14th Oxford-Berlin Young Researcher's Meeting on Applied Stochastic Analysis

10^{th} February – 12^{th} February 2021

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1. Welcome

It is our great pleasure to welcome you to the 14th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis. We hope you enjoy a productive meeting!

Conference organisers
Terry Lyons (University of Oxford)
Peter Friz (TU & WIAS Berlin)
Christina Zou (University of Oxford)
Satoshi Hayakawa (University of Oxford)
Philipp Jettkant (University of Oxford)

Presentations
All talks will be hosted on Zoom. They will be 15 minutes and we will have 5 minutes for questions after each talk. In addition to the presentations there will be coffee rooms hosted on Gather.town for discussion.

Supporting Institutions

This meeting is generously supported by the DataSıg programme (EPSRC EP/S026347/1).

2. Schedule

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3. Theory of Rough Paths

3.1 Rough stochastic differential equations

Khoa Le, Technische Universität Berlin

We introduce a concept of stochastic controlled rough paths and investigate existence and uniqueness of a hybrid rough stochastic differential equation with predictable coefficients. Applications to rough McKean-Vlasov equations and rough control problems are discussed if time permitted. The talk is based on a joint work with A. Hocquet and P. Friz under the same title.

3.2 Probabilistic rough paths

William Salkeld, Universite Cote d'Azur

In this talk, I will explain some of the foundation results for a new regularity structure developed to study interactive systems of equations and their mean-field limits. At the heart of this solution theory is a Taylor expansion using the so called Lions measure derivative. This quantifies infinitesimal perturbations of probability measures induced by infinitesimal variations in a linear space of random variable.
I will detail some of the distinctions between this regularity structure and previous examples and (depending on time) a quotient operations on branched rough paths which elucidates the link between probabilistic rough paths with an empirical law and their mean-field limits.
This talk is based on an upcoming preprint and ongoing work with my supervisor Francois Delarue at Universite Cote d'Azur.

3.3 Rough homogenization for Langevin dynamics on fluctuating Helfrich surfaces

Helena Katharina Kremp, Freie Universität Berlin

Motivated by the recent link between stochastic homogenization and rough paths from works by Kelly, Melbourne; Deuschel, Orenshtein and Perkowski, we prove a rough homogenization result for a Brownian particle on a fluctuating Gaussian hypersurface with covariance given by (the ultra-violet cutoff of) the Helfrich energy. The Brownian motion on the surface, whose generator in local coordinates is the Laplace-Beltrami operator, is a simple model for diffusing molecules on a biological surface, which is also known from physics as the overdamped Langevin dynamics on a Helfrich membrane. Considering the membrane moreover fluctuating in time and space (in different speed regimes), Duncan et al. could prove a convergence of the system X^{ε} to the homogenization limit X. We extend their results proving the convergence towards a particular lift of the homogenization limit in rough paths topology, for which (in certain regimes) a correction term to the Itô iterated integrals appears. This is ongoing work together with MATH+ AA1-3 project members Ana Djurdjevac, Peter Friz and Nicolas Perkowski.

3.4 Random Dynamical System generated by 3D Navier-Stokes equation with rough transport noise

Nimit Rana, Bielefeld University

We consider the Navier-Stokes system in three space dimensions perturbed by transport noise, which is smooth in space and rough in time, and subject to periodic boundary conditions. The existence of a weak solution has been proved by M. Hofmanova, J.-M. Leahy and T. Nilssen and uniqueness is still a major open problem. The aim here is to select a solution satisfying the semigroup property, with shifted rough path, an important feature of systems with uniqueness, which also respects the well-accepted admissibility criteria for physical solutions, namely, maximization of the energy dissipation. Moreover, under suitable assumptions on the driving rough path, we are able to construct a measurable random dynamical system corresponding to the considered Navier–Stokes system.
This is a joint work with Jorge Cardona (Darmstadt, Germany), Martina Hofmanová (Bielefeld, Germany) and Torstein Nilssen (Agder, Norway).

3.5 Inviscid mixing and enhanced dissipation for generic rough shear flows

Lucio Galeati, University of Bonn

In many physical and engineering applications, people are interested in quantifying the mixing properties of passive scalars advected by incompressible flows. Shear flows are a simple 2D subclass of this model in which, although the PDE can be solved easily, it is still difficult to understand the exact long time behaviour of solutions, apart from specific examples like Couette flow. In recent years there has been substantial progress in this direction by several authors, including Bedrossian, Coti Zelati, Drivas, Dolce, Wei, employing a variety of techniques like hypocoercivity, spectral theory and stochastic analysis. Combining their methods with suitable notions of irregularity (like ρ-irregularity), it's possible to describe in detail the mixing properties of generic Holder shear flows; genericity here is understood in the sense of prevalence. Based on an ongoing project with Massimiliano Gubinelli.

3.6 Lévy area without approximation

Isao Sauzedde, LPSM

We will briefly explain how to define the Lévy area without using pathwise-linear approximation of the Brownian path.

3.7 Càdlàg rough differential equations with reflecting barriers

Andrew Allan, ETH Zurich

We investigate rough differential equations with a time-dependent reflecting lower barrier, where both the driving (rough) path and the barrier itself may have jumps. Such reflected equations are particularly interesting due to the lack of uniqueness of solutions in the general case. We present the most general results known so far for such equations.

3.8 A Besov-type sewing lemma and applications

Benjamin Seeger, Collège de France and Université Paris-Dauphine (CEREMADE)

We present an abstract sewing lemma for two-parameter maps that belong to spaces of Besov type. This result unifies the approaches for Hölder and variation spaces, and, among the many potential applications, it can be used to prove existence, uniqueness, and stability results for rough differential equations driven by Besov rough paths of arbitrarily low regularity. We also prove an embedding of Besov path spaces into Hölder spaces, based on a generalized Campanato-type characterization of Hölder regularity. This is joint work with Peter Friz.

3.9 Approximation of controlled rough paths

Nikolas Tapia, WIAS / Technische Universität Berlin

We explicitly construct a dense subspace of the Banach space of paths controlled by a branched Rough Path. In particular, we show that the space of branched Rough Paths has the structure of a Field of Banach spaces. This talk is bases on joint ongoing work with M. Ghani (TUB), S. Riedel (TUB) and B. Schmeding (Nord U).

3.10 Higher order non-commutative rough paths

Carlo Bellingeri, Technische Universität Berlin

Introduced almost in the same years, non-commutative probability theory and rough paths have been two intensive research fields in probability, showing interesting connections to quite different subjects in mathematics. However, these two subjects rarely spoke between each other, with relatively few contributions of rough paths in the non-commutative world. Some recent constructions by Deya-Schotts have shown the existence of some new objects, the product Lévy area, an object with the same property of a Levy area, which is more suitable to describe rough evolution in a non-commutative context. In this talk, we review the basic definition of this approach and we propose an extension to their definitions, to cover the case of a non-commutative equivalent of a higher-order iterated integral. Joint work with N. Gilliers (Universität Greifswald)

4. McKean Vlasov Theory

4.1 Robust filtering and McKean-Vlasov equations

Michele Coghi, Technische Universität Berlin

We study a McKean-Vlasov equation with common noise derived from a filtering problem. The common noise is the observation process of the filtering problem. The law of the solution to the McKean-Vlasov equation is an approximation of the conditional law of the signal given the observation. We use rough-path techniques to prove that the law of the solution to the McKean-Vlasov equation depends continuously on the common noise. This gives a robust representation of the filtering problem.

4.2 Distribution dependent SDEs driven by additive fractional Brownian motion

Avi Mayorcas, University of Oxford

In this talk I will present some forthcoming results from a joint work between L. Galeati, F. Harang and myself regarding regularisation by noise for a class of generalised McKean—Vlasov equations (DDSDE). Continuing in the direction of research started by Catellier Gubinelli '16, we investigate the regularising effect of the fractional Brownian driver through averaging. We establish well-posedness results under a variety of regularity and structure assumptions on the drift. We are able to establish well-posedness for equations with drifts less regular than the classical Lipschitz criterion, in particular allowing for truly singular drifts in the presence of sufficiently rough noise. Time permitting I will present some ancillary results that may be of independent interest.

5. Rough Paths, Signatures and Data Science

5.1 Neural SDEs as infinite-Dimensional GANs

Patrick Kidger, Univeristy of Oxford

Stochastic differential equations (SDEs) are a staple of mathematical modelling of temporal dynamics. Such models have typically been theoretically motivated, and as such have been relatively inflexible. Here however, we show that the classical approach to SDEs is actually a *special case* of the modern machine learning of Wasserstein GANs. The input noise is Brownian motion, the output samples are time-evolving paths produced by a numerical solver, and by parameterising the discriminator as a Neural CDE we obtain Neural SDEs as (in modern machine learning parlance) continuous-time generative time series models. Unlike previous work on this problem this is a direct extension of the classical approach, without reference to either prespecified statistics or density functions. Arbitrary drift and diffusions are admissible, so that in the infinite data limit *any* SDE may be learnt.

5.2 Unified signature cumulants and generalized Magnus expansions

Paul Hager, Technische Universität Berlin

Signature cumulants, defined as logarithm of expected signatures of semimartingales, are seen to satisfy a fundamental functional relation. This equation, in a deterministic setting, contains Hausdorff's differential equation, which itself underlies Magnus' expansion. The (commutative) case of multivariate cumulants arise as another special case and yields a new Riccati type relation valid for general semimartingales. Here, the accompanying expansion provide a new view on recent "diamond" and "martingale cumulants" (Alos et al '17, Lacoin et al '19., Friz et al. '20) expansions. Many concrete examples are given.

5.3 Rotation-Reflection invariants of paths through signatures and moving frames

Rosa Preiß, Technische Universität Berlin

Joint work with Joscha Diehl, Micheal Ruddy and Nikolas Tapia
We apply the Fels-Olver's moving frame method to the log-signature to construct a set of integral invariants for curves in $\mathbb{R}^d$ under $O(d)$ and to compare paths up to rotations/reflections (and tree-like extensions). In particular we show that one can construct a set of invariants that characterize the equivalence class of the truncated iterated integral signature under orthogonal transformations.
In contrast to my talk at the last Berlin-Oxford Meeting, which was more of a teaser introducing the general underlying ideas, now that our preprint is online, I am able to present concrete results and examples on how invariants are obtained through the moving frame method.

5.4 Non-commutative time series

Joschua Diehl, Greifswald University

Time series with values in non-commutative algebras routinely appear, for example in the setting of machine learning and neural networks.
For matricial – finite dimensional – time series, the usual iterated-sums machinery applies entrywise.
Here, we propose instead to work consistently with the non-commutative objects themselves. In the scalar case, polynomial time-warping invariants constitute alltogehter the discrete signature of a time series. Invariants of a non-commutative time series contain all quasi-symmetric functions of the increments, and in fact much more.
We set up a suitable operadic structure with the objective of building the signature for a non-commutative time series as a representation of a Hopf algebra.

5.5 Path classification with continuous-time recurrent neural networks

Youness Boutaib, RWTH Aachen

We seek mathematical learning guarantees for path-classification tasks using stochastic (linear, in this talk) recurrent networks with continuous-time rate dynamics. This architecture finds its origin in neuroscience and is simple as training only requires finding a pre-processing projection vector and the parameters of a read-out map. We give generalisation error bounds and argue that stochasticity provides learning with a robustness against adversarial attacks. We also explicitly show that training (in the case of our loss function) is equivalent to an optimisation problem of a functional on the signatures of the training paths. This is an ongoing joint work with S. Nestler (FZ Jülich) and H. Rauhut (RWTH Aachen).

5.6 Seq2Tens: An efficient representation of sequences by low-rank tensor projections

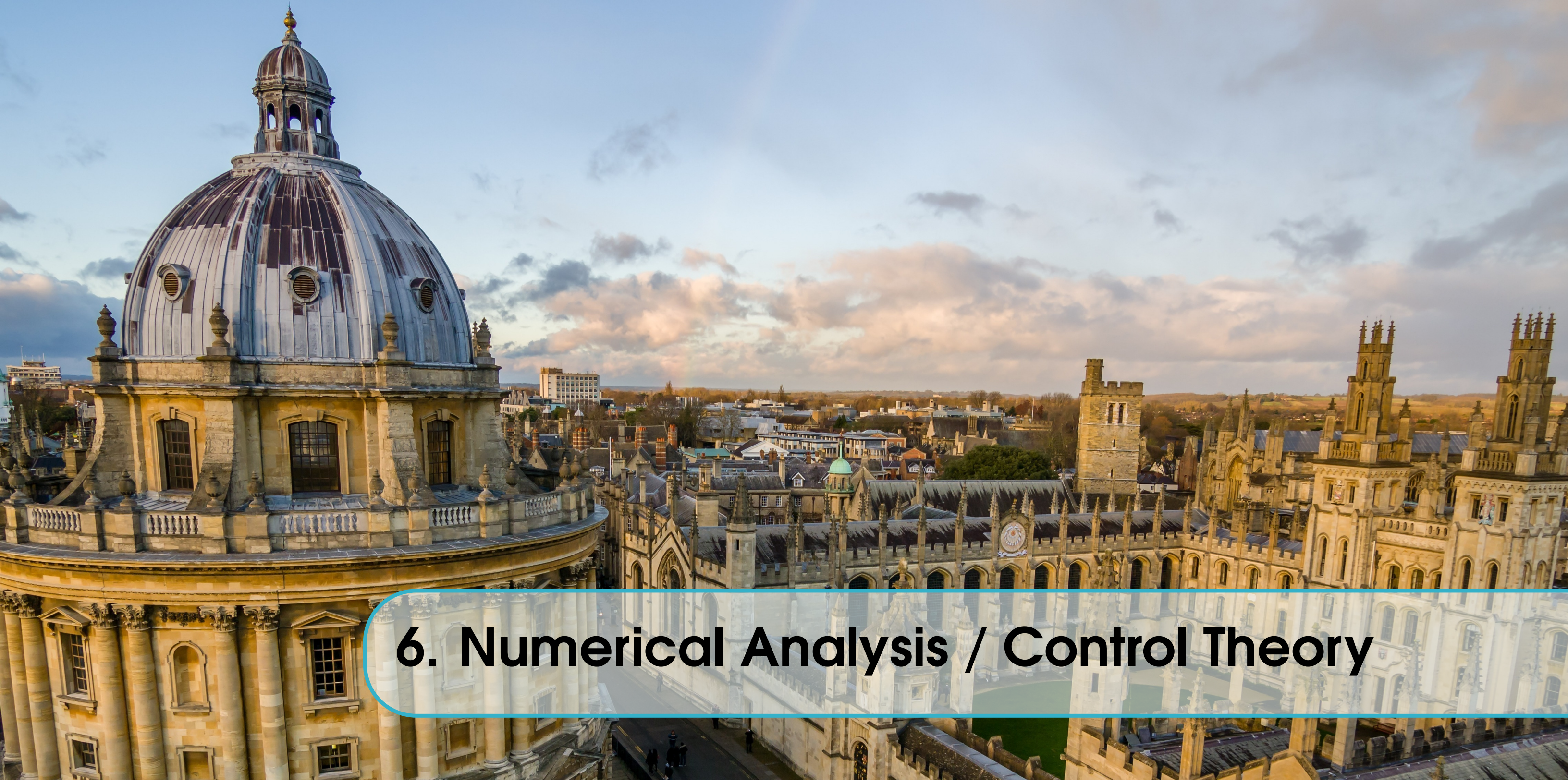
Csaba Toth, University of Oxford

Sequential data such as time series, video, or text can be challenging to analyse as the ordered structure gives rise to complex dependencies. At the heart of this is non-commutativity, in the sense that reordering the elements of a sequence can completely change its meaning. We use a classical mathematical object – the tensor algebra – to capture such dependencies. To address the innate computational complexity of high degree tensors, we use compositions of low-rank tensor projections. This yields modular and scalable building blocks for neural networks that give state-of-the-art performance on standard benchmarks such as multivariate time series classification mortality prediction and generative models for video.

5.7 Nonlinear independent component analysis for continuous-time signals

Alexander Schell, University of Oxford

We study the classical problem of recovering a multidimensional source process from observations of nonlinear mixtures of this process. Assuming statistical independence of the coordinate processes of the source, we show that this recovery is possible for many popular models of stochastic processes (up to order and monotone scaling of their coordinates) if the mixture is given by a sufficiently differentiable, invertible function. Key to our approach is the combination of tools from stochastic analysis and recent contrastive learning approaches to nonlinear ICA. This yields a scalable method with widely applicable theoretical guarantees for which our experiments indicate good performance.



6. Numerical Analysis / Control Theory

6.1 Runge-Kutta methods for rough differential equations

Martin Redmann, Martin-Luther University of Halle Wittenberg

We study Runge-Kutta methods for rough differential equations which can be used to calculate solutions to stochastic differential equations driven by processes that are rougher than a Brownian motion. We use a Taylor series representation (B-series) for both the numerical scheme and the solution of the rough differential equation in order to determine conditions that guarantee the desired order of the local error for the underlying Runge-Kutta method. Subsequently, we prove the order of the global error given the local rate. In addition, we simplify the numerical approximation by introducing a Runge-Kutta scheme that is based on the increments of the driver of the rough differential equation. This simplified method can be easily implemented and is computational cheap since it is derivative-free. We provide a full characterization of this implementable Runge-Kutta method meaning that we provide necessary and sufficient algebraic conditions for an optimal order of convergence in case that the driver, e.g., is a fractional Brownian motion with Hurst index $\frac{1}{4} < H \leq \frac{1}{2}$.

6.2 Improving Heun's method for SDEs with additive noise

James Foster, University of Oxford

Heun's method is a standard approximation for both ODEs and Stratonovich SDEs. In particular, when applied to SDEs with constant diffusion coefficients (i.e. "additive noise"), it achieves second order weak convergence. In this talk, we will present two variants of Heun's method for additive noise SDEs.

The first method reuses vector field evaluations and is thus as computationally cheap as the Euler-Maruyama method. Although the weak error analysis for this method remains an open problem, it exhibits second order weak convergence in our numerical experiment.

The second method uses both increments and time integrals of Brownian path. This allows it to converge with a strong order of 1.5 and a weak order of 2. To the best of our knowledge, this is the first method to do so whilst only requiring two vector field evaluations per step. In our numerical experiment, this method matches the accuracy of a more expensive stochastic Runge-Kutta method.

6.3 Hamilton–Jacobi equations for inference of matrix tensor products

Jiaming Xia, University of Pennsylvania

We study the high-dimensional limit of the free energy associated with the inference problem of finite-rank matrix tensor products. In general, we bound the limit from above by the unique solution to a certain Hamilton–Jacobi equation. Under additional assumptions on the nonlinearity in the equation which is determined explicitly by the model, we identify the limit with the solution. Two notions of solutions, weak solutions and viscosity solutions, are considered, each of which has its own advantages and requires different treatments. For concreteness, we apply our results to a model with i.i.d. entries and symmetric interactions. In particular, for the first order and even order tensor products, we identify the limit and obtain estimates on convergence rates; for other odd orders, upper bounds are obtained.

6.4 A stochastic control approach to Sine-Gordon

Nikolay Barashkov, University of Bonn

We present a method to analyze the Laplace transform of the Sine-Gordon measure using the Boue-Dupuis formula. By leveraging the stochastic control structure of the problem we are able to obtain a study the model in the full space and obtain an explicit description of the Laplace transform. We also obtain a new proof of the Osterwalder Schrader axioms and exponential clustering.

7. Mathematical Finance

7.1 Short dated smile under rough volatility

Paolo Pigato, Universita Roma Tor Vergata

In rough stochastic volatility models, volatility is driven by a fractional noise, in the ""rough"" regime of Hurst parameter less than $1/2$. We look at short-time formulae for option prices under this modelling assumption, investigating the fine structure of these expansions in large deviations and moderate deviations regimes. We discuss computational aspects relevant for practical applications.

7.2 A quantitative approach to sustainable finance via optimal stopping of diffusions

Emanuel Rapsch, Technische Universität Berlin

In Sustainable Finance an important question is which policy a regulator should adopt in order to stimulate irreversible investment of firms in a market economy. Typically, the firms face a trend (e.g. technological, consumer preference-related) whose future realisation is exposed to substantial uncertainty, but which is not sufficiently observable from the regulator's perspective.
Following real options and principal-agent theory, we propose quantifying that uncertainty and, hence, its impact on both the firms' timing decisions and the regulator's policy. Mathematically, we interpret this objective in terms of a stopping game problem of Langrangian type for a Wright-Fischer diffusion. It is equivalent to a coupled system of differential equations, that, under reasonable monotonicity assumptions, admits a transparent solution. In the upcoming talk, I would like to present this toy model, visualise its interest by means of an example, and provide a short outlook of how to proceed mathematically in order to include further relevant features of the underlying economic question.
This project is based on a collaboration with my doctoral supervisor Christoph Belak.

8. SPDEs and Regularity Structures

8.1 Singular stochastic operator

Antoine Mouzard, University of Rennes

In this talk, we explain the study of unbounded operator with a singular random potential using the paracontrolled calculus. In particular, this allows to construct the Anderson Hamiltonian and the random magnetic Laplacian with magnetic field white noise. As applications, one can solve associated evolution PDEs such as the Schrödinger equation and the wave equation with low-regularity solutions.

8.2 Statistical inference on the reaction term in semi-linear SPDEs

Sascha Gaudlitz, Humboldt University Berlin

Starting with an example for modelling real-world phenomena using semi-linear SPDEs, I will briefly outline the maximum-likelihood method applied to SPDEs. At its core lies a version of the well-known Girsanov Theorem for semi-linear SPDEs, that provides an explicit density on the path space. This density allows for a maximum-likelihood estimator for the reaction term, for which I will present first results in the linear case and in two asymptotic regimes: Firstly, in the classical case where the observation time increases and, secondly, in the novel asymptotic, in which the diffusivity of the system tends to zero. Both regimes allow for a Central Limit Theorem.

8.3 Approximation of the Dean-Kawasaki equation

Ana Djurdjevac, Freie Universität Berlin

Dean-Kawasaki (DK) equation describes the evolution of the density function of finitely many particles obeying Langevin dynamics. It is a nonlinear SPDE with a non-Lipschitz multiplicative noise in divergence form, which makes its solution theory different from the standard settings. We will presented the modified DK equation for non-interacting particles. For the modified equation we can prove the well-posedness in the weak PDE sense and strong in the probability sense. More over, the modified equation inherits the mass conservation and positivity property. We will also show that the modified equation approximates the DK equation in a weak sense.This is the joint work with H. Kremp and N. Perkowski.

8.4 Finite speed of propagation for the wave equation with white noise potential

Immanuel Zachhuber, Freie Universität Berlin

We adapt a method due to Tartar to show finite speed of propagation for multiplicative stochastic wave equations. This gives us global space-time well-posedness in 2 and 3 dimensions which was previously not possible due to the unbounded nature of white noise on the full space.

8.5 Analytical properties for stochastic transport systems

Oana Lang, Imperial College London

In this talk I will present analytical properties for two stochastic shallow water models. One of these models is derived using the Location Uncertainty approach (Mémin, 2014) and the other one is derived using the Stochastic Advection by Lie Transport method (Holm, 2015). Both systems are designed for turbulent compressible fluids and are driven by transport noise. Our well-posedness framework is based on approximating sequences of solutions with suitable convergence properties, and can be extended to more general systems of SPDEs.

8.6 Effect of noise on the speed of the wavefront for stochastic FKPP equations

Clayton Barnes, Technion-Israel Institute of Technology

The Fisher-KPP equation is a well studied reaction-diffusion equation motivated by biology as well as statistical physics. The solutions exhibit traveling "waves" that propagate through space with a finite. Propagative waves also exist for solutions to the stochastic Fisher-KPP (where the original FKPP equation is perturbed by a white noise term). Propagating waves also exist in this context, and we determine the asymptotic behavior of the wave-speed when the coefficient determining noise-strength approaches zero.

8.7 Regularity structures on manifolds and vector bundles

Harprit Singh, Imperial College London

We explain an extension of the theory of regularity structures that allows to treat singular partial differential equations on general vector bundles. The focus of the talk lies in explaining the novelties that arise in the geometric setting. We shall mostly focus on the scalar valued case.

9. Further Topics in Stochastic Analysis

9.1 Estimating the probability that a given vector is in the convex hull of a random sample

Satoshi Hayakawa, University of Oxford

For a d-dimensional random vector X, let $p_{n,X}$ be the probability that the convex hull of n i.i.d. copies of X contains a given point x. We provide several sharp inequalities regarding $p_{n,X}$ and N_X, which denotes the smallest n with $p_{n,X} \geq 1/2$. As a main result, we derive a totally general inequality which states $1/2 \leq \alpha_X N_X \leq 16d$, where α_X (a.k.a. the Tukey depth) is the infimum of the probability that X is contained in a fixed closed halfspace including the point x. We also provide some applications of our results, one of which gives a moment-based bound of N_X via the Berry-Esseen type estimate.

9.2 Large deviations for the Lagrangian trajectories of the Navier–Stokes system

Vahagn Nersesyan, University of Versailles

We will consider the motion of a particle in a random time-dependent vector field defined by the 2D Navier–Stokes system with a noise. Under suitable non-degeneracy hypotheses, we will see that the empirical measures of the trajectories of the pair (velocity field, particle) satisfy the large deviations principle (LDP). The proof is based on a new criterion for LDP formulated in terms of the controllability of the underlying deterministic system.
This is a joint work with V. Jaksic, C.-A. Pillet, and A. Shirikyan.

9.3 Pathwise large deviations for white noise chaos expansions

Alexandre Pannier, Imperial College London

We consider a family of continuous processes $\{X^\varepsilon\}_{\varepsilon>0}$ which are measurable with respect to a white noise measure, take values in the space of continuous functions $C([0,1]^d : \mathbb{R})$, and have the Wiener chaos expansion

$$X^\varepsilon = \sum_{n=0}^{\infty} \varepsilon^n I_n\big(f_n^\varepsilon\big).$$

We provide sufficient conditions for the large deviations principle of $\{X^\varepsilon\}_{\varepsilon>0}$ to hold in $C([0,1]^d : \mathbb{R})$, thereby refreshing a problem left open by Pérez-Abreu (1993) in the Brownian motion case. The proof is based on the weak convergence approach to large deviations: it involves demonstrating the convergence in distribution of certain perturbations of the original process, and is thus well-suited to deal with infinite-dimensional processes. The main difficulties lie in analysing and controlling the perturbed multiple stochastic integrals. Moreover, adopting this representation offers a new perspective on pathwise large deviations and induces a variety of applications thereof.

9.4 Skew fractional Brownian motion: going beyond the Catellier-Gubinelli setting

Oleg Butkovsky, WIAS Berlin

Work in progress with Khoa Le and Leonid Mytnik. We study well-posedness of skew fractional Brownian motion (fBM):

$$dX_t = \kappa \delta_0(X_t)dt + dW_t^H,$$

where W^H is an fBM of order $H \in (0,1)$, $\kappa \in \mathbb{R}$, and δ_0 is the Dirac delta function at 0. It follows from the seminal work of Catellier and Gubinelli that this equation has a unique strong solution for $H < 1/4$. On the other hand, it is also known that this equation is well-defined in the Brownian case ($H = 1/2$) for $|\kappa| \leq 1$. This creates a mysterious gap of values of H, namely $H \in [1/4, 1/2)$ where well-posedness of this equation is expected yet not known. We develop a new technique, stochastic sewing with random controls, and show that this equation is well posed for $H \in [1/4, 1/3)$, thus reducing this gap. We discuss also the main challenges which have to be overcomed to close the gap completely.

9.5 Dynamic polymers: invariant measures and ordering by noise

Hong-Bin Chen, New York University

We develop a dynamical approach to infinite volume polymer measures (IVPM) in random environments. We define polymer dynamics in 1+1 dimension as a stochastic gradient flow, and establish ordering by noise. We prove that, for a fixed asymptotic slope, the polymer dynamics has a unique invariant distribution given by a unique IVPM. Moreover, One Force – One Solution principle holds.

9.6 SLE with time-dependent parameter

Yizheng Yuan, Technische Universität Berlin

Schramm-Loewner evolution (SLE) is a family of random curves in the plane that appear naturally in conformally invariant models. They can be constructed via Loewner chains (a complex analytic tool), and driving them by a Brownian motion with some speed parameter. In the talk I will explain that we can also drive Loewner chains by Brownian motions with non-constant random speed. We show that this also gives rise to a continuous curve. The classical proofs do not immediately adapt to this setting, so we introduce a new argument that may have more applications.

9.7 Integrated density of states associated with two-dimensional white noise

Toyomu Matsuda, Freie Universität Berlin

One of the most important concepts in the theory of random Schrödinger operators is integrated density of states, which measures the expected number of eigenvalues per unit volume below a given energy. In this talk, we consider the integrated density of states associated with two-dimensional white noise.

9.8 Quantitative heat kernel estimates for diffusions with distributional drift

Willem van Zuijlen, WIAS Berlin

In this talk I will discuss a joint work with Nicolas Perkowski, in which we prove heat kernel estimates for diffusions with a distributional drift. Heat kernel estimates describe how the transition kernel of the diffusion can be estimated from above and from below by multiples of the Gaussian kernel. In our work we derive explicit dependence of the constants in front of the Gaussian kernels and describe them in terms of the regularity and the norm of the drift and of time.

9.9 A voter model approximation for the stochastic FKPP equation with seed bank

Florian Nie, Technische Universität Berlin

We introduce an on/off version of the classical long range voter model which allows active voters to save opinions in their subconsciousness (the ""seed bank""). At exponential rates trigger events can then occur in which the opinions of active voters are replaced by their dormant equivalents. Next, we show that after appropriate rescaling the empirical measure describing the active and dormant population will then converge in law to a measure valued process, whose density is given by the unique solution of the stochastic FKPP Equation with seed bank. Finally, if time permits, we will discuss properties of a special case of the limiting equation. Namely, we will be interested in probabilistic approaches to the existence of travelling wave solutions for the deterministic FKPP Equation with seed bank and the asymptotic speed of the rightmost particle of the on/off branching Brownian motion.

10. Participants

Andrew Allan (ETH Zürich)
Peter Bank (Technische Universität Berlin)
Nikolay Barashkov (University of Bonn)
Clayton Barnes (Technion-Israel Institute of Technology)
Dirk Becherer (Humboldt University Berlin)
Florian Bechtold (Sorbonne Université)
Christoph Belak (Technische Universität Berlin)
Carlo Bellingeri (Technische Universität Berlin)
Patric Bonnier (University of Oxford)
Youness Boutaib (RWTH Aachen)
Simon Breneis (WIAS Berlin)
Oleg Butkovsky (WIAS Berlin)
Bingguang Chen (Bielefeld University)
Hong-Bin Chen (NYU)
Henry Chiu (Imperial College London)
Michele Coghi (Technische Universität Berlin)
Francesco Cosentino (University of Oxford)
Robert Crowell (ETH Zürich)
Lancelot Da Costa (Imperial College London)
Konstantinos Dareiotis (University of Leeds)
Purba Das (University of Oxford)
Loiseaux David (ENS Rennes & Université Paris-Saclay)
Robert Denkert (Humboldt University Berlin)
Joschua Diehl (University of Greifswald)
Ana Djurdjevac (Freie Universität Berlin)
Henri Elad Altman (Imperial College London)
Sebastian Ertel (Technische Universität Berlin)
Hugo Eulry (Université de Rennes 1)
Eliana Fausti (University of Oxford)
Benjamin Fehrman (University of Oxford)
Philipp Forstner (Technische Universität Berlin)
James Foster (University of Oxford)
Lucio Galeati (University of Bonn)
Paul Gassiat (Universite Paris-Dauphine)
Sascha Robert Gaudlitz (Humboldt University Berlin)
Mate Gerencser (TU Wien)
Nicolas Gilliers (NTNU, Trondheim)
Lukas Gräfner (Humboldt University Berlin)
Emanuela Gussetti (Universität Bielefeld)
Paul Hager (Technische Universität Berlin)
Fabian Harang (University of Oslo)
Tsui Ho Lung (University of Oxford)
Dave Jacobi (Technische Universität Berlin)
Likai Jiao (Humboldt University Berlin)
Benjamin Joseph (University of Oxford)
Oscar Junge (Humboldt University Berlin)
Hannes Kern (Technische Universität Berlin)
Patrick Kidger (University of Oxford)
Tom Klose (Technische Universität Berlin)
Laura Koerber (Technische Universität Berlin)
Helena Katharina Kremp (Freie Universität Berlin)
Oana Lang (Imperial College London)
Theresa Lange (Technical University Berlin)
Khoa Le (Technische Universität Berlin)
David Lee (LPSM)
Jiawei Li (Carnegie Mellon University)
Chengcheng Ling (Technische Universität Berlin)
Chong Liu (University of Oxford)
Mądry Łukasz (Universite Paris-Dauphine)
Vlad Margarint (NYU Shanghai)
Toyomu Matsuda (Freie Universität Berlin)
Mario Maurelli (Università degli Studi di Milano)
Avi Mayorcas (University of Oxford)
Ghani Mazyar (Technische Universität Berlin)
Alexander Merkel (Technische Universität Berlin)
Remy Messadene (Imperial College London)
Laszlo Mikolas (University of Oxford)
Cecilia Mondaini (Drexel University)

Antoine Mouzard (University of Rennes)
Alexandra Neamtu (Bielefeld University)
Vahagn Nersesyan (University of Versailles)
Florian Nie (Technische Universität Berlin)
Torstein Nilssen (University of Agder)
Chanwoo Oh (Technion-Israel Institute of Technology)
Tal Orenshtein (TU & WIAS Berlin)
Salvador Ortiz-Latorre (University of Oslo)
Milan Pache (University of Oxford)
Alexandre Pannier (Imperial College London)
Gregor Pasemann (Technische Universität Berlin)
Nicolas Perkowski (Freie Universität Berlin)
Benedikt Petko (Imperial College London)
Paolo Pigato (University of Rome Tor Vergata)
Rosa Preiß (Technische Universität Berlin)
David Proemel (University of Mannheim)
Alexandra Quitmann (WIAS Berlin)
Rana Nimit (Bielefeld University)
Emanuel Rapsch (Technische Universität Berlin)
Martin Redmann (Martin Luther University of Halle-Wittenberg)
Sebastian Riedel (Technische Universität Berlin)
Marco Romito (Università di Pisa)
Paul Rosa (ENS Rennes/ENS Lyon)
William Salkeld (Universite Cote d'Azur)
Leandro Sánchez-Betancourt (University of Oxford)
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Csaba Toth (University of Oxford)
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Yue Wu (University of Oxford)
Jiaming Xia (University of Pennsylvania)
Wei Xiong (University of Oxford)
Lihu Xu (University of Macau)
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Xiangchan Zhu (Chinese Academy of Science)
Wang Ziheng (University of Oxford)
Pavel Zorin-Kranich (University of Bonn)