1 Program

	Monday	Tuesday	Wednesday	Thursday	Friday
09h00-10h30	M. Biskup	S. Peszat	M. Biskup	S. Peszat	M. Biskup
10h30-11h00					
11h00-12h30	S. Peszat	M. Biskup	S. Peszat	M. Biskup	S. Peszat
12h30-14h00	Lunch	Lunch	Lunch	Lunch	Lunch
14h30-15h00	M. Secci	P. Coupek		J. Krüger	
15h00-15h30	K. Kadlec	A. Munteanu		N.T. Anh	
15h30-16h00	J. Chorowski	T. Rubin	Hike	V. Senin	
16h00-16h30			Hike		
16h30-17h00	T. Sobotka	J. Martin	Hike	P. Veverka	
17h00-17h30	I. Vorkastner	J. Snuparkova	Hike	A. Saplaouras	
17h30-18h00	F. Flegel	R. Altmeyer	Hike	T. Bilarev	
19h00-21h00	Dinner	Dinner	Dinner	Dinner	Dinner

2 Abstract

Randolf Altmeyer (Humboldt-Universität zu Berlin)

Title. ESTIMATING OCCUPATION TIME OF CONTINUOUS SEMIMARTINGALES

Abstract. An important object in applications is the *Occupation time* $\int_0^T f(X_t)\,dt$ for a stochastic process $(X_t)_{t\geq 0}$ and a function of interest f. Given discrete data $X_{k/n}$, $k = 0,\ldots,\lfloor nT \rfloor - 1$, it can be estimated by the Riemann-type estimator $\frac{1}{n}\sum_{k=1}^{\lfloor nT \rfloor} f(X_{\frac{k-1}{n}})$. Recently, [1] and [2] found rates of convergence for this estimator when X is a one-dimensional diffusion with smooth coefficients and f is either an indicator function or has some Hölder smoothness.
Using a completely different set of techniques, based on Fourier analysis, we extend these results to d-dimensional continuous semimartingales and functions f lying in

some Fourier-Lebesgue space. In case of a d-dimensional Brownian motion we show that the rates are optimal. As an additional novelty, in contrast to [1] and [2], for sufficiently smooth functions, we are able to prove a stable central limit theorem which can be used for statistical inference. For the proof of the central limit theorem we introduce a generalized Itô formula which is of independent interest. It applies to d-dimensional continuous semimartingales and functions f in some Fourier-Lebesgue spaces. Compared to previous generalized Itô formulas, in our case the bounded variation part is fully explicit and can be easily approximated.

Tuan Anh Nguyen (Technische Universität Berlin)

Title. AN ANCHORED SOBOLEV INEQUALITY ON GRAPHS

Abstract. In the talk, we will introduce an anchored Sobolev inequality on graphs which satisfies volume regularity and relative isoperimetric inequalities for large sets. As an application, this inequality can be used to prove the so-called ℓ^1-sublinearity of the corrector in the Random Conductance Model, which is an important ingredient in the proof of the quenched invariance principle. (joint work with J.-D. Deuschel and M. Slowik).

Todor Bilarev (Humboldt-Universität zu Berlin)

Title. OPTIMAL LIQUIDATION UNDER STOCHASTIC RESILIENCE OF PRICE IMPACT

Abstract. We solve explicitly a two-dimensional singular control problem of finite fuel type in infinite time horizon. The problem stems from the optimal liquidation of an asset position in a financial market with multiplicative price impact with stochastic resilience. The optimal control is obtained as a diffusion process reflected at a non-constant free boundary. To solve the variational inequality and prove optimality, we show new results of independent interest on constructive approximations and Laplace transforms of the inverse local times for diffusions reflected at elastic boundaries.

Jakub Chorowski (Humboldt-Universität zu Berlin)

Title. APPROXIMATION OF INTEGRAL TYPE FUNCTIONAL OF MARKOV PROCESSES

Abstract. For Markov process $(X_t, 0 \leq t \leq T)$ the problem of estimating the integral functional

$$\Gamma_t(f) = \int_0^t f(X_s)ds,\ 0 \leq t \leq T$$

is considered. Functional Γ_t is not regular when the domain contains non smooth functions. Consequently, the approximation error can't be analysed with classical techniques. In this talk, an innovative approach that allows to control the estimation error based on the Sobolev smoothness s of f is presented. When X is a stationary diffusion, we derive a convergence rate $n^{-\frac{1+s}{2}}$, independent of the dimension of the state space.

Petr Čoupek (Charles University in Prague)

Title. STOCHASTIC HEAT EQUATION WITH ADDITIVE VOLTERRA NOISE

Abstract. In this talk, we investigate the existence and properties of the solution to stochastic heat equation driven by, in general non-Gaussian, stochastic processes. In particular, the fractional Brownian motion with $H > 1/2$ provides an example of a Gaussian process of this type while the Rosenblatt process constitutes a non-Gaussian one. In our investigation, we employ the infinite-dimensional approach. In particular, we consider a mild solution to a linear stochastic evolution equation with additive cylindrical Volterra process and provide sufficient conditions for its existence and continuity with special attention to the interplay between the kernel defining the covariance function and the diffusion coefficient.

Karel Kadlec (Charles University in Prague)

Title. ERGODIC CONTROL FOR LEVY-DRIVEN LINEAR STOCHASTIC EQUATIONS IN HILBERT SPACES

Abstract. Controlled linear stochastic evolution equations driven by cylindrical Levy processes are studied in the Hilbert space setting. The control operator may be unbounded which makes the results obtained in the abstract setting applicable to parabolic SPDEs with boundary or point control. The ergodic control problem is solved: The feedback form of the optimal control and the formula for the optimal cost are found. As examples, various parabolic type controlled SPDEs are studied.

Jennifer Krüger (Technische Universität Berlin)

Title. EXISTENCE AND UNIQUENESS OF MILD SOLUTIONS TO THE STOCHASTIC NEURAL FIELD EQUATION WITH DISCONTINUOUS FIRING RATE

Abstract. The neural field equation models the spatiotemporal evolution of neural activity in thin layers of cortical tissue from a macroscopic point of view. Under the influence of spatially extended additive noise (W^Q) it is given by

$$du(x,t) = \left[-u(x,t) + \int_{-\infty}^{\infty} w(x-y)\ F(u(y,t))\ dy \right] dt + \sigma\ dW^Q(x,t) \qquad (1)$$

where u describes the activity of a population of neurons at position x and time t. The function $F : \mathbb{R} \to \mathbb{R}$ models a nonlinear firing rate which is usually taken to be a sigmoid function. For this particular choice the existence and uniqueness of mild solutions can be shown with standard arguments. In the case where the steepness of the sigmoid function tends to infinity, i.e. when it converges to a Heaviside firing rate the question of existence and uniqueness of mild solutions has still been open for the deterministic as well as for the stochastic neural field equation.
We will prove existence via a fixed point iteration converging to a maximal mild solution of the equation. Concerning the issue of uniqueness different notions and approaches will be discussed. Having the maximal mild solution as a supersolution, we construct a subsolution of (1) in a similar spirit. Under an additional assumption on the distribution of the maximal solution uniqueness can then be shown in the deterministic as well as in the stochastic setting. Furthermore, we present a result of weak uniqueness on finite domain, which illustrates how suitable choices of noise can restore uniqueness even if this property is lost in the deterministic equation.

Jörg Martin (Humboldt-Universität zu Berlin)

Title. A REGULARITY STRUCTURE FOR ROUGH VOLATILITY

Abstract. We develop an approximation theory for option prices in a Black Scholes model with rough volatily driven by fractional Brownian motion with arbitrary Hurst index $H \in (0, 1)$. Our approach is based on Hairer's theory of regularity structures and relies on renormalization techniques.

Alexandra Munteanu (Technische Universität Berlin)

Title. ON THE PATH SPACE MEASURE APPROACH TO THE FIRST PASSAGE TIME DENSITY

Abstract. The stochastic integrate-and-fire model describes the membrane potential of a neuron by a stochastic differential equation up to the time when it reaches a certain threshold VF. At this point the neuron is said to "spike" or "fire" and the voltage is reset to a resting value VR. If the neuron is coupled to la large network, receiving inputs from surrounding neurons, the membrane potential can be modeled

with an associated mean-field equation:

$$X_t = X_0 + \int_0^t b(Xs)ds + \alpha\mathbb{E}(Mt) + W_t - M_t.$$

The mathematical analysis of this highly discontinuous non-Markovian stochastic process is a relatively new research area, with many open questions. Existence and uniqueness results for a scalar-valued stochastic mean-field equation have been obtained in [1]. The main technical difficulty in the mathematical analysis of these equations consists of the lack of understanding of the continuity properties of the firing time distribution. Using the path-space representation of the cumulative distribution function of the first passage time, we found a method to get a control on its density, relying on heat-kernel estimates at the threshold. The same method also allows to control on the path space the difference between the cumulative distribution functions corresponding to two different drift terms. The required estimates can be obtained using the method in [2], based on Doob's h-transform and log-Sobolev inequalities. In the particular case of Brownian motion with drift, where the assumed regularity conditions are known to be satisfied, we obtain explicit estimates, that surprisingly turn out to be uniform in the drift term.

Tomáš Rubín (Charles University in Prague)

Title. STOCHASTIC EVOLUTION EQUATIONS WITH SINGULAR FRACTIONAL NOISE

Abstract. In this talk, the integration theory with respect to cylindrical fractional Brownian motion will be reviewed. The differences of the H>1/2 case and the H<1/2 case will be discussed. The integration theory will be applied to mild solutions of stochastic evolution equations with additive noise. The $H < 1/2$ case will be studied in particular, and the impact of considering analytic semigroups will be discussed.

Alexandros Saplaouras (Technische Universität Berlin)

Title. A GENERAL RSULT ON eXISTENCE, UNIQUENESS AND ROBUSTNESS FOR BSDEs WITH JUMPS

Abstract. We consider the robustness property, also known in the literature as stability property, of backward stochastic differential equations with jumps, hereinafter BSDEJ. In our framework, we regard as standard data the sextuple $\mathcal{D} = (X, \mathbb{F}, T, \xi, f, C)$, where $\mathbb{F}$ is a general filtration, T is an $\mathbb{F}$-stopping time, X is an $\mathbb{F}$-martingale, f is a stochastic Lipschitz driver, ξ is an $\mathcal{F}_T$-terminal value and C is a random Lebesgue-Stieltjes integrator, all accompanied with suitable integrability and measurability conditions. The term robustness stands for the continuity of the operator which maps the standard data $\mathcal{D}$ to the solution $\mathcal{S} = (Y, Z, U, N)$ of the

$\mathcal{D}$-BSDEJ

$$Y_t = \xi + \int_t^T f_s(Y_s, Z_s, U_s)\ \mathrm{d}C_s - \int_t^T Z_s\ \mathrm{d}X_s^c - \int_t^T \int_{\mathbb{R}^n} U_s(x)\ \widetilde{\mu}^X(\mathrm{d}s, \mathrm{d}x) - \int_t^T \mathrm{d}N_s,$$

for $\mathcal{S}$ belonging in a suitable space.
Apart from the robustness property, two other results of independent interest are presented. The first one is a result on existence and uniqueness of solutions for BSDEJ, which generalises the result by El Karoui and Huang, [2], to the stochastically non-continuous case. This enables us to treat under a unified framework both continuous and dicrete time BSDEJ. The second one is the robustness of martingale representations under different filtrations, a result which generalises the one given by Jacod, Méléard and Protter, [1].
The robustness property allows us to derive numerical schemes for the $\mathcal{D}$-BSDEJ. In the case of a Lévy martingale X, the robustness for discrete time approximations is given by Madan, Pistorius and Stadje, [3], a result which can be seen as a special case of our general framework.

References

[1] J. Jacod, S. Méléard, and P. Protter. "Explicit form and robustness of martingale representations". In: Ann. Probab. 28.4 (Oct. 2000), pp. 1747–1780.

[2] N. El Karoui and J. Huang. "A general result of existence and uniqueness of backward stochastic differential equations". In: Backward Stochastic Differential Equations. Ed. by N. El Karoui and L. Mazliak. Vol. 364. Chapman & Hall/CRC Research Notes in Mathematics Series. CRC Press, 1997, pp. 27–36.

[3] D. Madan, M. Pistorius, and M. Stadje. "Convergence of BSDEs driven by random walks to BSDEs: the case of (in)finite activity jumps with general driver". url: http: //arxiv.org/abs/1406.7145.

Massimo Secci (Technische Universität Berlin)

Title. PESIN'S FORMULA FOR ISOTROPIC BROWNIAN FLOWS

Abstract. Pesin's formula is a relation between entropy of a dynamical system and its positive Lyapunov exponents. This formula was first established by Pesin in the late 1970s for some deterministic dynamical systems acting on a compact Riemannian manifold. Later were obtained plenty of generalizations of it. For example, different authors have proved the formula for some random dynamical systems, or have relaxed condition of state space compactness. Nevertheless, it has never been obtained for dynamical systems with invariant measure, which is infinite. The problem is that if invariant measure is infinite, then notion of entropy becomes senseless. Invariant measure of isotropic Brownian flows is Lebesgue measure on $\mathbb{R}^d$, which is, clearly, infinite. Nevertheless, we define entropy for such kind of flows using their translation invariance. Then we study analogue of Pesin's formula for these flows using defined entropy.

Vitalii I. Senin (Technische Universität Berlin)

Title. TIME DEPENDENT RANDOM CONDUCTANCE MODEL AND HEAT KERNEL ESTIMATES

Abstract. A time dependent RCM is a random walk on $\mathbb{Z}^d$ with the time dependent generator

$$\mathcal{L}_{\omega_t} f(x) = \sum_{y \sim x} \omega_t(x,y)(f(y) - f(x)),$$

where the ω_t's are positive random weights (called conductances) associated to the nearest neighbour edges (x,y). We will present an anchored Nash inequality recently introduced by J. C. Mourrat and F. Otto, which is useful to prove on diagonal upper bounds for the heat kernel $p_{s,t}(x,y)$ when the conductances are bounded from above but not from below. Then, exploiting decreasing properties of some funcionals, we will show Gaussian upper bounds for the heat kernel.

Jana Šnupárková (University of Chemistry and Technology, Prague)

Title. SDE WITH MULTIPLICATIVE FRACTIONAL BROWNIAN NOISE

Abstract. In the talk the existence of solutions to SDE's with multiplicative fractional Brownian noise will be discussed in the case where Hurst parameter $H > 1/2$ and stochastic integral is understood in Skorokhod and Stratonovich sense.

Tomáš Sobotka (University of West Bohemia, Pilsen)

Title. ROBUSTNESS ANALYSIS OF STOCHASTIC VOLATILITY MODELS UNDER DATA UNCERTAINTY

Abstract. In this talk we focus on jump-diffusion stochastic volatility models and we provide a methodology to quantify model calibration robustness under a data structure uncertainty. First of all we briefly look on how to obtain option prices using the generalized complex Fourier transform for a generic affine jump-diffusion model. This way we are able to retrieve numerically efficient pricing routines for all considered models which is a requisite for the proposed methodology. In order to quantify model robustness we set calibration trials on the data with varying structures which are obtained by bootstrapping market data sets. A mean-variance robustness criterion is introduced and the results of three popular models are compared.

Petr Veverka (UTIA, Academy of Sciences of CR, Prague)

Title. STOCHASTIC MAXIMUM PRINCIPLE FOR ERGODIC CONTROL PROBLEM IN FINITE DIMENSION

Abstract. A new kind of stochastic maximum principle for ergodic control of dissipative systems will be introduced. The main difficulty lies in formulating the adjoint backward equation which is done by an appropriate duality with the linearized state process. The talk is based on joint work with C.Orrieri and G. Tessitore.

Isabell Vorkastner (Technische Universität Berlin)

Title. SYNCHRONIZATION DEPENDENT ON THE NOISE

Abstract. In the talk, I will present an example of an SDE with degenerate additve noise where synchronization depends on the strength of noise. Here, synchronization means that the weak random attractor consists of a single random point. We show how to compute the top Lyapunov exponent and observe a change of sign. Then, we prove Synchronization in case of negative top Lyapunov exponent and no (weak) synchronization in case of positive Lyapunov exponent.