Archive:

Workshop on Stochastic Analysis and related topics 2016

Monday 9th and Tuesday 10th of May 2016

This is a workshop jointly organized by TU Dresden and our DAAD MaJKo partners in Japan Kansai University (Osaka, Japan) and Korea Seoul National University (Seoul, South Korea). The workshop is open to colleagues from other universities. Apart from the dissemination of state-of-the-art scientific results, it aims to train advanced students and to provide a platform for young researchers. After the workshop, from Wednesday - Friday there will be further talks and events within our Erasmus cooperation with Swansea U, UK.

Registration:
Please send a short mail to **rene.schilling (at) tu-dresden.de**
There will be a small nominal fee for tea & coffee during the breaks.

Organizer:
René SCHILLING, Martin KELLER-RESSEL (TU Dresden)

Location:
C207, Willersbau, Zellescher Weg 12-14, Dresden
A detailed description how to find us is given here.

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MAJKO 2016

Workshop on Stochastic Analysis and Related Topics,
May 09-10, 2016 - Technische Universität Dresden, Germany

Participants

Berschneider	Georg	TU Dresden
Bogdan	Krysztof	TU Wroclaw
Böttcher	Björn	TU Dresden
Czarna	Irmina	U Wroclaw
Di Tella	Paolo	TU Dresden
Evans	Christian	Swansea U
Grothaus	Martin	U Kaiserslautern
Harris	James	Swansea U
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Kaleta	Kamil	TU Wroclaw
Kang	Seunghyun	Seoul National U
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Kim	Kyung-Youn	Seoul National U / TU Dresden
Knopova	Victorya	U Kiev
Kosenkova	Tanya	U Potsdam
Kühn	Franziska	TU Dresden
Kulczycki	Tadeusz	TU Wroclaw
Kumagai	Takashi	Kyoto RIMS
Lee	Haesung	Seoul National U
Mucha	Jacek	TU Wroclaw
Neate	Andrew	Swansea U
Olszewski	Mariusz	TU Wroclaw
Palmowski	Zbigniew	U Wroclaw
Pavlyukevich	Ilya	U Jena
Rhind	Elian	Swansea U
Schilling	René	TU Dresden
Schwarzenberger	Michael	TU Dresden
Suzuki	Kohei	Kyoto U
Trutnau	Gerald	Seoul National U
Uemura	Toshihiro	Kansai U
Wardenga	Robert	TU Dresden
Yuan	Chenggui	Swansea U
Zurek	Grzegorz	TU Wroclaw

Workshop on Stochastic Analysis and Related Topics 2016

Monday May 9th	
09.00 – 09.35	**Toshihiro Uemura** (Kansai) On an optimal stopping problem and a variational inequality
09.40 – 10.15	**Tadeusz Kulczycki** (Wroclaw) Gradient estimates of Dirichlet heat kernels for unimodal Lévy processes
	Coffee
10.45 – 11.20	**Ilya Pavlyukevich** (Jena) Metastability of a periodic stable–like jump–diffusion
11.25 – 12.00	**Martin Grothaus** (Kaiserslautern) Mittag–Leffler Analysis: Construction and Applications
	Lunch
14.00 – 14.35	**Kamil Kaleta** (Wroclaw) The quenched asymptotics for nonlocal Schrödinger operators with Poissonian potentials
14.40 – 15.15	**Andrew Neate** (Swansea) Semiclassical stochastic mechanics for the Coulomb potential
	Coffee
15.45 – 16.20	**Zbigniew Palmowski** (Wroclaw) Fluctuations of Omega–killed spectrally negative Lévy processes
16.25 – 17.00	**Irmina Czarna** (Wroclaw) Parisian ruin for a refracted Lévy process
17.05 – 17.40	**Gerald Trutnau** (Seoul) A remark on the generator of a right–continuous Markov process

Tuesday May 10th	
09.00 – 09.35	**Takashi Kumagai** (Kyoto) Stability of heat kernel estimates and parabolic Harnack inequalities for jump processes on metric measure spaces
09.40 – 10.15	**Kohei Suzuki** (Kyoto) Convergence of Brownian motions on RCD spaces
	Coffee
10.45 – 11.20	**Kyung–Youn Kim** (TU Dresden) Estimates of Dirichlet heat kernel for symmetric Markov processes
11.25 – 12.00	**Tatiana Kosenkova** (Potsdam) Noise sensitivity of Lévy driven SDE's: estimates and applications
	Lunch
14.00 – 14.35	**Victoria Knopova** (Kiev) Accuracy of discrete approximation for integral functionals
14.40 – 15.15	**Franziska Kühn** (Dresden) Transition probabilities for Feller processes: Parametrix construction
	Coffee
15.45 – 16.20	**Robert Wardenga** (Dresden) Affine processes with stochastic discontinuities
16.25 – 17.00	**Chenggui Yuan** (Swansea) Harnack inequality and exponential integrability for functional SDEs
17.05 – 17.40	**Niels Jacob** (Swansea) Transition densities of Lévy processes put into broader context

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WORKSHOP ON STOCHASTIC ANALYSIS AND RELATED TOPICS 2016

Monday 9th and Tuesday 10th of May 2016

Arrival Information

This is a workshop jointly organized by TU Dresden and our DAAD MaJKo partners in Japan Kansai University (Osaka, Japan) and Korea Seoul National University (Seoul, South Korea). The workshop is open to colleagues from other universities. Apart from the dissemination of state-of-the-art scientific results, it aims to train advanced students and to provide a platform for young researchers. After the workshop, from Wednesday - Friday there will be further talks and events within our Erasmus cooperation with Swansea U, UK.

Registration: Please send a short mail to **rene.schilling (at) tu-dresden.de**
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Participants: PDF

Organizer: René SCHILLING, Martin KELLER-RESSEL (TU Dresden)

Location: C207, Willersbau, Zellescher Weg 12-14, Dresden
A detailed description how to find us is given here.

Zoom (4,7 MB)

Schedule: List of abstracts

Monday, May 9th (Room: WIL C 207)

09:00–09:35	**Toshihiro Uemura** (Kansai U, Osaka, Japan)	On an optimal stopping problem and a variational inequality
09:40–10:15	**Tadeusz Kulczycki** (TU Wroclaw, Poland)	Gradient estimates of Dirichlet heat kernels for unimodal Lévy processes
	Coffee break	
10:45–11:20	**Ilya Pavlyukevich** (U Jena, Germany)	Metastability of a periodic stable–like jump–diffusion
11:25–12:00	**Martin Grothaus** (TU Kaiserslautern, Germany)	Mittag–Leffler Analysis: Construction and Applications
	Lunch	
14:00–14:35	**Kamil Kaleta** (TU Wroclaw, Poland)	The quenched asymptotics for nonlocal Schrödinger operators with Poissonian potentials
14:40–15:15	**Andrew Neate** (Swansea U, UK)	Semiclassical stochastic mechanics for the Coulomb potential
	Coffee break	
15:45–16:20	**Zbigniew Palmowski** (U Wroclaw, Poland)	Fluctuations of Omega–killed spectrally negative Lévy processes
16:25–17:00	**Irmina Czarna** (U Wroclaw, Poland)	Parisian ruin for a refracted Lévy process
17:05–17:40	**Gerald Trutnau** (Seoul National U, S. Korea)	A remark on the generator of a right–continuous Markov process
19:00–	**Dinner**	

Tuesday, May 10th (Room: WIL C 207)

09:00–09:35	**Takashi Kumagai** (Kyoto RIMS, Japan)	Stability of heat kernel estimates and parabolic Harnack inequalities for jump processes on metric measure spaces
09:40–10:15	**Kohei Suzuki** (Kyoto U, Japan)	Convergence of Brownian motions on RCD spaces
	Coffee break	
10:45–11:20	**Kyung–Youn Kim** (TU Dresden, Germany)	Estimates of Dirichlet heat kernel for symmetric Markov processes
11:25–12:00	**Tatiana Kosenkova** (U Potsdam, Germany)	Noise sensitivity of Lévy driven SDEs: estimates and applications
	Lunch	
14:00–14:35	**Victoria Knopova** (Academy of Sciences, Kyiv, Ukraine)	Accuracy of discrete approximation for integral functionals
14:40–15:15	**Franziska Kühn** (TU Dresden, Germany)	Transition probabilities for Feller processes: Parametrix construction
	Coffee break	
15:45–16:20	**Robert Wardenga** (TU Dresden, Germany)	Affine processes with stochastic discontinuities
16:25–17:00	**Chenggui Yuan** (Swansea U, UK)	Harnack inequality and exponential integrability for functional SDEs
17:05–17:40	**Niels Jacob** (Swansea U, UK)	Transition densities of Lévy processes put into broader context

Further Activities within the EU Erasmus Exchange with Swansea University, UK

Wednesday, May 11th (Room: WIL C 203)

16:40–17:30	**Andrew Neate** (Swansea U, UK)	Feynman-Kac Formulae 1
17:40–18:30	**Kristian Evans** (Swansea U, UK)	Harmonic Anaylsis on Abelian Groups 1
18:35–19:00	**James Harris** (Swansea U, UK)	Geometric interpretations of diagonal term densities of certain operator semigroups

Thursday, May 12th (Room: WIL C 203)

16:40–17:30	**Andrew Neate** (Swansea U, UK)	Feynman-Kac Formulae 2
17:40–18:30	**Kristian Evans** (Swansea U, UK)	Harmonic Anaylsis on Abelian Groups 2
18:35–19:00	**Elian Rhind** (Swansea U, UK)	Hamiltonian and Lagrangian mechanics related to generators of Lévy processes.

Friday, May 13th (Room: WIL C 203)

16:40–17:30	**Andrew Neate** (Swansea U, UK)	Feynman-Kac Formulae 3
17:40–18:30	**Kristian Evans** (Swansea U, UK)	Harmonic Anaylsis on Abelian Groups 3

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Autor: René Schilling

Drucken

Stochastic Analysis and Related Topics (StART 2016)

TU Dresden, May 9 & 10 2016

Abstracts of the talks (in alphabetical order)

Irmina Czarna

Parisian ruin for a refracted Lévy process

We investigate Parisian ruin for a Lévy surplus process with an adaptive premium rate, namely a refracted Lévy process. More general Parisian boundary-crossing problems with a deterministic implementation delay are also considered. Our main contribution is a generalization of the result in [1] for the probability of Parisian ruin of a standard Lévy insurance risk process. Despite the more general setup considered here, our main result is as compact and has a similar structure. Examples are provided.

References:

1. R. Loeffen, I. Czarna, Z. Palmowski, Parisian ruin probability for spectrally negative Lévy processes, Bernoulli 2013, Vol. 19, No. 2, 599-609.

2. M.A. Lkabous, I. Czarna, J.-F. Renaud, Parisian ruin for a refracted Lévy process, draft

Irmina Czarna

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Martin Grothaus

Mittag–Leffler Analysis: Construction and Applications

Motivated by the results of infinite dimensional Gaussian analysis and especially white noise analysis, we construct a Mittag–Leffler analysis. This is an infinite dimensional analysis with respect to non-Gaussian measures of Mittag–Leffler type which we call Mittag-Leffler measures. Our results indicate that the Wick ordered polynomials, which play a key role in Gaussian analysis, cannot be generalized to this non-Gaussian case. We provide evidence that a system of biorthogonal polynomials, called generalized Appell system, is applicable to the Mittag–Leffler measures, instead of using Wick ordered polynomials. With the help of an Appell system, we introduce a test function and a distribution space. Furthermore we give characterizations of the distribution space and we characterize the weak integrable functions and the convergent sequences within the distribution space. We construct Donsker's delta in a non-Gaussian setting as an application. In the second part, we develop a grey noise analysis. This is a special application of the Mittag–Leffler

analysis. In this framework, we introduce generalized grey Brownian motion and prove differentiability in a distributional sense and the existence of generalized grey Brownian motion local times. Grey noise analysis is then applied to the time-fractional heat equation and the time-fractional Schrödinger equation. We prove a generalization of the fractional Feynman–Kac formula for distributional initial values. In this way, we find a Green's function for the time-fractional heat equation which coincides with the solutions given in the literature. The results presented in this talk are published in the references below.

References:

1. M. Grothaus; F. Jahnert; F. Riemann; J. L. da Silva. Mittag–Leffler analysis I: Construction and characterization. Journal of Functional Analysis. 268(7), 1876–1903, 2015.

2. M. Grothaus; F. Jahnert. Mittag–Leffler analysis II: Application to the fractional heat equation. Journal of Functional Analysis, 270(7), 2732–2768, 2016.

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Niels Jacob

Transition densities of Levy processes put into broader context

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Kamil Kaleta

The quenched asymptotics for nonlocal Schrödinger operators with Poissonian potentials

We study the quenched long time behaviour of the survival probability up to time t, $\mathbb{E}_x\big[e^{-\int_0^t V^\omega(X_s)\mathrm{d}s}\big]$, of a symmetric Lévy process with jumps, under a sufficiently regular Poissonian random potential V^ω on $\mathbb{R}^d$. Such a function is a probabilistic solution to the parabolic Anderson problem involving the nonlocal Schrödinger operator based on the generator of the process $(X_t)_{t\geq 0}$ with potential V^ω. For a large class of processes and potentials of finite range, we determine rate functions $\eta(t)$ and compute explicitly the positive constants C_1, C_2 such that

$$-C_1 \leq \liminf_{t\to\infty} \frac{\log \mathbb{E}_x\big[\mathrm{e}^{-\int_0^t V^\omega(X_s)\mathrm{d}s}\big]}{\eta(t)} \leq \limsup_{t\to\infty} \frac{\log \mathbb{E}_x\big[\mathrm{e}^{-\int_0^t V^\omega(X_s)\mathrm{d}s}\big]}{\eta(t)} \leq -C_2,$$

almost surely with respect to ω, for every fixed $x \in \mathbb{R}^d$. The functions $\eta(t)$ and the bounds C_1, C_2 heavily depend on the intensity of large jumps of the process. In particular, if its decay at infinity is 'sufficiently fast', then we prove that $C_1 = C_2$, i.e. the limit exists. Representative examples in this class are relativistic stable

processes with Lévy-Khintchine exponents $\psi(\xi) = (|\xi|^2 + m^{2/\alpha})^{\alpha/2} - m$, $\alpha \in (0,2)$, $m > 0$, for which we obtain that

$$\lim_{t\to\infty} \frac{\log \mathbb{E}_x\left[\mathrm{e}^{-\int_0^t V^\omega(X_s)ds}\right]}{t/(\log t)^{2/d}} = \frac{\alpha}{2} m^{1-\frac{2}{\alpha}} \left(\frac{\rho\omega_d}{d}\right)^{\frac{d}{2}} \lambda_1^{BM}(B(0,1)),$$

for almost all ω, where $\lambda_1^{BM}(B(0,1))$ is the principal eigenvalue of the Brownian motion killed on leaving the unit ball, ω_d is the Lebesgue measure of a unit ball and $\rho > 0$ corresponds to V^ω. We also identify two interesting regime changes ('transitions') in the growth properties of the rates $\eta(t)$ as the intensity of large jumps of the processes varies from polynomial to higher order, and eventually to stretched exponential order.
The talk is based on a joint work with Katarzyna Pietruska-Pałuba.
References:

1. K. Kaleta, K. Pietruska-Pałuba, *The quenched asymptotics for nonlocal Schrödinger operators with Poissonian potentials*, preprint 2016 (available at arXiv:1601.05597)

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Kyung-Youn Kim

Estimates of Dirichlet heat kernel for symmetric Markov processes

We consider a large class of symmetric pure jump Markov processes dominated by isotropic unimodal Lévy processes with weak scaling conditions. We first establish sharp two-sided heat kernel estimates for these processes in $C^{1,\rho}$ open sets, $\rho \in (\overline{\alpha}/2, 1]$ where $\overline{\alpha}$ is the upper scaling parameter in the weak scaling conditions. As a corollary of our main result, we obtain a sharp two-sided Green function estimates and a scale invariant boundary Harnack inequality with explicit decay rates in $C^{1,\rho}$ open sets. This talk is based on the joint work with Tomasz Grzywny and Panki Kim.
References:

1. T. Grzywny and K.-Y. Kim and P. Kim. Estimates of Dirichlet heat kernel for symmetric Markov processes. Submitted.

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Victoria Knopova

Accuracy of discrete approximation for integral functionals

Suppose that a Markov process X admits the transition probability density $p_t(x,y)$ which is differentiable in t and the derivative has an integrable upper bound of the type

$$|\partial_t p_t(x,y)| \le Ct^{-\beta} q_{x,t}(y), \quad t \in (0,T],$$

where q is a measurable function, such that $\int_{\mathcal{R}^d} q_{x,t}(y)dy = 1$ for each fixed t, x. We derive the accuracy rates for approximations of the functionals

$$I_T(h) = \int_0^T h(X_t)\, dt$$

by Riemannian sums. The talk is based on the joint work with Iu. Ganichenko and A. Kulik.

References:

1. Iu. Ganichnko, V. Knopova, A. Kulik. Accuracy of discrete approximation for integral functionals of Markov processes. *Modern Stochastics: Theory and Applications*, **2(4)** (2015), 401–420.

Victoria Knopova
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Tania Kosenkova

Noise sensitivity of Lévy driven SDE's: estimates and applications

The topic of this talk is induced by the following question: whether the deviation between the solutions of two different Lévy driven SDE's can be controlled in terms of the characteristics of the underlying Lévy processes? In the case of SDE's with additive noise we give the estimate for the deviation between the solutions in terms of the *coupling distance* for Lévy measures, which is based on the notion of the Wasserstein distance.

In case of Lévy-type processes, whose characteristic triplets are state dependent, we exploit the fact that every Lévy kernel can be obtained by means of a certain infinite Lévy measure and the transform function. And under an appropriate set of conditions on the state dependent characteristic triplet the Lévy-type process can be described as a strong solution to a Lévy driven SDE with multiplicative noise. The estimate of the deviation between two Lévy-type processes is given in terms of *transportation distance* between the Lévy kernels, which uses the transform functions of the kernels. Such estimates can be applied to the analysis of the low-dimensional conceptual climate models with paleoclimate data.

References:

1. Gairing J., Högele M., Kosenkova T., Kulik A. *Coupling distances between Lévy measures and applications to noise sensitivity of SDE*. Stochastics and Dynamics, 15 (2), 2015.

2. Gairing J., Högele M., Kosenkova T. *Noise sensitivity of multiplicative Lévy SDE in terms of transportation distances*. arXiv:1511.07666

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Franziska Kühn

Transition probabilities for Feller processes: Parametrix construction

In this talk we present an existence result for Feller processes. Feller processes behave locally like Lévy processes, but the Lévy triplet may depend on the current position. They can be characterized by their, so-called, symbol; this is the analogue of the characteristic exponent in the Lévy case.
Using a parametrix construction, we prove the existence of Feller processes with a given symbol under weak assumptions on the regularity (with respect to the space variable x) of the symbol. We derive heat kernel estimates for the transition density as well as its time derivative, and prove the well-posedness of the corresponding martingale problem. Our result applies to symbols of the form $q(x,\xi) = f_{\alpha(x)}(|\xi|^2)$ where $(f_\alpha)_{\alpha\in I}$ is a family of Bernstein functions and $\alpha : \mathbb{R}^d \to I$ a Hölder continuous mapping. This includes in particular stable-like, relativistic stable-like and normal tempered stable-like processes. In dimension $d = 1$ we also obtain results for solutions of Lévy-driven SDEs with Hölder continuous coefficients.

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Tadeusz Kulczycki

Gradient estimates of Dirichlet heat kernels for unimodal Lévy processes

Let X be a pure-jump isotropic unimodal Lévy process in $\mathbb{R}^d$ with the symbol ψ, $D \subset \mathbb{R}^d$ an open, nonempty set and $p_D(t,x,y)$ the Dirichlet heat kernel for X on D. Under some regularity conditions on the symbol and the Lévy measure we show that $\nabla_x p_D(t,x,y)$ exists for any $x, y \in D$, $t > 0$ and we have

$$|\nabla_x p_D(t,x,y)| \le c \max\left[\frac{1}{\delta_D(x) \wedge 1}, \psi^-(1/t)\right] p_D(t,x,y), \quad x, y \in D,\, t \in (0,1],$$

where $\delta_D(x) = \text{dist}(x, \partial D)$, ψ^- denotes the generalized inverse of $\psi^*(r) = sup_{\rho \le r}\psi(\rho)$ and $c = c(d, \psi)$.
The talk is based on paper [3]. Some ideas in the proof are taken from papers [1], [2], [4].
References:

1. K. Bogdan, T. Grzywny, M. Ryznar, Density and tails of unimodal convolution semigroups, J. Funct. Anal. 266 (2014), no. 6, 3543-3571.

2. K. Bogdan, T. Grzywny, M. Ryznar, Dirichlet heat kernel for unimodal Lévy processes, Stochastic Process. Appl. 124 (2014), no. 11, 3612-3650.

3. T. Kulczycki, M. Ryznar, Gradient estimates of Dirichlet heat kernels for unimodal Lévy processes, preprint (2016), arXiv:1604.02418

4. T. Kulczycki, M. Ryznar, Gradient estimates of harmonic functions and transition densities for Lévy processes, Trans. Amer. Math. Soc. 368 (2016), no. 1, 281-318.

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Takashi Kumagai

Stability of heat kernel estimates and parabolic Harnack inequalities for jump processes on metric measure spaces

We consider mixed-type jump processes on metric measure spaces and prove the stability of two-sided heat kernel estimates, heat kernel upper bounds, and parabolic Harnack inequalities. We establish their stable equivalent characterizations in terms of the jump kernels, modifications of cut-off Sobolev inequalities, and the Poincaré inequalities. In particular, we prove the stability of heat kernel estimates for α-stable-like processes even with $\alpha \ge 2$, which has been one of the major open problems in this area. We will also explain applications to stochastic processes on fractals.
This is a joint work with Z.Q. Chen (Seattle) and J. Wang (Fuzhou).

References:

1. Z.-Q. Chen and T. Kumagai. Heat kernel estimates for stable-like processes on d-sets. *Stochastic Process Appl.* **108** (2003), 27-62.

2. Z.-Q. Chen, T. Kumagai and J. Wang. Stability of heat kernel estimates for symmetric jump processes on metric measure spaces. In preparation.

3. Z.-Q. Chen, T. Kumagai and J. Wang. Stability of parabolic Harnack inequalities for symmetric jump processes on metric measure spaces. In preparation.

4. A. Grigor'yan, J. Hu and K.-S. Lau. Estimates of heat kernels for non-local regular Dirichlet forms. *Trans. Amer. Math. Soc.* **366** (2014), 6397-6441.

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Andrew Neate

Semiclassical stochastic mechanics for the Coulomb potential

We consider the semiclassical behaviour of a family of coherent states for the Coulomb potential which are concentrated on an ellipse, with the aim of deriving Keplerian motion on the ellipse in the semiclassical limit. This is done within the framework of Nelson's stochastic mechanics which associates a diffusion process to each quantum state. We are lead to a suitable semiclassical Nelson diffusion process which is closely related to the classical mechanics for a perturbation of the Coulomb potential. The properties of this system are investigated in terms of a constrained Hamiltonian system and constants of the motion for the perturbed potential are identified. This is joint work with Aubrey Truman.

References:

1. Durran, R. Neate, A. & Truman, A. (2008). The divine clockwork, *J. Math. Phys.*, 49(3),

2. Durran, R. Neate, A. Truman, A. & Wang, F. (2008). On the divine clockwork *J. Math. Phys.*, 49(10),

3. Neate, A. & Truman, A. (2014). Semiclassical wave functions and semiclassical dynamics for the Kepler/Coulomb problem. *J. Phys A: Math. and Theor.*, 47(22),

4. Neate, A. & Truman, A. (2016). Semiclassical stochastic mechanics for the Coulomb potential, to appear in *J. Math. Phys.*, May 2016.

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Zbigniew Palmowski

Fluctuations of Omega-killed spectrally negative Lévy processes

In this talk we present the solutions of so-called exit problems for a (reflected) spectrally negative one-dimensional Lévy process exponentially killed with killing intensity depending on the present state of the process. We will also analyze respective resolvents. All identities are given in terms of new generalizations of scale

functions. Particular cases concern $\omega(x) = q$ when we derive classical exit problems and $\omega(x) = q\mathbf{1}_{(a,b)}(x)$ producing Laplace transforms of occupation times of intervals until first passage times. We will show how derived results can be applied to find bankruptcy probability in so-called Omega model, where bankruptcy occurs at rate $\omega(x)$ when the surplus Lévy process process is at level $x < 0$. Finally, we demonstrate how to get some exit identities for a spectrally positive self-similar Markov processes. The main idea of all proofs relies on classical fluctuation identities for Lévy process, the Markov property and some basic properties of a Poisson process. The talk is based on [1].

References:

1. B. Li and Z. Palmowski (2016) Fluctuations of Omega-killed spectrally negative Lévy processes. Submitted for publication,
see http://arxiv.org/abs/1603.07967.

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Ilya Pavlyukevich

Metastability of a periodic stable-like jump-diffusion

We study a gradient system with a double-well potential perturbed by a stable-like additive process with a periodically varying stability index. Among a continuum of intrinsic time scales determined by the values of the stability index, we single out the characteristic time scale on which the system exhibits the metastable behaviour. This is a part of a joint work with I. Kuhwald (FSU Jena).

References:

1. I. Kuhwald and I. Pavlyukevich, Metastable behaviour of a jump-diffusion driven by a periodic stable-like additive process, submitted.

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Kohei Suzuki

Convergence of Brownian motions on RCD spaces

Our objective in this talk is to answer the following question:

(Q) Does the weak convergence of Brownian motions follows from some convergence of the underlying geometry (or vice versa)?

As a main result, we show that the weak convergence of Brownian motions is equivalent to the measured Gromov(-Hausdorff) convergence of the underlying metric measure spaces under *Riemannian curvature-dimension (RCD) condition*. Here RCD condition is a generalization of "Ricci curvatre $\geq K$" into non-smooth spaces.

References:

1. L. Ambrosio, N. Gigli, and G. Savaré, Metric measure spaces with Riemannian Ricci curvature bounded from below, *Duke Math. J.* Vol. **163**, No. 7, (2014) 1405–1490.

2. M. Erbar, K. Kuwada, and K.-T. Sturm. On the equivalence of the entropic curvature-dimension condition and Bochner's inequality on metric measure spaces, to appear in *Invention Math.*

3. N. Gigli, A. Mondino and G. Savaré, Convergence of pointed non-compact metric measure spaces and stability of Ricci curvature bounds and heat flows, arXiv: 1311.4907v1 19 Nov 2013.

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A remark on the generator of a right-continuous Markov process

Given a right-continuous Markov process $(X_t)_{t\geq 0}$ on a second countable metrizable space E with transition semigroup $(p_t)_{t\geq 0}$, we prove that there exists a σ-finite Borel measure μ with full support on E, and a closed and densely defined linear operator $(\mathcal{L}_p, D(\mathcal{L}_p))$ generating $(p_t)_{t\geq 0}$ on $L^p(E;\mu)$. In particular, we solve the corresponding Cauchy problem in $L^p(E;\mu)$ for any initial condition $u \in D(\mathcal{L}_p)$. Furthermore, for any real $\beta > 0$ we show that there exists a generalized Dirichlet form which is associated to $(e^{-\beta t}p_t)_{t\geq 0}$. If the β-subprocess of $(X_t)_{t\geq 0}$ corresponding to $(e^{-\beta t}p_t)_{t\geq 0}$, $\beta > 0$, is μ-special standard then all results from generalized Dirichlet form theory become available, and Fukushima's decomposition holds for $u \in D(\mathcal{L}_2)$. If $(X_t)_{t\geq 0}$ is transient, then β can be chosen to be zero. This is joint work with Michael Röckner (Bielefeld).

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Toshihiro Uemura

On an optimal stopping problem and a variational inequality

In the talk, I will discuss about an optimal stopping problem of the Markov process associated with a sem-Dirichlet form and derive a variational inequality using the semi-Dirichlet form.

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Affine processes with Stochastic Discontinuities

Motivated by the observation, that asset prices may exhibit jumps of random height at priorly fixed dates such as board meetings, we study affine processes beyond the common assumption of stochastic continuity.
We restrict ourselves to the study of $d-$dimensional semimartingales X with state space D on a filtered probability space $\left(\Omega, (\mathcal{F}_t)_{t\geq 0}, \mathcal{F}, \mathbb{P}\right)$ and define X to be *affine* if there exist $\mathbb{C}$ and $\mathbb{C}^d-$valued deterministic functions $\phi(s,t,u)$ and $\psi(s,t,u)$, respectively, such that

$$\mathbb{E}\left[e^{\langle u, X_t\rangle}\middle|\mathcal{F}_s\right] = \exp\left(\phi(s,t,u) + \langle \psi(s,t,u), X_s\rangle\right)$$

holds for all $u \in i\mathbb{R}^d$,$0 \leq s \leq t$ and $x \in D$. Under fairly general assumptions ϕ and ψ can be completely characterized as càdlàg solutions of a certain differential equation with jumps, i.e. in between jumps ϕ and ψ satisfy a generalized measure ODE with a driver of Lévy-Khintchine form and the jumps of ϕ and ψ satisfy another equation. On the other hand we prove existence of such affine semimartingales given a set of admissible parameters similar to those in Duffie (2003) and Filipovic (2005). Our findings generalize Filipovic (2005) to semimartingales with singular continuous and discontinuous characteristics.
We apply our result to affine processes in discrete time and elaborate on a model for defaultable Bonds.

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Harnack inequality and exponential integrability for functional SDEs

By constructing a new coupling, the Harnack inequality is established for the functional solution of a delay stochastic differential equation with multiplicative noise. An explicit sufficient condition on the hypercontractivity is derived for the Markov semigroup associated to a class of functional stochastic differential equations.

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