Abstracts

AbdulRahman Al-Hussein (Qassim University, Saudi Arabia)

BSPDEs and their applications to stochastic optimal control

In this talk we will present briefly the theory of existence and uniqueness of solutions to backward stochastic partial differential equations (BSPDEs). Such an equation is driven by an infinite dimensional martingale. This result is based on our work in [4]. Applications of BSPDEs to stochastic optimal control problems governed by SPDEs are provided. We shall cover the case when the control domain is not necessarily convex. All proofs of these applications can be found in [1], [2] and [3]. Further extensions and examples will be discussed as well.

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Sebastian Andres (Universität Bonn, Germany)

Invariance Principle for the Random Conductance Model with dynamic Conductances

In this talk we present a quenched invariance principle for the random conductance model. More precisely, we consider a continuous time random walk X in an environment of time-dependent random conductances in $\mathbb{Z}^d$. We assume that the conductances are stationary ergodic, uniformly bounded and bounded away from zero and polynomially mixing in space and time. In the last years quenched invariance principles have been proven for X in the case of static conductances under various assumptions on the law of the conductances, while the result for general i.i.d. conductances has been recently obtained in [2]. At the end of the talk we will discuss applications for stochastic interface models.

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David Applebaum (University of Sheffield, UK)

Second quantised representation of Mehler semigroups associated with Banach space valued Lévy processes

The solutions of linear SPDEs driven by Banach space valued additive Levy noise are generalised Ornstein-Uhlenbeck processes. These are Markov processes and their transition semigroups are sometimes called Mehler semigroups. If the driving noise is a Brownian motion then Anna Chojnowska-Michalik and Ben Goldys [1, 2] have shown that these semigroups can be represented by means of second quantisation within a suitable chaotic decomposition. The result has recently been extended to the Levy case (for Hilbert space valued noise) by Szymon Peszat [3] using a point process construction. In this talk I will present an alternate approach to this construction based on the use of exponential martingales.

This talk is based on joint work with Jan van Neerven (Delft)

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Bartosz Bandrowski (University of Zielona Góra, Poland)

Perturbed Volterra equations of convolution type

We consider stochastic perturbed Volterra equation of the form

$$X(t) = X_0 + \int_0^t [a(t-\tau) + (a*k)(t-\tau)]AX(\tau)d\tau + \int_0^t b(t-\tau)X(\tau)d\tau + \sum_{i=1}^{\infty} \int_0^t \Psi_i(\tau)dW_i(\tau),$$

in a separable Hilbert space H. In the above $t \geq 0$, X_0 is an H-valued random variable, $a,\ k,\ b \in L^1_{loc}(\mathbb{R}_+;\mathbb{R})$ are kernel functions and A is a closed unbounded linear operator in H with a dense domain. The noise term in the equation is defined as a series of integrals with respect to independent scalar Wiener processes W_i defined on a probability space $(\Omega, \mathcal{F}, (\mathcal{F}_t)_{t\geq 0}, P)$. The functions Ψ_i are adapted, piecewise uniformly continuous with values in $L^2(\Omega; H)$. The construction of the above stochastic integral is due to Onno van Gaans [1].

We use the resolvent approach to the considered equation. This approach is a generalization of the semigroup approach, which is usually used to differential equations. In the resolvent approach we introduce a family of bounded linear operators in H generated by the operator A and the kernel functions $a,\ k$ and b. The existence and approximation results for such operators have been provided by A. Karczewska and C. Lizama [4].

In the presentation we will provide sufficient conditions for the existence of the strong solution to the above perturbed stochastic Volterra equation. Moreover, we will discuss properties of the stochastic convolution corresponding to the equation under consideration. Our results are a generalization of the results obtained by A. Karczewska and C. Lizama in [2, 3] for the stochastic Volterra equations in the case where $k = b = 0$.

Joint work with Anna Karczewska.

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Rodrigo Bañuelos (Purdue University, West Lafayette, USA)

Heat trace asymptotics for Schrödinger operators

We present some result on higher order asymptotics for the trace difference of non-local Schrödinger operators on $\mathbb{R}^d$, $d \geq 1$. In particular, we discuss versions of M. van den Berg's two-term asymptotics when the Laplacian is replaced by the fractional Laplacian, the relativistic stable Laplacian and the mixed stable Laplacian. Some results for domains in $\mathbb{R}^d$ of finite volume will be stated and (time permitting) the connections to the Weyl's asymptotics law will be mentioned.

Mariusz Bieniek (Maria Curie-Skłodowska University, Lublin, Poland)

Extinction of Fleming-Viot-type particle systems with strong drift

For any fixed domain $D \subset \mathbb{R}^d$ and an integer $N \geq 2$, the Fleming-Viot-type process $\mathbf{X}_t = (X_t^1, \ldots, X_t^N)$, $t \geq 0$, driven by a diffusion X, is defined as follows: let $\mathbf{X}_0 = (x_0^1, \ldots, x_0^N) \in D$ and then $X_t^1, \ldots, X_t^N$ move in D as independent copies of X until the time τ_1 when one of them hits the boundary ∂D of D. Then the particle on the boundary dies, and one of the remaining particles splits into two, or in other words the particle that hit the boundary jumps onto one of the remaining particles. Then again all N particles move as independent copies of X up to time τ_2, when one of them hits ∂D, and so on.

If $\{\tau_n,\, n \geq 1\}$ is the sequence of times of successive jumps, then the evolution of $\mathbf{X}_t$ is well defined only up to time

$$\tau_\infty = \lim_{n \to \infty} \tau_n,$$

as there is no natural way of extending this definition beyond τ_∞ and therefore it is of great interest to study the conditions when $\tau < \infty$ or $\tau_\infty = \infty$. Note that the condition $\tau_\infty < \infty$ can be thought of as extinction of the process in finite time. In [3] the authors claimed that for Fleming-Viot process driven by Brownian motion in arbitrary bounded domain $D \subset \mathbb{R}^d$ we have $\tau_\infty = \infty$. However, in [1] it is shown that the proof of the above claim is wrong, and moreover that the claim is true but for all Lipschitz domains $D \subset \mathbb{R}^d$ with Lipschitz constant less than or equal to a constant depending only on d.

The aim of this talk is to show examples when $\tau_\infty < \infty$. More precisely, we give outlines of the proofs of the following two theorems.

Theorem 1. *Let $\mathbf{X}$ be a Fleming-Viot process with N particles on $(0, \infty)$ driven by Bessel process of dimension $\nu \in \mathbb{R}$.*

(i) If $N = 2$ then $\tau_\infty < \infty$, a.s., if and only if $\nu < 0$.

(ii) If $N\nu \geq 2$ then $\tau_\infty = \infty$, a.s.

Consider the following SDE for a diffusion on $(0,2]$,

$$X_t = x_0 + W_t - \int_0^t \frac{1}{\beta X_t^{\beta-1}}\, ds - L_t, \quad t \le T_0,$$

where $x_0 \in (0,2]$, $\beta > 2$, W is Brownian motion, T_0 is the first hitting time of 0 by X, and L_t is the local time of X at 2. We analyze a Fleming-Viot process on $(0,2]$ driven by the diffusion defined above. The role of the boundary is played by the point 0, i.e. the particles jump only when they reach 0.

Theorem 2. *Fix any $\beta > 2$. For every $N \ge 2$, the N-particle Fleming-Viot process on $(0,2]$ driven by X, has the property that $\tau_\infty < \infty$, a.s.*

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Katarzyna Borkowska (University of Technology and Life Sciences in Bydgoszcz, Poland)

Generalized BSDEs driven by fractional Brownian motion (poster)

Fractional Brownian motion (fBm) with Hurst parameter $H \in (0,1)$ is a zero mean Gaussian continuous process $B^H = \{B_t^H,\ t \ge 0\}$ with the covariance function

$$R_H(s,t) = E\left(B_s^H B_t^H\right) = \frac{1}{2}\left(t^{2H} + s^{2H} - |t-s|^{2H}\right).$$

The aim of the presentation is to show the existence and uniqueness of the solution of generalized backward stochastic differential equation with respect to fBm $(H > 1/2)$ of the form

$$Y_t = \xi + \int_t^T f(s,\eta_s,Y_s,Z_s)ds + \int_t^T g(s,\eta_s,Y_s)d\Lambda_s - \int_t^T Z_s dB_s^H,$$

where $\{\eta_t\}_{t\in[0,T]}$ is a solution of a stochastic differential equation with reflection, f, g are continuous functions and $\{\Lambda_t\}_{t\in[0,T]}$ is an increasing process.

Dariusz Buraczewski (University of Wrocław, Poland)

On solutions of linear stochastic equations in the critical case

During the talk we are going to discuss three models in the critical case:

- the random difference equation, i.e. the Markov chain $R_n = A_n R_{n-1} + B_n$;
- the homogeneous linear equation $R =_d \sum_{i=1}^{N} A_i R_i$;
- the nonhomogeneous linear equation $R =_d \sum_{i=1}^{N} A_i R_i + B$.

We will explain 'criticality' in each case and review techniques leading to description of asymptotic properties of solutions of all models. The talk will base on joint papers with Sara Brofferio (Paris Sud), Ewa Damek (Wroclaw), Konrad Kolesko (Wroclaw).

Krzysztof Burdzy (University of Washington, Seattle, USA)

Reflected Brownian motion in fractal domains

The talk will be devoted to obliquely reflected Brownian motion in fractal domains. Time permitting, I will also discuss discrete approximations of reflected Brownian motion in fractal domains. Joint work with Zhenqing Chen, Donald Marshall and Kavita Ramanan.

Yana Butko (Bauman Moscow State Technical University, Russia)

The method of Feynman formulae for approximation of Markov evolution

We present a new method to investigate and to describe Markov evolution. This method is based on representations of corresponding evolution semigroups (or, what is the same, representations of solutions of the corresponding evolution equations) by Feynman formulae, i.e. by limits if iterated n-fold integrals when n tends to infinity. Sometimes one succeeds to get Feynman formulae containing only integrals of elementary functions. Such Feynman formulae allow to calculate solutions of evolution equations directly, to approximate transition probabilities of underlying stochastic processes, to model stochastic and quantum dynamics numerically.

The limits in Feynman formulae often coincide with some functional integrals with respect to probability measures[1] or Feynman type pseudomeasures. Hence, Feynman formulae provide a tool to establish some new Feynman–Kac formulae, to calculate functional integrals, to find new connections between quantum mechanics and stochastic analysis.

In the talk we present different types of Feynman formulae for Feller semigroups and semigroups generated by stochastic processes in a domain with absorption on the boundary. We show how the method works for additive and multiplicative perturbations of semigroups. We also discuss some Feynman–Kac formulae and phase space Feynman path integrals related to the obtained Feynman formulae.

Some of the results are obtained in collaboration with O.G. Smolyanov, R.L. Schilling and M.G. Grothaus.

This work has been supported by the Grant of the President of Russian Federation MK-4255.2012.1, RFBR N10-01-00724-a, DFG and Erasmus Mundus.

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Bartłomiej Dyda (Universität Bielefeld and Wrocław University of Technology, Germany and Poland)

Some inequalities concerning Dirichlet forms of stable processes

We will present sufficient conditions on the kernel k for the comparability of the following quadratic forms:

$$\mathcal{E}(u) := \int_D \int_D \frac{(u(x)-u(y))^2}{|x-y|^{d+\alpha}}\, dy\, dx,$$
$$\mathcal{E}^k(u) := \int_D \int_D \frac{(u(x)-u(y))^2}{|x-y|^{d+\alpha}} k(x-y)\, dy\, dx.$$

We will show some applications of that fact. We will also present an extension of the comparability theorem to weighted forms:

$$\mathcal{E}_\phi(u) := \int_D \int_D \frac{(u(x)-u(y))^2}{|x-y|^{d+\alpha}} (\phi(y) \wedge \phi(x))\, dy\, dx,$$
$$\mathcal{E}^k_\phi(u) := \int_D \int_D \frac{(u(x)-u(y))^2}{|x-y|^{d+\alpha}} (\phi(y) \wedge \phi(x)) k(x-y)\, dy\, dx.$$

The results are joint work with Moritz Kassmann.

Lawrence Evans (University of Missouri, Columbia, USA)

Existence of an Invariant Measure for the Kick-Forced Primitive Equations with Physical Boundary Conditions

The 3-dimensional primitive equations are a variant of the 3-dimensional Navier-Stokes equations in which the equation for the third component of velocity is removed and we make the assumption that the pressure is independent of the third space coordinate. In particular, we consider the physically realistic "physical boundary conditions".

Although more computationally messy, the primitive equations hold some advantages over the Navier-Stokes equations: While the uniqueness of weak solutions (i.e. in L^2) remains open, the global existence of strong solutions (i.e. in H^1) is known.

We show that there exists (in H^1) an invariant measure to the primitive equations with kick-forcing. The structure of the primitive equations makes H^a-norm estimates very difficult for $a > 1$. We instead use a more subtle compactness argument introduced by Ning Ju.

Christel Geiss (University of Innsbruck, Austria)

Lévy driven BSDEs: L_2-regularity and fractional smoothness

Motivated by the results about the L_p-variation of *backward stochastic differential equations* (BSDEs) obtained in [1], we are interested in the L_2-regularity of the solution (Y, Z) to the BSDE

$$\begin{aligned} Y_t &= H + \int_t^T f\left(s, Y_s, \int_{\mathbb{R}} Z_{s,x}\kappa(dx)\right) ds - \sigma \int_{(t,T]} Z_{s,0} dW_s \\ &\quad - \int_{(t,T]\times\mathbb{R}} Z_{s,x}\, x\tilde{N}(dt, dx), \quad 0 \le t \le T. \end{aligned}$$

Here (σW_s) is the Brownian part and $\tilde{N}$ denotes the compensated Poisson random measure associated with a square integrable Lévy process (L_t). We assume that the generator f is Lipschitz (κ is a certain measure on $\mathbb{R}$) while the terminal condition $H \in L_2$ is supposed to be a function of finitely many increments of (L_t). Examples are $H = \mathbb{1}_{[k,\infty)}(X_T^n)$, where X_T^n is the Euler approximation of the SDE

$$X_t = x_0 + \int_0^t a(X_{s-}) dL_s, \quad 0 \le t \le T,$$

or $H = g(L_{t_1} - L_{t_0}, ..., L_{t_n} - L_{t_{n-1}})$ with $0 \le t_1 < t_2 < ... < t_n \le T$ and $g : \mathbb{R}^n \to \mathbb{R}$ being a Borel function.

We introduce the concept of (path-dependent) fractional smoothness in the Malliavin sense, i.e. a version of anisotropic Besov spaces defined by the real interpolation method, and relate the fractional smoothness of H to the L_2-regularity properties of the solution (Y, Z).

This is joint work with A. Steinicke.

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Nicola Gigli (Université de Nice, France)

On the differential structure of metric measure spaces and applications

We will discuss the possibility of analyzing the duality relations between differentials and gradients of Sobolev functions defined on arbitrary metric measure spaces. As a first application we derive the definition of distributional Laplacian and show that on spaces with Ricci curvature bounded from below the Laplacian of the distance function has the standard sharp comparison properties.

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Tomasz Grzywny (TU Dresden and Wrocław University of Technology, Germany and Poland)

On the potential theory of one-dimensional subordinate Brownian motions

The purpose of this talk is to present some recent results about subordinate Brownian motions on $\mathbb{R}$. We give new forms of estimates for the Lévy and potential density of the subordinator near zero. These results provide us to find estimates for the Lévy and potential density of the subordinate Brownian motion X near origin. Next we show the asymptotic behaviour of the derivative of the renewal function of the ascending ladder-height process for Using these results we find estimates for the Poisson kernel of a half-line.

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Masanori Hino (Graduate School of Informatics, Kyoto University, Japan)

Geodesic distances and intrinsic distances on some fractal sets

The off-diagonal Gaussian asymptotics of the heat kernel density associated with local Dirichlet form is often described by using the intrinsic distances (cf. [4, 3] and the references therein). When the underlying space has a Riemannian structure, the geodesic distance is defined as well, and it coincides with the intrinsic distance in good situations.

Then, what if the underlying space is a fractal set? In typical examples, the heat kernel asymptotics is *sub*-Gaussian; accordingly, the intrinsic distance vanishes identically. However, if we take (a sum of) energy measures as the underlying measure, we can define the nontrivial intrinsic distance as well as the geodesic distance, and can pose a problem whether they are identical. For the two-dimensional standard Sierpinski gasket, the affirmative answer has been obtained ([1, 2]) by using some detailed information on the transition density. In this talk, I will discuss this problem in a more general framework and provide some partial answers based on elementary arguments.

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Yasushi Ishikawa (Ehime University, Matsuyama, Japan)

Optimal Consumption Control Problem Associated with Jump-Diffusion Processes

We study an optimal consumption control problem in a jump-diffusion model under the uncertainty. We show a verification result to the existence of a solution of the Hamilton-Jacobi-Bellman equation associated with the stochastic optimization problem, and then give an optimal consumption policy in terms of the solution. An application to the one-sector Ramsey theory in the economic growth is also given.

Adam Jakubowski (Nicolaus Copernicus University, Toruń, Poland)

S-topology on the Skorokhod space. Recent developments and complements

It is known that the Skorokhod space of càdlàg functions is a Polish space when equipped with Skorokhod's J_1 topology. This topology, however, is non-linear, hence difficult in handling e.g. minimization problems. On the Skorokhod space there exists also a weaker, sequential topology, called S, in which addition is sequentially continuous and which have already found several applications.

In the talk we review typical applications of S-topology.

In the part related to complements we define a locally convex topology on the Skorokhod space and show that the sequential topology generated by the newly defined topology coincides with the S-topology. We shaw also how to define the S-topology on the space of càdlàg functions on the positive half line.

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Tomasz Jakubowski (Wrocław University of Technology, Poland)

Fractional Laplacian with singular drift

For $\alpha \in (1,2)$ we consider the equation $\partial_t u = \Delta^{\alpha/2}u - b \cdot \nabla u$, where b is a time-independent, divergence free singular vector field belonging to the Morrey space $M_1^{1-\alpha}$. We show that if $||b||_{M_1^{1-\alpha}}$ is sufficiently small the fundamental solution is globally in time comparable with the density of the isotropic stable process. The talk is based on the papers [1], [2].

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Naotaka Kajino (Universität Bielefeld, Germany)

Weyl's Laplacian eigenvalue asymptotics for the measurable Riemannian structure on the Sierpinski gasket

On the Sierpiński gasket K, Kigami [3] has introduced the notion of the measurable Riemannian structure, with which the "gradient vector fields" of functions, the "Riemannian volume measure" μ and the "geodesic metric" $\rho_{\mathcal{H}}$ are naturally associated. Kigami has also proved in the same paper the two-sided Gaussian bound for the corresponding heat kernel $p_t^{\mathcal{H}}(x,y)$, and I have further shown several detailed heat kernel asymptotics, such as Varadhan's asymptotic relation

$$\lim_{t\downarrow 0} 4t \log p_t^{\mathcal{H}}(x,y) = -\rho_{\mathcal{H}}(x,y)$$

in a recent paper [1].

In the talk, Weyl's Laplacian eigenvalue asymptotics is presented for this case. Specifically, let d be the Hausdorff dimension of K and $\mathcal{H}^d$ the d-dimensional Hausdorff measure on K, both with respect to the "geodesic metric" $\rho_{\mathcal{H}}$. Then for some $c_N > 0$ and for any non-empty open subset U of K with $\mathcal{H}^d(\partial U) = 0$,

$$\lim_{\lambda\to\infty} \frac{N_U(\lambda)}{\lambda^{d/2}} = c_N \mathcal{H}^d(U),$$

where $N_U(\lambda)$ is the number of the eigenvalues, less than or equal to λ, of the Dirichlet Laplacian on U. Moreover, we will also see that the Hausdorff measure $\mathcal{H}^d$ is Ahlfors regular with respect to $\rho_{\mathcal{H}}$ but that it is singular to the "Riemannian volume measure" μ. A renewal theorem for functionals of Markov chains due to Kesten [2] plays a crucial role in the proof of the above asymptotic behavior of $N_U(\lambda)$.

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Kamil Kaleta (Wrocław University of Technology, Poland)

Intrinsic ultracontractivity and ground state estimates for Feynman-Kac semigroups of some class of Lévy processes

We derive two-sided sharp estimates of the ground state and characterize the (asymptotic) intrinsic ultracontractivity property of Feynman-Kac-type semigroups related to a class of symmetric Lévy processes subject to some regularity assumptions on the Lévy measure. These assumptions are satisfied by basic classes of Lévy processes, including many cases of interest such as rotationally invariant stable, relativistic stable, stable-like, mixed stable, jump-diffusion, and others. The talk is based on joint work with J. Lőrinczi.

Grzegorz Karch (University of Wrocław, Poland)

Nonlocal porous medium equation

We study a generalization of the porous medium equation $\partial_t u = \nabla \cdot \big(|u|\nabla p\big)$ with the nonlocal and nonlinear pressure $p = (-\Delta)^{\frac{\alpha}{2}-1}(u|u|^{m-2})$ and we show the existence of solutions to the corresponding initial value problem. Moreover, we construct explicit compactly supported self-similar solutions using the Getoor function expressing the expectation of the first passage time to the exterior of the unit ball of the symmetric α-stable process.

This is a joint work with Piotr Biler and Cyril Imbert.

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Moritz Kaßmann (Universität Bielefeld, Germany)

Local Regularity of Nonlocal Operators

In recent years several important regularity results for differential operators of second order have been extended or rather transferred to integrodifferential operators of order $\alpha/2 \in (0, 1)$. We review some of these works with a special emphasis on two issues: the notion of ellipticity for nonlocal operators and robustness of the results as $\alpha \to 2-$. The talk is based on recent joint works with Dyda, Felsinger, Mimica and Rang.

Panki Kim (Seoul National University, Korea)

On Green function of subordinate Brownian motion

A subordinate Brownian motion is a Lévy process which can obtained by replacing the time of Brownian motion by an independent increasing Lévy process. In this talk, we consider a large class of subordinate Brownian motions without diffusion term. We discuss an explicit form of sharp two-sided estimates on the Green functions of these subordinate Brownian motions in bounded $C^{1,1}$ open set.

Tomasz Komorowski (Maria Curie-Skłodowska University, Lublin, Poland)

Behavior of a passive tracer in a long range correlated flow

In our talk we consider a passive tracer particle moving in a locally self-similar, d-dimensional, Gaussian, stationary random vector field with incompressible realizations. In case when the correlations of the flow decay sufficiently fast it has been shown in [3], for time dependent flows, and in [2], for time independent ones, that the diffusively scaled particle trajectory converge in law to a Brownian motion (even without the assumption of incompressibility of trajectories). In our paper [1] we have shown that when the correlations decay, but not too fast, the laws of the trajectories under shorter than diffusive scale converge to a superdiffusive fractional Brownian motion. However, the diffusive scale reappears when we consider the relative motion of two particles, [4].

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Tadeusz Kulczycki (Wrocław University of Technology, Poland)

Gradient estimates of q-harmonic functions of fractional Schrödinger operator

We will present results concerning gradient estimates of q-harmonic functions u of the fractional Schrödinger operator $-(-\Delta)^{\alpha/2}+q$, $\alpha \in (0,1]$ in bounded domains $D \subset \mathbf{R}^d$. For nonnegative u we show that if q is Hölder continuous of order $\eta > 1-\alpha$ then $\nabla u(x)$ exists for any $x \in D$ and $|\nabla u(x)| \leq cu(x)/(\text{dist}(x, \partial D) \wedge 1)$. The exponent $1-\alpha$ is critical i.e. when q is only $1-\alpha$ Hölder continuous $\nabla u(x)$ may not exist. The above gradient estimates were known for $\alpha \in (1,2]$ under the assumption that q belongs to the Kato class $\mathcal{J}^{\alpha-1}$. The case $\alpha \in (0,1]$ is different. To obtain results for $\alpha \in (0,1]$ probabilistic methods are used. As a corollary, one obtains for $\alpha \in (0,1)$ that a weak solution of $-(-\Delta)^{\alpha/2}u+qu=0$ is in fact a strong solution.

Kazumasa Kuwada (Ochanomizu University, Tokyo, Japan)

An extension of Wasserstein contraction associated with the curvature-dimension condition

We obtain a new characterization of complete Riemannian manifolds with lower Ricci curvature bound and upper dimension bound in terms of the Wasserstein distance between heat distributions. It is formulated as a local space-time Lipschitz estimate of the Wasserstein distance between two heat distributions with different initial data at different times. It extends a part of result in [2] where they studied the case that no upper dimension bound is imposed. The proof is based on establishing an equivalence with a gradient estimate of heat semigroups studied in [3], by following a strategy in [1]. In addition, we can obtain a sharper estimate by using a coupling method.

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Kazuhiro Kuwae (Kumamoto University, Japan)

On analytic characterizations of gaugeability for generalized Feynman-Kac functionals

We give analytic characterizations of gaugeability for generalized Feynman-Kac functionals including continuous additive functional of zero quadratic variation in the framework of irreducible, transient m-symmetric Markov processes under the absolute continuity condition with respect to m. Our result improves the previous work due to Chen [1, 2] even if we restrict ourselves to deal with non-local perturbations. We also prove that such a characterization is also equivalent to the subcriticality of the Schrödinger operator associated to our generalized Feynman-Kac semigroup under some conditions.

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Mateusz Kwaśnicki (Polish Academy of Sciences and Wrocław University of Technology, Poland)

Two-term asymptotics for Lévy operators in intervals

The eigenvalues $(-\lambda_n)$ of the Dirichlet Laplace operator Δ in a domain $D \subseteq \mathbf{R}^d$ obey the Weyl law

$$\lambda_n = c_d |D|^{-2/d} n^{2/d} + o(n^{2/d}),$$

with $c_d = (2\pi)^2/|B(0,1)|^{2/d}$. The second term is known for many smooth domains due to Ivrii [2]:

$$\lambda_n = c_d |D|^{-2/d} n^{2/d} + \tilde{c}_d |D|^{-1-1/d} |\partial D| n^{1/d} + o(n^{1/d}),$$

where $\tilde{c}_d$ is known explicitly.

Blumenthal and Getoor [1] proved that the eigenvalues $(-\lambda_n)$ of the fractional Laplace operator $-(-\Delta)^{\alpha/2}$ in a domain $D \subseteq \mathbf{R}^d$ with Dirichlet exterior condition satisfy the Weyl-type law

$$\lambda_n = c_{d,\alpha} |D| n^{\alpha/d} + o(n^{2/d}),$$

where $c_{d,\alpha} = (2\pi)^\alpha/|B(0,1)|^{\alpha/d}$. However, no Ivrii-type result is known in the fractional case. Due to lack of explicit expressions, even for the interval $D = (-a, a)$ the second term was not known until very recently. With Kamil Kaleta, Tadeusz Kulczycki, Jacek Małecki and Andrzej Stós [3, 4, 5] we proved that in this case

$$\lambda_n = \left(\tfrac{n\pi}{2a} - \tfrac{(2-\alpha)\pi}{8a}\right)^\alpha + O(\tfrac{1}{n}).$$

Generalizations to many other generators of one-dimensional symmetric Lévy processes are possible.

I will begin the talk with a brief review of known results in the area. Next I will discuss the above two-term asymptotic formula and its extensions. Finally, I will show the main ideas behind our results.

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Ki-Ahm Lee (Seoul National University, Korea)

Regularity theory and Asymptotic Behaviors in Integro-differential operators

In this talk, we consider the asymptotic behavior of nonlocal flows $u_t + (-\triangle)^{\frac{1}{2}}u = 0$ to find the geometric property of the solutions in nonlinear eigenvalue problem:

$$(-\triangle)^{\frac{1}{2}}\varphi = \lambda\varphi$$

posed in a strictly convex domain $\Omega \subset \mathbb{R}^n$ with $\varphi > 0$ in Ω and $\varphi = 0$ on $\mathbb{R}^n \backslash \Omega$. This corresponds to an eigenvalue problem for Cauchy process. The concavity of φ is well known for the dimension $n = 1$. In this talk, we will show $\varphi^{-\frac{2}{n+1}}$ is convex. Moreover, the eventual power-convexity of the parabolic flows is also proved. We extend geometric results to Cauchy problem for the fractional heat operator.

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Janna Lierl (Universität Bonn, Germany)

Boundary Harnack principle on inner uniform domains

The boundary Harnack principle states that the ratio of any two functions that are positive and harmonic on some domain, is bounded near part of the boundary where both functions vanish. A given domain may or may not have this property, depending on the geometry of its boundary and the ambient metric space. In this talk I will focus on a geometric (scale-invariant) version of the boundary Harnack principle which holds on domains that satisfy an inner uniformity condition. This condition is described solely in terms of the length metric of the domain. Interesting examples in Euclidean space are the interior or exterior of the Koch snowflake, or the complement of a convex set. I will discuss generalizations to (non-symmetric or fractal-type) Dirichlet spaces that have certain geometric properties (doubling measure, Poincare inequality, etc).

Xue-Mei Li (University of Warwick, UK)

Convergence of Stochastic Processes and Collapsing of Manifolds

Out talk is concerned with the convergence of stochastic processes on Berger's spheres, associated to the Hopf fibration, considered together with the problem of collapsing manifolds. A family of manifolds equipped with a family of Riemannian metrics converge to a Riemannian manifold of lower dimension while keeping the sectional curvatures bounded.

Terry J. Lyons (University of Oxford, UK)

What have rough paths got to do with finance: Extending Itō's formula

Jan Maas (Universität Bonn, Germany)

Ricci curvature of Markov chains via convexity of the entropy

We shall discuss a new notion of Ricci curvature that applies to Markov chains on discrete spaces. This notion relies on geodesic convexity of the entropy and is analogous to the one introduced by Lott, Sturm, and Villani for geodesic measure spaces. In order to apply to the discrete setting, the role of the Wasserstein metric is taken over by a different metric, having the property that continuous time Markov chains are gradient flows of the entropy. This allows us to prove discrete analogues of results by Bakry–Émery and Otto–Villani.

This is joint work with Matthias Erbar.

Marinela Marinescu and **Daniela Ijacu** (Bucharest Academy of Economic Studies, Romania)

Three problems for stochastic flows associated with nonlinear SPDEs and backward parabolic equations with parameters

In this paper are solved three problems related to stochastic differential equations. In problem (A) we construct a classical solution for a Markovian system of SDE with parameters for which a useful integral representation of the stochastic flow is valid. In problem (B) a fundamental system of stochastic first integrals can be constructed as the unique solution of the flow equation. The solution of Problem (A) and (B) is used to associate a non-Markovian SDE and functionals for which a filtering Problem (C) is solved, where the drift vector fields commutes with diffusion vector fields.

Ante Mimica (Universität Bielefeld, Germany)

Harnack Inequalities for Subordinate Brownian Motions

A class of subordinate Brownian motions in $\mathbf{R}^d$ ($d \geq 1$) is considered. The aim is to show scale invariant Harnack inequalities for non-negative functions which are harmonic with respect to these processes. The examples covered by this approach include geometric stable processes and, more generally, a class of subordinate Brownian motions for which the Laplace exponent of the underlying subordinator varies slowly at infinity. New forms of asymptotical behavior of the Lévy density and the Green function near the origin will be presented.

James Norris (University of Cambridge, UK)

Estimates on the convergence of Kac's particle model for a dilute gas of hard spheres to the Boltzmann equation

I will present a new proof of Sznitman's convergence theorem. The new argument combines martingale and metric entropy inequalities to obtain an explicit estimate in a weighted Wasserstein distance, which is a more quantitative version of Sznitman's result.

Harald Oberhauser (TU Berlin, Germany)

Revisiting Clark's robustness problem in nonlinear filtering

In the late seventies, Clark pointed out that it would be natural for π_t, the probability measure that is the solution of the stochastic filtering problem, to depend continuously on the observed data $\{Y_s : s \in [0,t]\}$. Indeed, if the signal and the observation noise are independent one can show that, for any suitably chosen test function f, there exists a continuous map θ_t^f defined on the space of continuous paths endowed with the uniform convergence topology such that $\pi_t = \theta_t^f(Y)$ a.s. Unfortunately, for general correlated noise and multidimensional observations such a representation does not hold. By using the theory of rough paths we provide a solution: if the observation is "lifted" to a process $\boldsymbol{Y}$ that includes the Lévy-area process one can show that $\pi_t = \tilde{\theta}_t^f(\boldsymbol{Y})$ a.s. where $\tilde{\theta}_t^f$ is a *continuous* map defined on a suitably chosen space of rough paths. Further, we give a similar approach on the level of the Zakai SPDE by using the theory of viscosity solutions. (Joint work with D.Crisan,J.Diehl,P.Friz).

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Adam Osękowski (University of Warsaw, Poland)

Orthogonal martingales and Riesz transforms

Orthogonal martingales arise naturally while studying the probabilistic counterpart of the classical Riesz' theorem which compares the sizes of a harmonic function on the circle and its conjugate. We will introduce a general method to prove estimates for such martingales and, as application, we will show how these can be used to yield interesting sharp bounds for Riesz transforms in $\mathbb{R}^d$.

Mihai Pascu (Transilvania University of Braşov, Romania)

Brownian couplings and applications

The technique of coupling is a useful probabilistic tool for obtaining various estimates or comparisons of certain quantities associated with the processes involved.

In this talk I will present some of the main couplings of reflecting Brownian motions in smooth domains: synchronous, mirror and scaling coupling of reflecting Brownian motions.

As applications, I will present a resolution of the Hot spots conjecture (Jeffrey Rauch, 1974) in the case of smooth convex domains with symmetries, a unifying proof of Isaac Chavel's conjecture (1986) on the domain monotonicity of the Neumann heat kernel in the case of convex domains satisfying the intermediate ball condition, and a resolution of the Laugesen-Morpurgo conjecture (1998) on the radial monotonicity of the diagonal of the Neumann heat kernel of the unit ball in $\mathbb{R}^n$.

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Robert Philipowski (Université du Luxembourg, Luxembourg)

Ricci flow, Brownian motion and entropy

We discuss Brownian motion on manifolds with time-dependent Riemannian metric. In particular, we present a criterion for non-explosion and an application to an entropy formula for Ricci flow on non-compact manifolds. This talk is based on joint work with Kazumasa Kuwada, Hongxin Guo and Anton Thalmaier.

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Katarzyna Pietruska-Pałuba (University of Warsaw, Poland)

Poincaré inequality and related function spaces on fractals

Given a nondegenerate harmonic structure, we elementarily prove a Poincaré-type inequality for functions in the domain of the Dirichlet form on nested fractals, involving the Kusuoka energy measure. We then study the Hajlasz-Sobolev spaces on nested fractals.

The results were obtained jointly with Andrzej Stós (Clermont-Ferrand).

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Jan Rosiński (University of Tennessee, Knoxville, USA)

Asymptotic independence and limit laws for Wiener chaos

Let $(X_i)_{i\in I}$ be random variables such that each X_i is a homogeneous Wiener chaos of order q_i relative to a fixed Brownian motion. Consider $(X_i)_{i\in I_k}$, where

$I_k \subset I$ are disjoint nonempty blocks. Then $(X_i)_{i\in I_k}$ are independent between blocks if and only if $\mathrm{Cov}(X_i^2, X_j^2) = 0$ for all i, j which are not in the same block. This extends the criterion for the independence of a sequence of multiple Wiener-Itô integrals given in Rosiński and Samorodnitsky (1999) (the case $\mathrm{Card}(I_k) = 1$). It also generalizes the well-known covariance criterion for the independence of jointly Gaussian random variables ($q_i = 1$).

We extend this criterion to the asymptotic moment-independence of a homogeneous Wiener chaos. As a consequence, we derive a multidimensional version of the celebrated fourth moment theorem of Nualart and Peccati (2005) and show new bounds on the rate of convergence. Other related results on the multivariate convergence of multiple Wiener-Itô integrals, that involve Gaussian and non Gaussian limits, will be discussed. If time permits, an extension to a non-Gaussian discrete chaos will also be mentioned.

This talk is based on a recent joint work with Ivan Nourdin.

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Andrzej Rozkosz (Nicolaus Copernicus University, Toruń, Poland)

Semilinear obstacle problem with measure data and generalized reflected BSDEs

We consider semilinear obstacle problem with measure data associated with uniformly elliptic divergence form operator. We show existence and uniqueness of entropy solution of the problem and its stochastic representation in terms of solution of some generalized backward stochastic differential equation.

Joint work with Tomasz Klimsiak and Leszek Słomiński.

Michał Ryznar (Wrocław University of Technology, Poland)

Dirichlet heat kernels and exit times for subordinate Brownian motions

Let $B(t)$ be a d-dimensional Brownian motion and T_t be an independent subordinator with its Laplace exponent being a complete Bernstein function. We consider the behaviour of the heat kernel (transition density) of the subordinate process $Y(t) = B(T_t)$ killed after exiting an open set D. One of the most important examples is a rotationaly invariant stable process for which the heat kernel $p_D(t, x, y)$ is approximately factorized as a product of the heat kernel of the free process (transition density of the free process) and the corresponding survival probabilities $P^x(\tau_D > t)P^y(\tau_D > t)$, at least for small values of t. We show that under some regularity assumptions on the subordinator the same type of behaviour holds for the underlying subordinate Brownian motion for a bounded open set with sufficiently smooth boundary. In some more particular cases we extend these type estimates to unbounded exterior sets. We also provide two-sided sharp estimates of the survival probability $P^x(\tau_D > t)$ in terms of the Laplace exponent of the subordinator.

René L. Schilling (TU Dresden, Germany)

Path Properties of Feller Processes Via the Symbol

We study some path properties of Feller and Lévy-type processes which are generated by pseudo-differential operators $-p(x, D)$ with a negative definite symbol $p(x, \xi)$. We are mainly interested in local times, transience/recurrence and short-time LILs. We show how one can use the symbol to give criteria for these properties which resemble the 'usual' criteria for Lévy processes where the symbol $p(x, \xi) = \psi(\xi)$ is just the characteristic exponent.

The results were obtained in collaboration with Jian Wang (Fujian Normal University, Fujian, China) and Victoriya Knopova (Glushkov Institute of the Academy of Sciences, Kiev, Ukraine).

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Alina Semrau-Giłka (University of Technology and Life Sciences in Bydgoszcz, Poland)

Euler's Approximations of Solutions of Reflecting SDEs with Discontinuous Coefficients (poster)

Let D be either a convex domain in $\mathbb{R}^d$ or a domain satisfying the conditions (A) and (B) considered by Lions and Sznitman [1]. The object of investigation are solutions of d-dimensional stochastic differential equations (SDEs) on a domain D with reflecting boundary condition of the form

$$X_t = X_0 + \int_0^t \sigma(X_s)\, dW_s + \int_0^t b(X_s)\, ds + K_t, \qquad t \in \mathbb{R}^+. \tag{1}$$

Here $X_0 = x_0 \in \overline{D} = D \cup \partial D$, X is a reflecting process on $\overline{D}$, K is a bounded variation process with variation $|K|$ increasing only when $X_t \in \partial D$, W is a d-dimensional standard Wiener process and $\sigma : \overline{D} \longrightarrow \mathbb{R}^d \otimes \mathbb{R}^d$, $b : \overline{D} \longrightarrow \mathbb{R}^d$ are measurable functions.

This presentation will be devoted to show convergence in law as well as in L^p for the Euler and Euler-Peano schemes for SDEs (1). The coefficients are measurable, continuous almost everywhere with respect to the Lebesgue measure and the diffusion coefficient may degenerate on some subsets of the domain. The proofs of theorems are based on some new generalized inequalities of Krylov's type for stochastic integrals.

These results strengthen and extend these given in the papers [2],[3]. First, the assumption of uniform ellipticity of $\sigma\sigma^*$ is considerably weaken, and secondly, theorems for D satisfying the conditions (A) and (B) are given.

Joint work with Katarzyna Borkowska.

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Grzegorz Serafin (Wrocław University of Technology, Poland)

Some relationships between potential theories of classical and hyperbolic Brownian motion

We consider hyperbolic Brownian motion on the half-space model $\mathbb{H}^n$ of the real hyperbolic space, i.e. diffusion on $\mathbb{H}^n$ having Laplace-Beltrami operator as its generator. We show relationships between potential theories of hyperbolic Brownian motion and classical Brownian motion for the sets of the form $D \times (0, \infty) \subset \mathbb{H}^n$, where D is a domain in $\mathbf{R}^{n-1}$. Eventually, we focus on a hyperbolic strip $\{x \in \mathbb{H}^n : x_1 \in (0, a)\}$, $a > 0$ and give explicit formula and uniform estimates of its Poisson kernel.

Yuichi Shiozawa (Okayama University, Japan)

Conservation property of symmetric jump-diffusion processes

We say that a Markov process is conservative if the associated particle stays at the state space forever. This property is one of important global path properties of Markov processes. In particular, there are many results on the conservativeness criterion of symmetric diffusion processes, in terms of the volume growth of the underlying measure and the growth of the "coefficient", established by Grigor'yan, Davies, Ichihara, Takeda, Oshima, Sturm,....

Motivated by the recent progress on the analysis of jump processes, there also have been results on the conservativeness criterion of symmetric jump(-diffusion) processes generated by regular Dirichlet forms ([1, 2, 3, 4]). In [1, 2, 3], the volume of the underlying measure is allowed to grow exponentially, but the coefficients are assumed to be bounded. In contrast with this, we allow in [4] the coefficients to be unbounded; however, since the explicit form of the L^2-generator is needed for the proof, we assume that the state space is $\mathbb{R}^d$ and the underlying measure is the Lebesgue measure on $\mathbb{R}^d$. Furthermore, we also need the assumption on the "drift" parts which may entail the continuity on the coefficients.

A purpose in this talk is to establish a conservativeness criterion for symmetric jump-diffusion processes generated by regular Dirichlet forms, in terms of the volume growth of the underlying measure and the growth of the coefficients. Moreover, by using this criterion, we remove the conditions in [4] as we mentioned before. We also generalize the results in [1, 2, 3, 4] so that we allow the volume of the underlying measure to grow exponentially and the coefficients to be unbounded at the same time. We do not know about the sharpness of our criterion in general; however, we can show the sharpness for a class of time changed Dirichlet forms.

We finally give examples related to symmetric stable-like processes and censored stable-like processes.

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Bartłomiej Siudeja (University of Oregon, Eugene, USA)

Lower bounds for heat traces

Luttinger's result states that among domains with given area, the ball has the largest heat trace. Intuitively, this means that balls keep heat for the longest time. This can be restated in a scale invariant way as: the trace at time $area * t$ is maximal for balls. We will discuss a way to modify the time by a factor $G \geq 1$ such that trace at $area * t/G$ is minimal for balls. This factor will depend on the shape of the domain, and it can be understood as a measure of roundness.

Boubaker Smii (King Fahd University of Petroleum and Minerals, Saudi Arabia)

Feynman graph representation of the KPZ equation driven by Lévy noise

In this talk we consider a KPZ equation defined on a Lattice L_δ with coefficients of non-linearity with degree p. An analytic solution in the sense of formal power series is given.
The obtained series can be re-expressed in terms of rooted trees with two types of leaves. A graphical representation of the solution and the correlation function is given in this talk.
The special case when the noise is of Lévy type gives a simplified representations of the solution of the KPZ equation.

Renming Song (University of Illinois, Urbana-Champaign, USA)

Dirichlet heat kernel estimates for relativistic stable processes

In this talk I will give a survey of some of the recent results on sharp two-sided estimates of the Dirichlet heat kernels of relativistic stable processes in $C^{1,1}$ open sets. This talk is based on joint works with Zhen-Qing Chen and Panki Kim.

Alexander Soshnikov (University of California, Davis, USA)

On the Distribution of the Outliers in Large Random Matrices

Our talk will be devoted to the problem of fluctuation of the outliers in the spectrum of finite-rank deformations of large Wigner random matrices (see [1] and [2]). In particular, we will show how the problem can be reduced to the problem of fluctuation of matrix entries of regular functions of large Wigner matrices ([3], [4]). The results are obtained in collaboration with Sean O'Rourke (Rutgers), Alessandro Pizzo (UC Davis), and David Renfrew (UCLA).

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[1] On Finite Rank Deformations of Wigner Matrices (joint with Alessandro Pizzo and David Renfrew), to appear in the Annales de l'Institut Henri Poincare (B) Probabilites et Statistiques, `http://arxiv.org/abs/1103.3731/`

[2] On Finite Rank Deformations of Wigner Matrices II: Delocalized Perturbations (joint with David Renfrew), `http://arxiv.org/abs/1203.5130/`

[3] On Finite Rank Deformations of Wigner Matrices (joint with Alessandro Pizzo and David Renfrew), Journal of Statistical Physics, v. 146, No. 3, 550-591, (2012). `http://arxiv.org/abs/1103.1170/`

[4] On Fluctuations of Matrix Entries of Regular Functions of Wigner Matrices with Non-Identically Distributed Entries (joint with Sean O'Rourke and David Renfrew), to appear in the Journal of Theoretical Probability, `http://arxiv.org/abs/1104.1663/`

Joachim Syga (University of Zielona Góra, Poland)

Application of semimartingale measure to the investigation of stochastic inclusions

A measure for a semimartingale is introduced. It is used to investigate properties of the solution set of different types stochastic inclusions.

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Karol Szczypkowski (Wrocław University of Technology)

Schrödinger perturbations of transition densities

We prove a 4G Theorem for the Gaussian kernel, the inequality which is a non-trivial extension of the so called 3G Theorem ([2], [1]) and a counterpart of the 3P Theorem ([3], [4]) (as well known, 3P fails in its primary form for the Gaussian kernel). Furthermore, we present a new method of estimating Schrödinger perturbations of general transition densities, which applies to the Gaussian kernel.

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Tomoko Takemura (Nara Women's University, Japan)

Lévy measure density corresponding to inverse local time

We are concerned with Lévy measure density corresponding to the inverse local time at the regular end point for harmonic transform of a one dimensional diffusion process. We show that the Lévy measure density is represented as a Laplace transform of the spectral measure corresponding to an original diffusion process, where the absorbing boundary condition is posed at the end point if it is regular.

Joint work with joint work with Matsuyo Tomisaki.

Kaneharu Tsuchida (National Defense Academy of Japan, Yokosuka, Japan)

On a sufficient condition for large deviations of additive functionals

We prove the large deviation principle for continuous additive functionals under certain assumptions. The underlying symmetric Markov processes include the Brownian motion, the symmetric stable process and the relativistic stable process. In this talk, we introduce these conditions to hold large deviations.

This talk is based on joint works with Zhen-Qing Chen (University of Washington).

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Toshihiro Uemura (Kansai Univesity, Osaka, Japan)

On dual generators for nonlocal semi-Dirichlet forms

Let E be a locally compact separable metric space equipped with a metric d, m a positive Radon measure on E with full topological support and $k(x,y)$ a nonnegative Borel measurable function on the space $E \times E \setminus \{(x,x) : x \in E\}$.

We have constructed a Hunt process on E with jump behaviours being governed by $k(x,y)$ by using a lower bounded semi-Dirichlet form on $L^2(E;m)$ in [2] (The conditions imposed on $k(x,y)$ in [2] was relaxed by [3]).

In this talk, we applied the result to the Bass's stable-like process and show a precise expression of the dual generator on $L^2(\mathbb{R}^d)$ under some smoothness conditions on the variable index $\alpha(x)$. In particular, obtaining its dual generator, the Dirichlet form concerning to the reversed kernel $k^*(x,y) = k(y,x) = w(y)|x-y|^{-d-\alpha(y)}$ plays a role.

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Laura Villafuerte Altuzar (Universidad Autónoma de Chiapas, Tuxtla Gutiérrez, Mexico)

The Differential transform method for solving random differential models

In this talk, a Differential Transform Method (DTM) based on the fourth calculus is developed to solve random differential models. An analytical mean fourth convergent series solution is found for linear and nonlinear equations by using the random DTM. Besides of obtaining the solutions of the equations, we provide approximations of the main statistical functions of the stochastic solution process such as the mean and variance.

Joint work with Benito Miguel Chen Charpentier.

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Zoran Vondraček (University of Zagreb, Croatia)

On potential theory of subordinate Brownian motion in unbounded sets

Many aspects of potential theory, such as the Green function estimates, boundary Harnack principle and Martin boundary identification, are known for rather wide classes of subordinate Brownian motion in bounded open sets. On the other hand, except for a few particular examples of Lévy processes, much less is known in case of unbounded open sets. In this talk I will discuss some potential theoretic problems for subordinate Brownian motion in unbounded open sets.

Jian Wang (Fujian Normal University, Fuzhou, China)

Weighted-Poincaré Inequalities for Nonlocal Dirichlet Forms

Let V be a locally bounded measurable function such that e^{-V} is bounded and belongs to $L^1(dx)$, and let $\mu_V(dx) := C_V e^{-V(x)}\,dx$ be a probability measure. We present the criterion for the weighted Poincaré inequality of the non-local Dirichlet form

$$D_{\rho,V}(f,f) := \iint (f(y)-f(x))^2 \rho(|x-y|)\,dy\,\mu_V(dx)$$

on $L^2(\mu_V)$. Taking $\rho(r) = e^{-\delta r} r^{-(d+\alpha)}$ with $0<\alpha<2$ and $\delta \ge 0$, we get some conclusions for general fractional Dirichlet forms, which can be regarded as a complement of our recent work [2], and an improvement of the main result in [1]. In this especial setting, concentration of measure for the standard Poincaré inequality is also derived.

Our technique is based on the Lyapunov conditions for the associated truncated Dirichlet form, and it is considerably efficient for the weighted Poincaré inequality of the following non-local Dirichlet form

$$D_{\psi,V}(f,f) := \iint (f(y)-f(x))^2 \psi(|x-y|)\,e^{-V(y)}\,dy\,e^{-V(x)}\,dx$$

on $L^2(\mu_{2V})$, which is associated with symmetric Markov processes under Girsanov transform of pure jump type.

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Jon Warren (University of Warwick, UK)

A multi-layer extension of the KPZ equation

The Airy process describes the evolution of the largest eigenvalue of Hermitian Brownian motion, and extends to the so called multi-layer Airy process which describes the kth largest eigenvalues for $k = 1, 2, 3, \ldots$. On the other hand we know that the KPZ equation, starting from the wedge initial condition is a finite temperature analogue of the largest eigenvalue, which converges as time goes to infinity to the Airy process. Thus it is natural to try to construct an extension of the KPZ to capture the analogues of the other eigenvalues.This extension will be described in the talk together with some of its properties.

Monika Wrzosek (University of Gdańsk, Poland)

The Newton method for stochastic functional differential equations
(poster)

The convergence of the Newton method for stochastic differential equations was proved by Kawabata and Yamada [3]. In [1] Amano formulates equivalent problem and gives a direct way to estimate the approximation error. In [2] he proposes a probabilistic second-order error estimate. Our goal is to obtain similar results in the case of stochastic functional differential equations:

$$\begin{cases} dX_t &= b(t, X_{t+\cdot})dt + \sigma(t, X_{t+\cdot})dB_t \text{ for } t \in [0, T] \\ X_t &= \varphi_t \text{ for } t \in [-\tau, 0], \end{cases}$$

where $X_{t+\cdot}$ is the $L^2(\Omega)$-valued Hale-type operator.

The existence and uniqueness of solutions to stochastic functional differential equations has been discussed in a large number of papers ([4]). The first part of the present paper deals with the first-order convergence. We formulate a Gronwall type inequality which plays an important role in the proof of the convergence theorem. In the second part the probabilistic second-order convergence is considered.

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Jerzy Zabczyk (Polish Academy of Sciences, Warsaw, Poland)

Regularity of generalized Ornstein-Uhlenbeck processes

The talk is devoted to spatial and temporal regularity of the solution X to the evolution equation

$$dX = AXdt + dZ(t), X(0) = x \in H,$$

where A generates a semigroup $(S(t), t \geq 0)$ of linear operators on a Hilbert space H and Z is a Lévy process on a larger Hilbert space U. Conditions are given under which the process X takes values in the space H or in some of its subspaces. Existence of a càdlàg or of a weak càdlàg modification of X is examined as well. The presentation is based on the papers listed below.

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Adrian Zălinescu ("Alexandru I. Cuza" University, Iaşi, Romania)

Stochastic variational inequalities driven by Poisson random measures

We consider jump-difussion variational inequalities of the following type:

$$dX_t + \partial\varphi\left(X_t\right)dt \ni b\left(t, X_t\right)dt + \sigma\left(t, X_t\right)dW_t + \int_{\mathbb{R}^d\setminus\{0\}} \gamma\left(t, X_{t-}, z\right)\tilde{N}_t\left(dz\right)dt.$$

Here, $\partial\varphi$ is the subdifferential of a proper, l.s.c., convex function $\varphi : \mathbb{R}^n \to \overline{\mathbb{R}}$, W is a Brownian motion in $\mathbb{R}^d$, and $\tilde{N}$ is the compensated measure of a Poisson random measure N, independent of W.

We show that, under Lipschitz assumptions on the coefficients b, σ and γ and a certain growth condition on φ, there exists a unique strong solution of the above equation. The existence of the solution is proven via a penalization method, by considering the Yosida regularization of φ; the main ingredient for the uniqueness is the monotonicity of the subdifferential operator.

Furthermore, by imposing only the continuity and linear growth of the coefficients, we are able to show that there exists a weak solution, by appealing the martingale problem method of Stroock and Varadhan.

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Lorenzo Zambotti (Université Pierre et Marie Curie - Paris 6, France)

On Exceptional times of Fleming-Viot processes with mutation

It is known since a work of Byron Schmuland that there exist exceptional times at which a population evolving according to a standard Fleming-Viot process with constant mutation rate θ has only finitely many types if and only if $\theta < 2$. We prove that if the population dynamic is that of generalized Beta-Fleming-Viot processes with index $\alpha \in (1, 2)$ then

$$P\big(\exists t > 0 : \#\{\text{types at time } t\} < \infty\big) = 0$$

as soon as $\theta > 0$. Along the proof we introduce a measure-valued branching process with non-Lipschitz interactive immigration via which a Pitman-Yor representation allows us to deduce the result from classical covering result for Poisson point.

(Joint work with J. Berestycki, L. Döring, L. Mytnik)
