the algorithm itself or from a stochastic model for the algorithm's input. The focus is on asymptotic properties of these complexities. The complexities reviewed include the cost of partial match queries

in random point quadtrees, of quantile selection in data with a version of the FIND/Quickselect algorithm, and of radix selection with strings generated by Markov sources. The methods to derive process convergences are based on probability metrics. Properties of the respective limit processes are also discussed.

Kinetic and hydrodynamic limits for a chain of harmonic oscillators with a point Langevin heat bath

Stefano Olla Fri 11:40

Abstract. We consider an infinite chain of coupled harmonic oscillators with a Langevin thermostat attached at the origin and energy, momentum and volume conserving noise that models the collisions between atoms. The noise is rarefied in the limit so that in the macroscopic unit time only a finite number of collisions takes place. We prove that after the hyperbolic space-time rescaling the Wigner distribution, describing the energy density of phonons in space-frequency domain, converges to a positive energy density function $W(t, y, k)$ that evolves according to the linear kinetic equation, with the interface condition at $y = 0$ that corresponds to reflection, transmission and absorption of phonons.
Under a further superdiffusive rescaling we prove that the macroscopic evolution of the thermal energy is giverned by a fractional heat equation with a special boundary condition at the position of the heat bath. The results have been obtained in collaboration with T. Komorowski (Polish Academy of Sciences), L. Ryzhik (Stanford Univ.) and H. Spohn (TU München).

Exponential decay for the exit probability from slabs of random walk in random environment

Alejandro Ramírez Thu 14:00

Abstract. It is believed that in dimensions $d \geq 2$ any random walk in an i.i.d. uniformly elliptic random environment (RWRE) on $\mathbb{Z}^d$ which is directionally transient is ballistic. In 2001 and 2002 Sznitman introduced the ballisticity conditions (T) and (T'), as a way to quantify the gap which would be needed to prove affirmatively this question. The first one is the requirement that certain unlikely quenched exit probabilities from a set of slabs decay exponentially fast with their width L. The second one is the requirement that for all $\gamma \in (0,1)$ the decay is like $\exp(-CL_\gamma)$ for some $C > 0$. In this talk we present a proof of a conjecture of Sznitman of 2002, stating that (T) and (T') are equivalent. This is a joint work with Enrique Guerra.

Recent results on vertex-reinforced jump processes

Silke Rolles Mon 14:00

Abstract. Vertex-reinforced jump processes are stochastic processes in continuous time that prefer to jump to sites that have accumlated a large local time. Sabot and Tarres showed interesting connections between vertex-reinforced jump processes and a supersymmetric hyperbolic nonlinear sigma model introduced by Zirnbauer in a completely different context.
In the talk, I will present an extension of Zirnbauer's model and show how it arises naturally as a weak joint limit of a time-changed version of the vertex-reinforced jump process. It describes the asymptotics of rescaled crossing numbers, rescaled fluctuations of local times, asymptotic local times on a logarithmic scale, endpoints of paths, and last exit trees. Furthermore, I will present a construction of random interlacements for transient vertex-reinforced jump processes on a general graph. The talk is based on joint work with Franz Merkl and Pierre Tárres.

On microscopic derivation of a mean-curvature flow

Sunder Sethuraman Fri 09:35

Abstract. We discuss a derivation of a continuum mean-curvature flow as a scaling limit of a class of particle systems, more robust than previous methods. We consider zero-range + Glauber interacting particle systems, where the zero-range part moves particles while preserving particle numbers, and the Glauber part allows creation and annihilation of particles. When the two parts are simultaneously seen in certain (different) time-scales, and the Glauber part is 'bi-stable', a mean-curvature flow can be captured directly as a limit of the mass empirical density.

Such a 'direct' limit might be compared with a 'two-stage' approach: When the zero-range part is diffusively scaled but the Glauber part is not scaled, the hydrodynamic limit is a non-linear Allen-Cahn reaction-diffusion PDE. It is well-known in such PDEs, when the 'bi-stable' reaction term is now scaled, that the limit of the solutions takes on stable values across an interface moving by a mean-curvature flow. This is joint work-in-progress with Perla El Kettani, Tadahisa Funaki, Danielle Hilhorst, and Hyunjoon Park.

Domains of (state-dependent) fractional Laplacians and function spaces

René Schilling Mon 14:50

Abstract. We characterize the domain of Lévy-type processes, e.g. stable Lévy processes, stable-like Lévy processes and more general processes, using function spaces of Hölder and Hölder-Zygmund type.

The polaron at strong coupling

Robert Seiringer Tue 16:10

Abstract. We review old and new results on the Fröhlich polaron model. The discussion includes the validity of the (classical) Pekar approximation in the strong coupling limit, quantum corrections to this limit, as well as the divergence of the effective polaron mass.

The Polaron measure: its existence and properties

S. R. S. Varadhan Wed 11:40

Abstract. The Polaron measure $\mathbb{Q}_{\alpha,T}$ on a finite interval with respect to the three dimensional Brownian increments measure $\mathbb{P}$ on $[-T,T]$ is given by a tilted measure

$$\mathsf{d}\mathbb{Q}_{\alpha,T} = \frac{1}{Z(\alpha,T)} \exp\left[\alpha \int\int_{-T\le s<t\le T} \frac{\mathsf{e}^{-|t-s|}}{|x(t)-x(s)|}\mathsf{d}t\mathsf{d}s\right]\mathsf{d}\mathbb{P}.$$

Objects of interest are

- Behavior of the ground state in the strong coupling limit:

$$F(\alpha) = \lim_{T\to\infty} \frac{1}{2T} \log Z(\alpha,T) \qquad \text{and} \qquad \lim_{\alpha\to\infty} \frac{F(\alpha)}{\alpha^2}.$$

- Existence of the actual polaron measure $\lim_{T\to\infty} \mathbb{Q}_{\alpha,T} =: \mathbb{Q}_\alpha$ and its strong-coupling limit $\lim_{\alpha\to\infty} \mathbb{Q}_\alpha$ under proper scaling.

- Validity of the central limit theorem

$$\mathbb{Q}_{\alpha,T}\left[\frac{x(T)-x(-T)}{\sqrt{2T}}\right]^{-1} \text{ with variance } \sigma^2(\alpha) = \lim_{T\to\infty} \frac{\mathbb{E}^{\mathbb{Q}_{\alpha,T}}[|x(T)-x(-T)|^2]}{2T}.$$

The final question is the behavior of $\sigma^2(\alpha)$ for large α. Joint works with Chiranjib Mukherjee (Münster).

Interfaces in planar Ising and Potts models: a review

Yvan Velenik Mon 11:10

Abstract. I will provide a review of rigorous results about statistical and geometrical properties of the interface between two equilibrium phases in the planar Ising and Potts models. Among the topics to be discussed:

- exact results on the profile of expected magnetization in the 2d Ising model;
- microscopic structure of the interface in Ising and Potts models;
- invariance principle for Ising and Potts interfaces and regularity properties of the equilibrium crystal shapes;
- pinning and wetting of Ising and Potts interfaces by a row of modified coupling constants;
- effect of an external magnetic field on the interface: critical prewetting in the Ising model.

The results I will present have been obtained over several decades (from the 1970s to the present day), with contributions by many people. Techniques used in the earliest works range from exact computations, relying on the integrability of the planar Ising model, to various perturbative approaches. Most of the more recent works rely on the non-perturbative Ornstein-Zernike theory, that allows to construct a coupling between the interface and a suitable directed random walk (usually in an external potential), combined with an analysis of the latter process.

Participants

Alsmeyer, Gerold (Münster)
Andreis, Luisa (Berlin)
Asselah, Mohamed-Amine (Paris)
Assing, Sigurd (Warwick)
Aurzada, Frank (Darmstadt)
Balázs, Márton (Bristol)
Bazaes, Rodrigo (Santiago)
Bechtold, Florian (Paris)
Berestycki, Nathanaël (Vienna)
Betz, Volker (Darmstadt)
Bock, Wolfgang (Kaiserslautern)
Bolthausen, Erwin (Zurich)
Bröker, Yannic (Münster)
Brückerhoff-Plückelmann, Martin (Münster)
Busani, Ofer (Bristol)
Butkovsky, Oleg (Berlin)
Chatterjee, Sourav (Stanford)
Comets, Francis (Paris)
Cosco, Clement (Paris)
Cygan, Wojciech (Dresden)
Dahmani, Zoubir (Mostaganem)
Debbi, Latifa (Algiers)
Dereich, Steffen (Münster)
Deuschel, Jean-Dominique (Berlin)
Ehlert, Johannes (Darmstadt)
Eick, Christopher (Münster)
Fels, Maximilian (Bonn)
Ferrari, Pablo A. (Buenos Aires)
Gantert, Nina (Munich)
Gerencsér, Máté (Klosterneuburg)
Gess, Benjamin (Bielefeld/Leipzig)
Giacomin, Giambattista (Paris)
Godland, Philipp (Münster)
Holbach, Simon (Bielefeld)
Huesmann, Martin (Münster)
Kabluchko, Zakhar (Münster)
Kassing, Sebastian (Münster)
Kistler, Nicola (Frankfurt)
König, Wolfgang (Berlin)
Kowsky, Felix (Münster)
Kupper, Michael (Konstanz)
Landim, Claudio (Rio de Janeiro)
Lammers, Isabel (Münster)
Ling, Chengcheng (Bielefeld)
Liu, Jingjia (Münster)
Löwe, Matthias (Münster)
Luckhaus, Stephan (Leipzig)
Maiwald, Martin (Münster)
Marchesani, Stefano (L'Aquila)
Merkl, Franz (Munich)
Mukherjee, Chiranjib (Münster)
Mytnik, Leonid (Haifa)
Neininger, Ralph (Frankfurt)
Nejjar, Peter (Klosterneuburg)
Ohlberger, Mario (Münster)
Okamura, Kazuki (Shinshu)
Olla, Stefano (Paris)
Orenshtein, Tal (Berlin)
Owis, Ashraf (Cairo)
Paulsen, Volkert (Münster)
Prochno, Joscha (Graz)
Ramírez, Alejandro (Santiago)
Recke, Konstantin (Münster)
Rehmeier, Marco (Bielefeld)
Rolles, Silke (Munich)
Röttger, Frank (Magdeburg)
Sau, Federico (Delft)
Schenke, Andre (Bielefeld)
Schilling, René (Dresden)
Schroer, Alexander (Münster)
Schweiger, Florian (Bonn)
Seidel, Hauke (Münster)
Seiringer, Robert (Vienna)
Sethuraman, Sunder (Tucson)
Stevens, Angela (Münster)
Stottmeister, Alexander (Münster)
Sun, Wen (Berlin)
Terveer, Sara Karina (Münster)
Thürigen, Johannes (Münster)
Tkachov, Pavlo (L'Aquila)
Upgang, Sven (Münster)
Varadhan, S. R. S. (New York)
Velenik, Yvan (Geneva)
Weidner, Marvin (Bielefeld)
Wulkenhaar, Raimar (Münster)
Zou, Christina (Oxford)