WWU MÜNSTER

Stochastic analysis and applications
Open Japanese-German conference

September 19 – 23, 2022
Münster

Organizers

Martin Huesmann
André Schlichting

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MM Mathematics Münster
Cluster of Excellence

General information

Venue. The conference talks take place in lecture hall M2 on the ground floor of the lecture hall building located at **Einsteinstr. 64, 48149 Münster**. *Registration* takes place in the lecture hall building right in front of lecture hall M2. *Coffee breaks* and *poster sessions* take place in the lounge of the seminar building SRZ (second floor). The seminar building SRZ is located at Orléans-Ring 12 on the mathematics campus.
You can find the latest 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.

Coffee break/Lunch. We provide 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 (closed on Tuesday)
- La Gondola D’oro (Italian), Hüfferstraße 34
- Gustav Grün (Green Fast Food), Wilhelmstraße 1
- Áro (Green Fast Food), Neutor 3

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

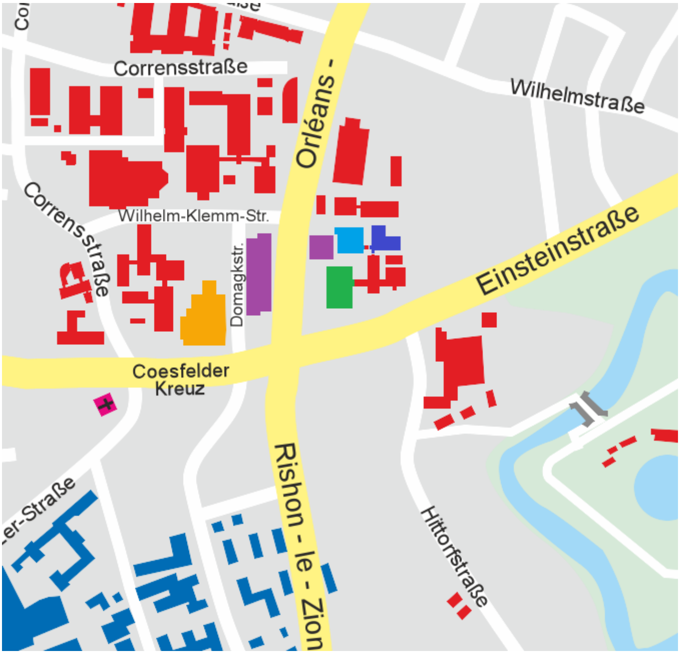

Figure A: Lecture building, canteen, SRZ, MM building, parking lot.

Acknowledgements

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

Schedule

	Mo	Tue	Wed	Thu	Fri
9.00-9.30	Registration	Inahama	Sturm	Nakashima	Fukuizumi
9.30-10.00	Kumagai	Habermann	Deuschel	Beiglböck	Sasamoto
10.00-10.30	**Coffee**	**Coffee**	**Coffee**	**Coffee**	**Coffee**
10.30-11.00	Weber	Renesse	Honda	Fattler	Kajino
11.00-11.30	Kusuoka	Shiraishi	Erbar	Röckner	Berestycki
11.30-12.00	Hiroshima	Fukushima	Kuwae	Prömel	Gantert
12.00-14.00	**Lunch**	**Lunch**	**Lunch**	**Lunch**	**Lunch**
14.00-14.30	Eberle	Neamtu	Excursion	Kopfer	
14.30-15.00	Ishiwata	Aida		Osada	
15.00-15.30	Butkovsky	Friz		Li	
15.30-16.00	**Coffee**	**Coffee**		**Coffee**	
16.00-16.30	Hoshino	Xie		Hartung	
16.30-17.00	Pitch Talks	Hinz		Fehrman	
17.00-17.30	Pitch Talks				

Posters.

There are posters by young scientists on display during the reception and coffee breaks. Those are accompanied by pitch talks in the Monday afternoon session.

Reception.

There is a reception on Monday evening starting at 5.30 p.m. with Reibekuchen (potato pancakes) and some drinks.

Conference dinner.

The conference dinner takes place on Wednesday at 6.00 p.m. at the Restaurant A2 am Aasee (Annette-Alle 3, 48149 Münster)

Book of abstracts

An approach to asymptotic error distributions of rough differential equations

Shigeki Aida Tue 14:30

Abstract. We study asymptotic error distributions of rough differential equations driven by the fractional Brownian motion whose Hurst parameter H satisfies $\frac{1}{3} < H < \frac{1}{2}$ for several approximation schemes. To this end, we introduce an interpolation process between the solution and the approximate solution. Also we study limit theorems of weighted sum processes of Wiener chaos of order 2. Our proof is based on the fourth moment theorem for Wiener chaos of finite order, estimates of multidimensional Young integrals and integration by parts formula in the Malliavin calculus.

This is a joint work with Nobuaki Naganuma.

The Structure of Martingale Benamou-Brenier in Multiple Dimensions

Mathias Beiglböck Thu 9:30

Abstract. In classical optimal transport, the contributions of Benamou–Brenier and McCann regarding the time-dependent version of the problem are cornerstones of the field and form the basis for a variety of applications in other mathematical areas.

Stretched Brownian motion provides an analogue for the martingale version of this problem. In this article we provide a characterization in terms of gradients of convex functions, related to the characterization of optimizers in the classic transport problem for quadratic distance cost.

Weyl law in Liouville quantum gravity

Nathanael Berestycki Fri 11:00

Abstract. Can you hear the shape of LQG? We obtain a Weyl law for the eigenvalues of Liouville Brownian motion: the n-th eigenvalue grows like n times the Liouville area of the domain (times a certain deterministic constant depending on $\gamma \in (0, 2)$). At the heart of the proof we obtain estimates of independent interest on the small-time behaviour of the on-diagonal heat kernel. Interestingly, we show that the scaled heat kernel displays non-trivial pointwise fluctuations, which however vanish when integrating over a domain.

This is joint work in preparation with Mo-Dick Wong (Durham).

Regularization by noise for SDEs and SPDEs beyond the Brownian case

Oleg Butkovsky Mon 15:00

Abstract. It is well-known that an SDE

$$dX_t = b(X_t)dt + dW_t$$

might have a unique solution even if the corresponding noiseless ODE

$$dX_t = b(X_t)dt$$

has no or infinitely many solutions. This is called regularization-by-noise. While this phenomenon is quite well understood in the case of Brownian forcing, much less is known if the forcing is non-Markovian (for example, fractional Brownian) or infinite-dimensional. This happens not because regularization-by-noise is specific to the Brownian case, but rather because there are (almost) no appropriate tools to study this problem in other setups. We

will talk about a new technique, stochastic sewing, and its latest modifications, which is surprisingly effective in tackling this problem in the non-Brownian setting.

An isomorphism theorem for anharmonic fields and scaling limits

Jean-Dominique Deuschel Wed 9:30

Abstract. We introduce a natural measure on bi-infinite random walk trajectories evolving in a time-dependent environment driven by the Langevin dynamics associated to a gradient Gibbs measure with convex potential. We derive an identity relating the occupation times of the Poissonian cloud induced by this measure to the square of the corresponding gradient field, which generically is not Gaussian. In the quadratic case, we recover a well-known generalization of the second Ray-Knight theorem. We further determine the scaling limits of the various objects involved in dimension 3, which are seen to exhibit homogenization. In particular, we prove that the renormalized square of the gradient field converges under appropriate rescaling to the Wick-ordered square of a Gaussian free field on R3 with suitable diffusion matrix, thus extending a celebrated result of Naddaf and Spencer regarding the scaling limit of the field itself.

Joint work with Pierre-Francois Rodriguez, Imperial College London

Coupling approaches for Langevin dynamics and nonlinear stochastic differential equations

Andreas Eberle Mon 14:00

Abstract. Couplings are one of the main techniques to quantify the convergence to equilibrium of Markov processes. In this talk, we discuss couplings for (second order) Langevin dynamics and nonlinear stochastic differential equations in the sense of McKean, as well as for the corresponding mean field particle systems. In all these cases, the adequate coupling process has a sticky behaviour on a lower dimensional subspace of the state space. For nonlinear SDE, the coupling distance process is bounded from above by a one-dimensional nonlinear diffusion with a sticky boundary at zero. The phase transition of this dominating process can be studied explicitly.

Covariance-modulated optimal transport and gradient flows

Matthias Erbar Wed 11:00

Abstract: We study a variant of the dynamical optimal transport problem in which the energy to be minimised is modulated by the covariance matrix of the current distribution. Such transport metrics arise naturally in mean field limits of recent particle filtering methods for inverse problems. We show that the transport problem splits into two separate minimisation problems: one for the evolution of mean and covariance of the interpolating curve and one its shape. The latter consists in minimising the usual Wasserstein length under the constraint of maintaining fixed mean and covariance along the interpolation. We analyse the geometry induced by this modulated transport distance on the space of probabilities as well as the dynamics of the associated gradient flows. Those show better convergence properties in comparison to the classical Wasserstein metric in terms of exponential convergence

rates independent of the Gaussian target. Also on the level of the gradient flows a similar splitting into the evolution of moments and shapes of the distribution can be observed.

This is joint work with Martin Burger, Franca Hoffmann, Daniel Matthes and André Schlichting

Ultrametric random walks via Dirichlet forms and an application to conformational dynamics of proteins

Torben Fattler Thu 10:30

Abstract. In this talk we construct ultrametric random walks constrained by hierarchical energy landscapes using Dirichlet form techniques. Such stochastic processes having as state space e.g. the p-adic numbers can be considered as models for the transition of conformational states of a protein. The conformational dynamics of a protein has impact on the protein's function.

Stochastic homogenization with space-time ergodic divergence-free drift

Benjamin Fehrman Thu 16:30

Abstract. We prove that diffusion equations with a space-time stationary and ergodic, divergence-free drift homogenize in law to a deterministic stochastic partial differential equation with Stratonovich transport noise. In the absence of spatial ergodicity, the drift is only partially absorbed into the skew-symmetric part of the flux through the use of an appropriately defined

stream matrix. This leaves a time-dependent, spatially-homogenous transport which, for mildly decorrelating fields, converges to a Brownian noise with deterministic covariance in the homogenization limit. The results apply to uniformly elliptic, stationary and ergodic environments in which the drift admits a suitably defined stationary and square-integrable stream matrix.

Itô and Lyons in tandem

Peter Friz Tue 15:00

Abstract. We establish a simultaneous generalization of Itô's stochastic- and Lyons' rough differential equations. This enables us to extend and revisit numerous previous works in stochastic analysis, amongst other relating to conditioning, filtering, pathwise control, fractional noise, McKean-Vlasov equations, common noise and stochastic partial differential equations.

A stochastic effect in the quantum synchronization

Reika Fukuizumi Fri 9:00

Abstract. The Schrödinger-Lohe model consists of wave functions interacting with each other, according to a system of Schrödinger equations with a specific coupling such that all wave functions evolve on the L^2 unit ball. This model has been extensively studied over the last decade and it was shown that under suitable assumptions on the initial state, if one waits long enough all the wave functions become arbitrarily close to each other, which we call a synchronization. In this talk, we consider a stochastic perturbation

of the Schrödinger-Lohe model and present a weak version of synchronization for this perturbed model. This is a joint work with Leo Hahn (Université Clermont Auvergne)

Number of paths in oriented percolation as zero temperature limit of directed polymer

Ryoki Fukushima Tue 11:30

Abstract. We prove that the free energy of directed polymer in Bernoulli environment converges to the growth rate for the number of open paths in super-critical oriented percolation as the temperature tends to zero. Our proof is based on rate of convergence results which hold uniformly in the temperature. We also prove that the convergence rate is locally uniform in the percolation parameter inside the super-critical phase, which implies that the growth rate depends continuously on the percolation parameter.

Mixing times for exclusion processes with open boundary

Nina Gantert Fri 11:30

Abstract. We present some recent results about (sequences of) exclusion processes with open boundaries on finite graphs, about their mixing times and about the cutoff phenomenon. In particular, we study mixing times of the symmetric and asymmetric simple exclusion process on the segment where particles are allowed to enter and exit at the endpoints. We consider different regimes depending on the entering and exiting rates as well as on the rates in the bulk, and show that the process exhibits pre-cutoff and in some cases cutoff.

Based on joint work with Evita Nestoridi and Dominik Schmid

Intrinsic sub-Laplacian for hypersurface in a contact sub-Riemannian manifold

Karen Habermann Tue 9:30

Abstract. We construct and study the intrinsic sub-Laplacian, defined outside the set of characteristic points, for a smooth hypersurface embedded in a contact sub-Riemannian manifold. We prove that, away from characteristic points, the intrinsic sub-Laplacian arises as the limit of Laplace-Beltrami operators built by means of Riemannian approximations to the sub-Riemannian structure using the Reeb vector field. We carefully analyse three families of model cases for this setting obtained by considering canonical hypersurfaces embedded in model spaces for contact sub-Riemannian manifolds. In these model cases, we show that the intrinsic sub-Laplacian is stochastically complete and in particular, that the stochastic process induced by the intrinsic sub-Laplacian almost surely does not hit characteristic points.

The speed of invasion in an advancing population

Lisa Hartung Thu 16:00

Abstract. We derive rigorous estimates on the speed of invasion of an advantageous trait in a spatially advancing population in the context of a system of one-dimensional coupled F-KPP equations. The model was introduced and studied heuristically and numerically in a paper by Venegas-Ortiz et al. In that paper, it was noted that the speed of invasion by the mutant

trait is faster faster when the resident population ist expanding in space compared to the speed when the resident population is already present everywhere. We use probabilistic methods, in particular the Feynman-Kac representation, to provide rigorous estimates that confirm these predictions. Based on joint work in progress with A. Bovier.

Removable sets and L^p-uniqueness on manifolds and metric measure spaces

Michael Hinz Tue 16:30

Abstract. We study symmetric diffusion operators on metric measure spaces. Our main question is whether essential self-adjointness or L^p-uniqueness are preserved under the removal of a small closed set from the space. We provide characterizations of the critical size of removed sets in terms of capacities and Hausdorff dimension without any further assumption on removed sets. As a key tool we prove a non-linear truncation result for potentials of nonnegative functions. Our results are robust enough to be applied to Laplace operators on general Riemannian manifolds as well as sub-Riemannian manifolds and metric measure spaces satisfying curvature dimension conditions. For non-collapsing Ricci limit spaces with two-sided Ricci curvature bounds we observe that the self-adjoint Laplacian is already fully determined by the classical Laplacian on the regular part. The results are joint with Jun Masamune and Kohei Suzuki.

Renormalization and localization by path measures

Fumio Hiroshima Mon 11:30

Abstract. We provide the tools to study spectral analysis of quantum field theory. We give definitions of Fock space $F = L^2(Q)$ in the Schroedinger representation, second quantization $d\Gamma$, Gaussian random variable $\phi(f)$ indexed by f, etc. Define the so-called Nelson Hamiltonian with UV cutoff H_Λ as a self-adjoint operator in the tensor product $L^2(R^3)\otimes F$, which describes a linear interaction between a scalar quantum field and a Schroedinger particle, and is of the form

$$H_\Lambda = \left(-\frac{1}{2}\Delta_x + V(x)\right) \otimes 1 + 1 \otimes d\Gamma(|k|) + \phi_\Lambda(x).$$

Here $\phi_\Lambda(x)$ is a field operator with UV cutoff $\Lambda > 0$. The bottom of the spectrum of H_Λ, e_g, is called the ground state energy, and φ_g such that

$$H_\Lambda \varphi_g = e_g \varphi_g$$

is called the ground state if it exists. We show (1)-(3) below: (1) We define the renormalized Nelson Hamiltonian H_∞ by $H_\Lambda - E_\Lambda$ as $\Lambda \to \infty$ with some renormalization term E_Λ. (2) Existence and absence of the ground state of H_∞. (3) Localization of the ground state of H_∞. These results are derived from applications of the functional integral representation of e^{-TH} and the infinite volume Gibbs measure associated with H_∞.

References

(1) E. Nelson, JMP. 5 (1964), 1990-1997.
(2) M. Gubinelli, FH and J. Lorinczi, JFA. 267 (2014), 3125-3153.
(3) FH, Adv. in Math. 259 (2014), 784-840.
(4) FH and O.Matte, RMP. (2021), 84 pages, online.
(5) FH and O.Matte, Point-wise spatial decay of eigenvectors in the Nelson model, preprint in 2022.

Weakly non-collapsed RCD spaces are strongly non-collapsed

Shouhei Honda Wed 10:30

Abstract. In this talk we solve a conjecture raised by De Philippis-Gigli which states that a metric measure space with Ricci curvature bounded below (so-called RCD space) is weakly noncollapsed if and only if it is strongly noncollpased up to multiplying a positive constant to the reference measure.

This is based on a joint work with Camillo Brena (SNS), Nicola Gigli (SISSA) and Xingyu Zhu (Georgia Tech).

Stochastic quantization associated with the exp$(\alpha\phi)_2$-quantum field model

Masato Hoshino Mon 16:00

Abstract. We consider the stochastic quantization equation of the quantum field model called exp$(\alpha\phi)$-model or Høegh-Krohn's model on the two-dimensional torus. Making use of key properties of Gaussian multiplicative chaos, we construct a unique time-global solution to the equation in the full L^1-regime $\alpha^2 < 8\pi$ of the charge parameter α. We also identify the solution with an infinite-dimensional diffusion process constructed by the Dirichlet form approach.

This talk is based on a joint work with Hiroshi Kawabi (Keio University) and Seiichiro Kusuoka (Kyoto University).

Large deviations for small noise hypoelliptic diffusion bridges on sub-Riemannian manifolds

Yuzuru Inahama Tue 9:00

Abstract. In this talk we discuss a large deviation principle of Freidlin-Wentzell type for pinned hypoelliptic diffusion measures associated with a natural sub-Laplacian on a compact sub-Riemannian manifold. To prove this large deviation principle, we use rough path theory, quasi-sure analysis and manifold-valued Malliavin calculus.

Poincare constant on manifolds with ends

Satoshi Ishiwata Mon 14:30

Abstract. In geometric analysis, the Poincare inequality, which gives the lower bound of the spectral gap on balls, plays an important role. However, on a manifolds with ends, such as R^3 # R^3, the Poicare inequality does not hold. In this talk, we discuss an optimal estimate of the spectral gap on central balls on manifolds with ends. This talk is besed on a joint work with Alexander Grigor'yan and Laurent Saloff-Coste.

Quasisymmetric Gaussian uniformization is impossible for Brownian motion on the Sierpiński carpet

Naotaka Kajino Fri 10:30

Abstract. It is an established result in the field of analysis of diffusion processes on fractals, that the transition density of the diffusion typically satisfies analogs of Gaussian bounds which involve a space-time scaling exponent β greater than two and thereby are called SUB-Gaussian bounds. The exponent β, called the walk dimension of the diffusion, could be considered as representing "how close the geometry of the fractal is to being smooth".

It has been observed by Kigami in [Math. Ann. **340** (2008), 781–804] that, in the case of the standard two-dimensional Sierpiński gasket, one can decrease this exponent to two (so that Gaussian bounds hold) by suitable changes of the metric and the measure while keeping the associated Dirichlet form (the quadratic energy functional) the same. Then it is natural to ask how general this phenomenon is for diffusions on fractals.

In fact, it turns out that the above phenomenon, that one can decrease the exponent β to two so that Gaussian bounds hold, seems to happen only for a very limited class of self-similar fractals. This talk is aimed at presenting the result that this phenomenon indeed does NOT happen for the Brownian motion on the standard (two-dimensional) Sierpiński carpet, as well as for the Brownian motion on the standard three- and higher-dimensional Sierpiński gaskets.

This talk is based on joint works with Mathav Murugan (UBC).
The result for the standard Sierpiński carpet is in progress, and that for the standard higher-dimensional Sierpiński gaskets is given in arXiv:2008.12836 (to appear in Inventiones mathematicae).

Random Riemannian geometry

Eva Kopfer Thu 14:00

Abstract. We study random perturbations of Riemannian manifolds (M, g) by means of so-called Fractional Gaussian Fields, which are defined intrinsically by the given manifold. The fields $h\colon \omega \mapsto h^\omega$ will act on the manifolds via conformal transformation $g \mapsto g^\omega. = e^{2h^\omega} g$.

Spectral dimension of simple random walk on a long-range percolation cluster

Takashi Kumagai Mon 9:30

Abstract. Consider the long-range percolation model on the integer lattice Z^d in which all nearest-neighbour edges are present and otherwise x and y are connected with probability $q_{x,y} := 1 -$ exp$(-|x-y|^{-s})$, independently of the state of other edges. Throughout the regime where the model yields a locally-finite graph (i.e. for $s > d$), we determine the spectral dimension of the associated simple random walk, apart from at the exceptional value $d = 1, s = 2$, where the spectral dimension is discontinuous. Towards this end, we present various on-diagonal heat kernel bounds, a number of which are new. In particular, the lower bounds are derived through the application of a general technique that utilizes the translation invariance of the model. We highlight that, applying this general technique, we are able to partially extend our main result beyond the nearest-neighbor setting, and establish lower heat kernel bounds over the range of parameters $s \in (d, 2d)$.

Our approach is applicable to short-range models as well.

Construction of a non-Gaussian and rotation invariant Φ^4-measure and associated flow on $\mathbb{R}^3$ through stochastic quantization

Seiichiro Kusuoka Mon 11:00

Abstract. We construct the Φ^4-measure on $\mathbb{R}^3$ of the quantum field theory by stochastic quantization. For this we apply approximation by the stationary solutions of equations with regularization and localization of the interaction. We remark that our approximation is not by a scaled torus. As an advantage of our approximation, we are able to show the rotation invariance of the Φ^4-measure. This talk is based on a joint work with Sergio Albeverio.

Equivalence of the strong Feller properties of analytic semigroups and associated resolvents

Kazuhiro Kuwae Wed 11:30

Abstract. In this talk, we give sufficient conditions for the equivalence between semigroup strong Feller property and resolvent strong Feller property.

Joint work with Kouhei Matsuura and Seiichiro Kusuoka.

Non-Markovian stochastic dynamics

Xue-Mei Li Thu 15:00

A remark of the free energy for disordered pinning model and directed polymers in random environment

Makoto Nakashima Thu 9:00

Abstract. In this talk, we focus on disordered pinning models and directed polymers in random environment(DPRE). It is known that disordered pinning models have the scaling limits in an intermediate regime when the distribution of the underlying renewal process has a polynomial tail with exponent $\alpha \in (1/2, 1)$. The same phenomena happens for $1+1$ dimensional directed polymers in random environment. Furthermore, it has been proved that under a certain technical condition, their free energies have a universal asymptotic behavior in the weak coupling regime which is explicitly given in terms of the scaling limits. Recently, the same asymptotic behavior is obtained without the technical condition.

A semigroup approach for quasilinear SPDE

Alexandra Neamtu Tue 14:00

Abstract. We investigate quasilinear parabolic evolution equations driven by γ-Hölder rough paths, where $\gamma \in (1/3, 1/2]$. We construct mild solutions for such equations exploring functional analysis techniques and the controlled rough path approach. We apply our results to the stochastic Landau-Lifshitz-Gilbert and Shigesada-Kawasaki-Teramoto equation. Moreover we obtain a random dynamical system associated to the Landau-Lifshitz-Gilbert equation.

Joint work with Antoine Hocquet.

The sub-diffusivity and diffusivity of tagged particles for interacting Brownian particles

Hirofumi Osada Thu 14:30

Abstract. We introduce two concepts for translation invariant random point fields: "Inverse reduced Palm measure" and "Decomposability of random point fields." If the reversible random point field has the inverse reduced Palm measure, the tagged particles are diffusive. If the reversible random point field is decomposable, the tagged particles are sub-diffusive. Using the last result, we prove that the tagged particles of the Ginibre interacting Brownian motion and the diffusion process related to the planner Gaussian analytic function are sub-diffusive.

On the existence and uniqueness of stochastic Volterra equations with non-Lipschitz coefficients

David Prömel Thu 11:30

Abstract. The study of stochastic Volterra equations with non-Lipschitz continuous coefficients has recently attracted quite some attention motivated by their successful applications as well-suited volatility models in mathematical finance. While stochastic Volterra equations with Lipschitz continuous coefficients are well-studied integral equations, in the case of less regular coefficients many fundamental questions are still open. In this talk we discuss the existence of strong and weak solutions as well as pathwise uniqueness of stochastic Volterra equations with time-inhomogeneous non-Lipschitz continuous coefficients. The talk is based on joint work with David Scheffels.

Markov property of weak solutions to McKean-Vlasov SDEs

Michael Röckner Thu 11:00

Abstract: In this talk we shall present a general method to show that the laws of the weak solution to a McKean-Vlasov SDE form a (nonlinear) Markov process. Examples include McKean-Vlasov SDEs whose associated nonlinear Fokker-Planck equations is a porous media equation perturbed by the divergence of a vector field depending nonlinearly on the solution, where both the diffusivity function and the vector field are allowed to depend explicitly on the spatial variable.
Joint work with: 1. Panpan Ren and Feng-Yu Wang, and 2. Vlorel Barbu.

References

Ren, Panpan; Röckner, Michael; Wang, Feng-Yu Linearization of nonlinear Fokker-Planck equations and applications. J. Differential Equations 322 (2022), 1–37.

Barbu, Viorel, Röckner, Michael Uniqueness for nonlinear Fokker-Planck equations and for McKean-Vlasov SDEs: The degenerate case, arXiv:2203.00122

KPZ equation in half-space

Tomohiro Sasamoto Fri 9:30

Abstract. For the last few decades, many impressive results have been achieved for models in the Kardar-Parisi-Zhang (KPZ) universality class, including the KPZ equation itself, in one dimension. The current standard approach to study them exactly is to combine Markov duality and Bethe ansatz, and find a Fredholm determinant. However, studies of half-space models have been very much limited.

Recently we discovered a direct connection between solvable models in the KPZ class and free fermionic models at positive temperature (or determinant point processes). The key ingredient in our theory is a new identity between marginals of the q-Whittaker measure and the periodic Schur measure, which is proved in bijective fashion by substantially generalizing the RSK algorithm. Once the connection is established, subsequent analysis becomes rather standard and it allows to study various half-space models by putting symmetry to the bijection.

In this talk we present a Fredholm Pfaffian formula for KPZ models in half-space for a much wider class of boundary conditions than before and prove their limit theorems.

The talk is based on collaborations with Takashi Imamura and Matteo Mucciconi[1].

[1] T. Imamura, M. Mucciconi, T. Sasamoto, Solvable models in the KPZ class: approach through periodic and free boundary Schur measure, arXiv: 2204.0842.

Exceptional sets for simple random walk paths

Daisuke Shiraishi Tue 11:00

Abstract. I will discuss several exceptional sets for simple random walk (SRW) paths: cut points, loop-erased random walk and outer boundary of 2D SRW. I will show that the renormalized counting measure for these sets converges as the lattice spacing goes to zero.

This is joint work with Yifan Gao, Xinyi Li and Petr Panov.

Distribution-valued Ricci Bounds

Theo Sturm Wed 9:00

Abstract. We will study regularity issues for Dirichlet forms beyond the scope of uniform lower Ricci bounds. In particular, we introduce distribution-valued lower Ricci bounds $BE_1(\kappa, \infty)$.

- for which we prove the equivalence with sharp gradient estimates,
- the class of which will be preserved under time changes with arbitrary $\psi \in \mathsf{Lip}_b(X)$, and
- which are satisfied for the Neumann Laplacian on arbitrary semi-convex subsets $Y \subset X$.

In the latter case, the distribution-valued Ricci bound will be given by the signed measure $\kappa = km_Y + l\sigma_{\partial Y}$ where k denotes a variable synthetic lower bound for the Ricci curvature of X and l denotes a lower bound for the "curvature of the boundary" of Y, defined in purely metric terms.

Spectral gap estimates for Brownian motion with sticky boundary diffusion

Max von Renesse Tue 10:30

Abstract. Introducing an interpolation method we estimate the spectral gap for Brownian motion on general domains with sticky-reflecting boundary diffusion associated to the first non trivial eigenvalue for theLaplace operator with corresponding Wentzell-type boundary condition. In the manifold case our proof sinvolve novel applications of the celebrated Reilly formula.

Convergence of the Ising-Kac model to Φ^4 in three dimensions

Hendrik Weber Mon 10:30

Abstract. The Ising-Kac model is a variant of the Ising model with long range interaction. We consider the Glauber dynamics on a three dimensional lattice at near critical temperature and show that, in a certain parameter regime, these dynamics approximate the parabolic φ^4 SPDE. Our result completes previous works in one and two spatial dimensions, and confirms a conjecture by Giacomin-Lebowitz-Presutti. Technically, our analysis builds on the theory of regularity structure. The key step is the construction and analysis of an appropriate model for the discrete particle system.

Joint work with Paolo Grazieschi and Konstantin Matetski.

Global solvability and stationary solutions of singular quasilinear stochastic PDEs

Bin Xie Tue 16:00

Abstract. In this talk, we study a singular quasilinear stochastic PDE with spatial white noise as a potential over 1-dimensional torus. Such singular stochastic PDEs are derived from the study of the hydrodynamic scaling limit of a microscopic interacting particle system in a random environment. Under some sufficient conditions on coefficients and the noise, we study the global existence of solutions in paracontrolled sense, and we also show the convergence of the solutions to its stationary solutions as time goes to infinity. We use the approach based on energy inequality and Poincare inequality in our proofs. This talk is based on the joint work with T. Funaki.

Poster

A Unification of Weighted and Unweighted Particle Solutions to the Filtering Problem

Ehsan Abedi

Abstract. We study the Kushner-Stratonovich equation, a stochastic PDE arising in the continuous-time nonlinear filtering problem. Particle solutions to this equation, also referred to as particle filters (PFs), can be divided into weighted and unweighted PFs (i.e., whether particles share the same weight or not). It is well known that weighted PFs suffer from weight degeneracy and the curse of dimensionality. To sidestep these issues, unweighted PFs have been gaining attention, though they have their own computational challenges. The existing literature on these types of PFs was based on distinct approaches. We construct a particle solution that unifies weighted and unweighted PFs. In particular, we demonstrate that the well-known solutions bootstrap particle filter and the feedback particle filter arise as special cases from a broad class and that there is a smooth transition between the two. The freedom in designing the PF dynamics opens up potential ways to address the issues in the aforementioned numerical methods.

Joint work with Simone Carlo Surace and Jean-Pascal Pfister, published in SIAM Journal on Control and Optimization 2022.

Nonlinear semigroups and scaling limits for convex expectations

Jonas Blessing

Abstract. Motivated by model uncertainty in the context of Markov processes and scaling limits, we develop a theory of convex monotone semigroups. In contrast to the linear theory, the domain of the generator is, in general, not invariant under the semigroup. In order to overcome this issue, we consider so-called invariant Lipschitz sets which turn out to be a

suitable domain for a weaker notion of the generator. This is defined using Γ-convergence in an appropriate function space. Furthermore, we show that the Γ-generator uniquely characterizes the non-linear semigroup and is determined by the evaluation at smooth functions. As an application of our results, we show that LLN and CLT type results for convex expectations can be systematically obtained by the so-called Chernoff approximation. For example, Cramer's theorem can be seen as LLN for the entropic risk measure.

Joint work with Robert Denk, Michael Kupper and Max Nendel

The Wasserstein distance between complex eigenvalues and the Circular Law

Jonas Jalowy

Abstract. It is well known that the expected Wasserstein distance between the empirical measure of n i.i.d. points and the uniform measure is of order $\sqrt{\log n/n}$. However, the repulsive behavior of complex eigenvalues of random matrices forces the point process to be more evenly spread. This phenomenon will be illustrated by simulations and shall be quantified in terms of the Wasserstein distance.

On this poster we investigate the Wasserstein distance between the empirical spectral distribution of non-Hermitian random matrices with i.i.d. entries and the Circular Law, the uniform distribution on the complex disk. For Gaussian entry distributions, I present an optimal rate of convergence in expected 1-Wasserstein distance of order $n^{-1/2}$, i.e. the optimal transport cost of eigenvalues is cheaper by a logarithmic factor compared to that of i.i.d. points. For non-Gaussian entry distributions with finite moments, we also show that the rate of convergence nearly attains this optimal rate.

An extension of the stochastic sewing lemma and its applications

Toyomu Matsuda

Abstract. Lê (20) introduced the stochastic sewing lemma. The lemma beautifully combines the sewing lemma from the rough path theory and a martingale inequality, and have quickly became a useful tool for stochastic analysts. In this talk, we discuss an extension of Lê's stochastic sewing lemma. An advantage of our extension and some applications to the fractional Brownian motion will be explained.

Joint work with Nicolas Perkowski

Quantitative estimates for the 2D-discrete random matching problem

Francesco Mattesini

Abstract. The optimal matching problem is a classical random variational problem which may be interpreted as an optimal transport problem between two random measures. Its easier instance deals with matching 2 n-clouds of i. i. d. uniformly distributed points. In recent years Caracciolo-Lucibello-Parisi-Sicuro made exact predictions on the convergence of the rescaled cost thanks to a first order linearization of the Monge-Ampére equation. This approach was later partially justified by Ambrosio-Stra-Trevisan and showed quantitative bounds for the convergence of the approximating transport map (Ambrosio-Glaudo-Trevisan). Such an approach had been repurposed by Benedetto-Caglioti to study the case of of i. i. d. random points with non-constant densities. By subadditivity and PDE arguments Ambrosio-Goldman-Trevisan were able to justify the latter for the convergence of the rescaled cost. We show quantitative upper bounds for the approximating transport map in the case of i. i. d. points and weakly correlated points with non-constant densities. We extend our results to the case

of unbalanced matching, i. e. matching between point clouds of different size.

Approximation of Coarse Grained Second Order Response

Fenna Müller

Abstract. We propose estimators for dynamic second order response theory in coarse grained variables for driven out-of-equilibrium subsystems. The error is controlled through the notion of subsystem spectral gap for the convergence of coarse grained observables. (Based on arXiv:2204.10217.)

Stochastic Evolution Equations with Rough Boundary Noise

Tim Seitz

Abstract. We investigate the well-posedness of stochastic evolution equations perturbed by multiplicative Neumann boundary noise, such as fractional Brownian motion for $H \in (1/3, 1/2]$. Combining the controlled rough path approach with the theory of extrapolation operators, we establish global existence of solutions and flows for such equations.

Joint work with Alexandra Neamtu

Quenched functional CLT for RWRE with bounded cycle representation

Weile Weng

Abstract. In this work we consider continuous time variable speed random walks in random environments on $\mathbb{Z}^d (d \geq 2)$, that are spacial invariant and ergodic, and in particular generated by bounded cycles shifting over space with measurable random cycle weights. We prove quenched functional FCLT (QFCLT) only with finite p-q moment condition and ellipticity condition on the symmetric part of the speed.