Stochastic Partial Differential Equations and Related Fields

10–14 October 2016

Faculty of Mathematics
Bielefeld University

Supported by:

Organisers: Andreas Eberle (Bonn), Martin Grothaus (Kaiserslautern), Walter Hoh (Bielefeld), Moritz Kassmann (Bielefeld), Wilhelm Stannat (Berlin), Gerald Trutnau (Seoul)

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Schedule

	Monday, 10 Oct	Tuesday, 11 Oct	Wednesday, 12 Oct	Thursday, 13 Oct	Friday, 14 Oct
09:00–09:40	Kumagai	Da Prato	Cerrai	Friz	Wang
09:45–10:25	Sturm	Bogachev	X. Zhang	Weber	Gess
			Break		
10:50–11:30	Ma	Krylov	Jentzen	Perkowski	Russo
11:35–12:15	Z.Q.Chen	Sh. Peng	Pardoux	Funaki	Kondratiev
			Lunch Break		
13:30–14:10	Driver	Barbu	Nualart	Zambotti	T.S. Zhang
14:15–14:55	Fukushima	Lunardi	Hofmanova	Imkeller	Föllmer
15:00–15:40				Lyons	
				Break	
16:00–18:30	Parallel Sessions	Parallel Sessions	Parallel Sessions	16:00–18:00 Special Session on occasion of Michael Röckners 60th Birthday 16:30–17:10 Hairer 17:15–17:45 Stannat	
				18:30 Reception and Dinner Mensa, X-building	

Parallel Sessions

Monday, 10 Oct

	Session 1	Session 2	Session 3
15:00–15:30	Elworthy	Gordina	Scheutzow
15:30–16:00	X.-M. Li	Kim	Schmalfuß
16:00–16:30	Kawabi	Jin	Maslowski
		Break	
17:00–17:30	Teplyaev		Duan
17:30–18:00	Hocquet		Chong
18:00–18:30	Hinz		Neamtu

Tuesday, 11 Oct

	Session 1	Session 2	Session 3
15:00–15:30	Takeda	Tölle	Blömker
15:30–16:00	Beznea	Majee	Kozitzky
16:00–16:30	Cimpean	Geiss	X.-D. Li
		Break	
17:00–17:30	Ouknine	Marinelli	R. Zhu
17:30–18:00	Kolesnikov	Butko	X. Zhu
18:00–18:30	Shaposhnikov		Rüdiger

Wednesday, 12 Oct

	Session 1	Session 2	Session 3
15:00–15:30	Dalang	Gyöngy	Deuschel
15:30–16:00	Brzezniak	L. Chen	Assing
16:00–16:30	Hausenblas	Nerlich	Osada
		Break	
17:00–17:30	D. Zhang	Zhigun	Yoshida
17:30–18:00	Müller	Cioica-Licht	Fattler
18:00–18:30	Voßhall	Gerencsér	Yue

Schedule: Monday October 10th

Lecture Hall **H12**

09:00 – 09:40	**Takashi Kumagai** (Kyoto University) Stability of heat kernel estimates and parabolic Harnack inequalities for symmetric non-local Dirichlet forms on metric measure spaces
09:45 – 10:25	**Karl-Theodor Sturm** (Universität Bonn) Heat flow on time-dependent metric measure spaces and super Ricci flows
10:30 – 10:50	**Coffee Break**
10:50 – 11:30	**Zhi-Ming Ma** (Academy of Math and Systems Science, Beijing) Distribution flows associated with positivity preserving coercive forms
11:35 – 12:15	**Zhen-Qing Chen** (University of Washington) Super-Brownian motion in random environments
12:20 – 13:30	**Lunch Break**
13:30 – 14:10	**Bruce K. Driver** (University of California, San Diego) On the Makeenko-Migdal Equations
14:15 – 14:55	**Masatoshi Fukushima** (Osaka University) Reflections at infinity of time changed RBMs on a domain with Liouville branches
15:00 – 16:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13
16:30 – 17:00	**Coffee Break**
17:00 – 18:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13

Schedule: Monday October 10th

Session 1, Lecture Hall **H11**

15:00 – 15:30	**David Elworthy** (The University of Warwick) Ramer's finite co-dimensional forms and stochastic analysis
15:30 – 16:00	**Xue-Mei Li** (The University of Warwick) Some comments on the Feynman-Kac Kernel
16:00 – 16:30	**Hiroshi Kawabi** (Okayama University) Riemannian Wasserstein geometry on the space of Gaussian measures over the Wiener space
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Alexander Teplyaev** (University of Connecticut) Vector analysis for Dirichlet forms and related questions
17:30 – 18:00	**Antoine Hocquet** (TU Berlin) Singularities of the stochastic harmonic map flow
18:00 – 18:30	**Michael Hinz** (Universität Bielefeld) Some applications of vector analysis for Dirichlet forms

Session 2, Lecture Hall **H12**

15:00 – 15:30	**Maria Gordina** (University of Connecticut) Non-smooth perturbations of the Ornstein-Uhlenbeck operators
15:30 – 16:00	**Panki Kim** (Seoul National University) Estimates of Dirichlet heat kernel for subordinate Brownian motions
16:00 – 16:30	**Peng Jin** (Bergische Universität Wuppertal) Stable Process with Singular Time-Dependent Drift
16:30 – 17:00	**Coffee Break**

Schedule: Monday October 10th

Session 3, Lecture Hall **H13**

15:00 – 15:30	**Michael Scheutzow** (TU Berlin) Minimal random attractors
15:30 – 16:00	**Björn Schmalfuß** (Friedrich Schiller University Jena) Dynamics of SPDE driven by Young integrals
16:00 – 16:30	**Bohdan Maslowski** (Charles University in Prague) Stochastic PDEs driven by general Volterra noise
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Jinqiao Duan** (Illinois Institute of Technology, Chicago) Effective Dynamics for Stochastic Partial Differential Equations
17:30 – 18:00	**Carsten Chong** (Ludwig-Maximilians-University of Munich) Stochastic PDEs with Heavy–tailed noise
18:00 – 18:30	**Alexandra Neamtu** (Friedrich Schiller University Jena) Dynamics of Stochastic Evolution Equations in Banach Spaces

Schedule: Tuesday October 11th

Lecture Hall **H12**

09:00 – 09:40	**Giuseppe Da Prato** (Scuola Normale Superiore, Italy)) Some existence and uniqueness results of continuity equations in Hilbert spaces
09:45 – 10:25	**Vladimir Bogachev** (Moscow State University) Stationary Kolmogorov equations for measures on finite and infinite dimensional spaces
10:30 – 10:50	**Coffee Break**
10:50 – 11:30	**Nicolai Krylov** (University of Minnesota, Minneapolis) Poisson stochastic process and basic Schauder and Sobolev estimates in the theory of parabolic equations
11:35 – 12:15	**Shige Peng** (Shandong University) A fully nonlinear supermartingale decomposition theorem and its applications
12:20 – 13:30	**Lunch Break**
13:30 – 14:10	**Viorel Barbu** (Romanian Academy, Iasi) Generalized solutions to nonlinear Fokker-Planck equations
14:15 – 14:55	**Alessandra Lunardi** (University of Parma) Surface measures in Banach spaces
15:00 – 16:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13
16:30 – 17:00	**Coffee Break**
17:00 – 18:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13

Schedule: Tuesday October 11th

Session 1, Lecture Hall **H11**

15:00 – 15:30	**Masayoshi Takeda** (Tohoku University) Spectral Properties of Symmetric Markov Processes with Tightness Property
15:30 – 16:00	**Lucian Beznea** (Institute of Mathematics of the Romanian Academy and University of Bucharest) On the existence of invariant measures for Markovian semigroups
16:00 – 16:30	**Iulian Cimpean** (Institute of Mathematics of the Romanian Academy) On semimartingale functionals of Markov processes associated to lower bounded semi-Dirichlet forms
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Youssef Ouknine** (Cadi Ayyad University, Marrakesh) On Semimartingale local time inequalities and Applications in SDE's
17:30 – 18:00	**Alexander Kolesnikov** (Steklov Mathematical Institute of the Russian Academy of Sciences) Sobolev estimates for mass transportation mappings with application to transport equations and spectral gap
18:00 – 18:30	**Stanislav Shaposhnikov** (Moscow State University) On the uniqueness of solutions to continuity equations

Session 2, Lecture Hall **H12**

15:00 – 15:30	**Jonas Tölle** (Aalto University) Nonlinear, singular SPDE perturbed by noise acting along infinitesimal motions on domains with symmetries
15:30 – 16:00	**Ananta Kumar Majee** (Universität Tübingen) On Stochastic Optimal Control in Ferromagnetism
16:00 – 16:30	**Stefan Geiss** (University of Jyväskylä) Besov spaces and quadratic BSDEs
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Carlo Marinelli** (University College London) Semilinear stochastic evolution equations on L_p spaces
17:30 – 18:00	**Yana A. Butko** (Universität des Saarlandes) Chernoff approximation of evolution semigroups corresponding to Markov processes

Schedule: Tuesday October 11th

Session 3, Lecture Hall **H13**

15:00 – 15:30	**Dirk Blömker** (Universität Augsburg) A surface Growth SPDE and Lack of Regularity
15:30 – 16:00	**Yuri Kozitzky** (Maria Curie-Skłodowska University, Lublin) Solving Fokker-Planck equations for continuum infinite particle systems
16:00 – 16:30	**Xiang-Dong Li** (AMSS, Chinese Academy of Sciences) On a new stochastic characterization of the incompressible Navier-Stokes equation
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Rongchan Zhu** (Beijing Institute of Technology & Bielefeld University) Restricted Markov uniqueness and ergodicity for the stochastic quantization of $p(\Phi)_2$ and its applications
17:30 – 18:00	**Xiangchan Zhu** (Beijing Jiaotong University & Bielefeld University) Dirichlet form associated with Φ^4_3 model
18:00 – 18:30	**Barbara Rüdiger** (Bergische Universität Wuppertal) The Enskog Process

Schedule: Wednesday October 12th

Lecture Hall **H12**

09:00 – 09:40	**Sandra Cerrai** (University of Maryland) An asymptotic approach to SPDEs on graphs
09:45 – 10:25	**Xicheng Zhang** (Wuhan University) Singular Multidimensional Stochastic Differential Equations
10:30 – 10:50	**Coffee Break**
10:50 – 11:30	**Arnulf Jentzen** (ETH Zürich) On the mild Ito formula and weak convergence rates for stochastic partial differential equations
11:35 – 12:15	**Etienne Pardoux** (Aix-Marseille Université) Homogenization of a semilinear heat equation with highly oscillating random potential
12:20 – 13:30	**Lunch Break**
13:30 – 14:10	**David Nualart** (The University of Kansas) Stochastic heat equation with rough multiplicative noise
14:15 – 14:55	**Martina Hofmanovà** (TU Berlin) Rough Gronwall Lemma and weak solutions to RPDEs
15:00 – 16:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13
16:30 – 17:00	**Coffee Break**
17:00 – 18:30	**Parallel Sessions 1-3** Lecture Halls H11, H12, H13

Schedule: Wednesday October 12th

Session 1, Lecture Hall **H11**

15:00 – 15:30	**Robert C. Dalang** (Ecole Polytechnique Fédérale de Lausanne) Hitting probabilities for systems of stochastic partial differential equations: an overview
15:30 – 16:00	**Zdzislaw Brzezniak** (The University of York) Existence of weak and stationary solutions as well as of invariant measures for stochastic Navier-Stokes Equations with multiplicative noise
16:00 – 16:30	**Erika Hausenblas** (University of Leoben) The nonlinear Schrödinger Equation driven by Levy noise
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Deng Zhang** (Shanghai Jiao Tong University) The stochastic logarithmic Schrödinger equation
17:30 – 18:00	**Marvin Müller** (ETH Zürich) Stochastic Moving Boundary Problems
18:00 – 18:30	**Robert Voßhall** (TU Kaiserslautern) On the stochastic heat equation with sticky reflected boundary condition

Session 2, Lecture Hall **H12**

15:00 – 15:30	**Istvan Gyöngy** (University of Edinburgh) Accelerated finite element schemes for stochastic PDEs
15:30 – 16:00	**Le Chen** (University of Kansas) Regularity and positivity of densities for the stochastic (fractional) heat equation
16:00 – 16:30	**Alexander Nerlich** (University of Ulm) A randomized weighted p-Laplacian evolution equation with Neumann Boundary conditions
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Anna Zhigun** (TU Kaiserslautern) The Malliavin derivative and compactness: an application to a degenerate PDE – SDE coupling
17:30 – 18:00	**Petru A. Cioica-Licht** (University of Otago) On the regularity of stochastic partial differential equations on non–smooth domains
18:00 – 18:30	**Máté Gerencsér** (IST Austria) Representation of solutions of SPDEs and approximations

Schedule: Wednesday October 12th

Session 3, Lecture Hall **H13**

15:00 – 15:30	**Jean-Dominique Deuschel** (TU Berlin) Quenched invariance principle for random walk in time-dependent non-elliptic balanced random environment
15:30 – 16:00	**Sigurd Assing** (The University of Warwick) On the collapse of wave functions satisfying a damped driven non-linear Schrödinger equation
16:00 – 16:30	**Hirofumi Osada** (Kyushu University) Infinite-dimensional stochastic differential equations with symmetry
16:30 – 17:00	**Coffee Break**
17:00 – 17:30	**Minoru W. Yoshida** (Kanagawa University) On L^2 properties of the drift coefficient of operator corresponding to Φ_3^4 stochastic quantization
17:30 – 18:00	**Torben Fattler** (TU Kaiserslautern) Stochastic quantization of the fractional Edwards measure
18:00 – 18:30	**Wen Yue** (TU Wien) Discrete Beckner inequalities via the Bochner-Bakry-Emery approach for Markov chains

Schedule: Thursday October 13th

Lecture Hall **H12**

09:00 – 09:40	**Peter Friz** (TU and WIAS Berlin) Malliavin Calculus for regularity structures: the case of gPAM
09:45 – 10:25	**Hendrik Weber** (The University of Warwick) Quasilinear SPDEs via rough paths
10:30 – 10:50	**Coffee Break**
10:50 – 11:30	**Nicolas Perkowski** (HU Berlin) Universality of martingale solutions to the KPZ equation
11:35 – 12:15	**Tadahisa Funaki** (University of Tokyo) Sharp interface limit for a stochastically perturbed mass conserving Allen-Cahn equation
12:20 – 13:30	**Lunch Break**
13:30 – 14:10	**Lorenzo Zambotti** (UPMC-Paris 6) Renormalisation of SPDEs
14:15 – 14:55	**Peter Imkeller** (HU Berlin) A Fourier analytic approach to stochastic analysis
15:00 – 15:40	**Terry Lyons** (University of Oxford) Rough paths, expected signatures and the potential theory of higher order elliptic operators
15:40 – 16:00	**Coffee Break**

Schedule: Thursday October 13th

Lecture Hall **H12**

16:00 – 18:00	**Special Session** on the occasion of Michael Röckner's 60th birthday
16:00 – 16:30	**Addresses**
16:30 – 17:10	**Martin Hairer** (The University of Warwick) Ergodic theory of singular stochastic PDEs
17:15 – 17:45	**Wilhelm Stannat** (TU Berlin) Special lecture in honor of Michael Röckner
18:30	**Reception and Dinner**, Mensa, X-building

Schedule: Friday October 14th

Lecture Hall **H12**

09:00 – 09:40	**Feng-Yu Wang** (Beijing Normal University & Swansea University) From Weak Poincaré to Weak Hypocoercivity
09:45 – 10:25	**Benjamin Gess** (Max Planck Institute for Mathematics in the Sciences, Leipzig) Well-posedness and regularization by noise for nonlinear PDE
10:30 – 10:50	**Coffee Break**
10:50 – 11:30	**Francesco Russo** (ENSTA ParisTech) Probabilistic aspects of a porous media type equation with irregular coefficient
11:35 – 12:15	**Yuri Kondratiev** (Universität Bielefeld) Fractional stochastic dynamics in the continuum
12:20 – 13:30	**Lunch Break**
13:30 – 14:10	**Tusheng Zhang** (The University of Manchester) Global solutions of stochastic heat equations
14:15 – 14:55	**Hans Föllmer** (HU Berlin) A non-linear extension of Gibbs measures

Abstracts

Plenary Talks (40 min)

Viorel Barbu (Romanian Academy, Iasi)

Generalized solutions to nonlinear Fokker-Planck equations

The nonlinear Fokker–Planck equation

$$u_t + \operatorname{div}_x(a(u)) - \Delta\beta(u) = 0 \text{ in } (0,t)\times\mathbb{R}^d$$

describes the particle transport in irregular media (the so-called *anomalous diffusion*). One proves via nonlinear semigroup theory the existence and uniqueness of a mild solution which is an entropy generalized solution in the sense of S. Kruzkov.

Vladimir Bogachev (Moscow State University)

Stationary Kolmogorov equations for measures on finite and infinite dimensional spaces

A survey will be given on research over the last two decades related to stationary Kolmogorov equations for measures on finite and infinite dimensional spaces. In particular, this survey will include (but will not be limited to) a brief account of activities of Michael Röckner with his group. The main object to be considered is the second order elliptic equation in the so-called double divergence form

$$\sum_{i,j}\partial_{x_i}\partial_{x_j}(a^{ij}\mu) - \sum_i \partial_{x_i}(b^{ij}\mu) = 0$$

with respect to bounded measures μ on $\mathbb{R}^d$ (or an analogous equation on an infinite dimensional space), where (a^{ij}) is a mapping with values in the space of positive definite matrices and (b^i) is a vector field. The principal problems to be discussed concern existence and uniqueness of solutions in various classes of measures and properties of solutions. A number of challenging open problems in this area will be mentioned. No special prerequisites are needed.

Sandra Cerrai (University of Maryland)

An asymptotic approach to SPDEs on graphs

I will present some recent results about some classes of SPDEs defined on graphs, obtained as limit of SPDEs depending on some parameters defined on suitable two dimensional domains.

Zhen-Qing Chen (University of Washington)

Super-Brownian motion in random environments

In 1996, Mytnik considered a class of super-Brownian motion with random branching mechanism, which we call super-Brownian motion in random environments. This class of measure-valued processes can be characterized by conditional Laplace transform, conditioned on the Gaussian random field $W(t,x)$ that models the random branching mechanism. Let X be such a process starting with initial Lebesgue measure m on R^d with the Gaussian field $W(t,x)$ white in time and colored in spatial variable.Let $g(x,y)$ be the covariance function is given by $g(x,y)(t\wedge s)$. We show that in dimension three and higher, there is a constant $\delta > 0$ such that if there exists a positive definite function g_0 so that $g(x,y) \le g_0(x-y)$ and $\sup_x \int_{R^d} G(x,y) g_0(y)dy \le \delta$, then the distribution of X_t converges weakly to a non-trivial distribution π^m as $t\to\infty$ and $\int \mu\pi^m(d\mu) = m$. Moreover π^m is an invariant probability distribution of X_t. This gives an affirmative answer to a Conjecture due to Mytnik and Xiong 2007. We further show that if $g(x,y)=g(x-y)$ with $g\in C^2(R^d)$ and $g(0)$ is sufficiently large, then X suffers local extinction.

This is a joint work with Yanxia Ren and Guohuan Zhao.

Giuseppe Da Prato, (Scuola Normale Superiore, Italy)

Some existence and uniqueness results of continuity equations in Hilbert spaces

We prove existence and uniqueness of a continuity equation in a separable Hilbert space. We look for solutions which are absolutely continuous with respect to a reference measure γ which is the invariant measure of a reaction–diffusion equation.

We exploit that the gradient operator D is closable with respect to $L^p(H,\gamma)$ and a recent formula for the commutator DP_t-P_tD where P_t is the corresponding transition semigroup, [2].

We stress that P_t is not necessarily symmetric as in [1]. Our paper is an extension of [3] where γ was the invariant measure of a suitable Ornstein–Uhlenbeck operator.

Joint paper in progress with Michael Röckner.

References

[1] L. Ambrosio and D. Trevisan, *Well posedness of Lagrangian flows and continuity equations in metric measure spaces*, Anal. PDE 7, no. 5, 1179–1234, 2014.

[2] G. Da Prato and A. Debussche, *Existence of the Fomin derivative of the invariant measure of a stochastic reaction–diffusion equation*, Kyoto University, Kyoto, Japan, 121–134, 2014, arXiv:1193405.

[3] G. Da Prato, F. Flandoli and M. Röckner, *Uniqueness for continuity equations in Hilbert spaces with weakly differentiable drift,* Stoch. PDE: Anal. Comp., **2**, 121–145, 2014.

Bruce K. Driver, (University of California, San Diego)

On the Makeenko-Migdal Equations

The *Makeenko–Migdal equation* (MM equation) relates variations of a “Wilson loop functional” (relative to the Euclidean Yang–Mills measure) in the neighborhood of a simple crossing to the associated Wilson loops on either side of the crossing. The original equations, in any dimension, were the subject of Makeenko and Migdal (1979). V. A. Kazakov and I. K. Kostov (1980) in showed in the plane case that one side of the MM equation may be interpreted as the alternating sum of derivatives of the Wilson loop functional with respect to the areas of the faces surrounding a simple crossing. Lévy (2011) then provided a rigorous proof of the planar Makeenko–Migdal equation starting with the formulas in D. (1989). A different proof was subsequently given by A. Dahlqvist (2014). Recently, D., Hall, and Kemp (2016) gave three new (local) proofs of the MM equation and then later with F. Gabriel (2016) we showed two of these proof work in the context of the Yang–Mills measure over an arbitrary compact surface. The aim of this talk is to 1) explain the original heuristic argument of the *Makeenko–Migdal equation* in more detail and precision, and 2) to then indicate how this heuristic argument can be made rigorous with the aid of stochastic calculus.

Hans Föllmer (HU Berlin)

A non-linear extension of Gibbs measures

We discuss the quantification of systemic risk in large financial networks. Our focus will be on the systemic risk measures proposed by Chen, Iyengar, and Moallemi (2013). In order to clarify the interplay between local and global risk assessment, we study the class of all systemic risk measures which are consistent with a given family of conditional risk measures for smaller subsystems, and the appearance of phase transitions at the global level. This can be seen as a non-linear extension of the analysis of Gibbs measures in terms of their local specification.

Peter Friz (TU and WIAS Berlin)

Malliavin Calculus for regularity structures: the case of gPAM

Malliavin calculus is implemented in the context of [M. Hairer, A theory of regularity structures, Invent. Math. 2014]. This involves some constructions of independent interest, notably an extension of the structure which accomodates a robust, and purely deterministic, translation operator, in L2-directions, between "models". In the concrete context of the generalized parabolic Anderson model in 2D - one of the singular SPDEs discussed in the afore-mentioned article - we establish existence of a density at positive times. Joint work with. G. Cannizzaro (Berlin/Warwick) und P. Gassiat (Paris).

Masatoshi Fukushima (Osaka University)

Reflections at infinity of time changed RBMs on a domain with Liouville branches

Let Z be the transient reflecting Brownian motion on the closure of an unbounded domain of a finite dimensional Euclidean space with several Liouville branches. We consider a diffusion X having finite lifetime obtained from Z by a timechange. We show that X admits only a finite number of possible symmetric conservative diffusion extensions Y beyond its lifetime characterized by possible partitions of the collection of ends of branches and we identify the family of the extended Dirichlet spaces of all Y as subspaces of the function space of Beppo Levi spanned by the extended Dirichlet space of Z and the approaching probabilities of Z to the ends of Liouville branches.

Tadahisa Funaki (University of Tokyo)

Sharp interface limit for a stochastically perturbed mass conserving Allen-Cahn equation

I will discuss the sharp interface limit for a mass conserving Allen-Cahn equation added an external mild noise which converges to a white noise in time. We derive a stochastically perturbed volume preserving mean curvature motion in the limit. We apply the asymptotic expansion method, in which powers of noise appear. But, if the convergence speed of our mild noise to the white noise is slow enough, one can control them. This is joint work with Satoshi Yokoyama.

Benjamin Gess (Max Planck Institute for Mathematics in the Sciences, Leipzig)

Well-posedness and regularization by noise for nonlinear PDE

In this talk we will revisit regularizing effects of noise for nonlinear SPDE. In this regard we are interested in phenomena where the inclusion of stochastic perturbations leads to increased regularity of solutions as compared to the unperturbed, deterministic case. Closely related, we study effects of production of uniqueness of solutions by noise, i.e. instances of nonlinear SPDE having a unique solution, while non-uniqueness holds for the deterministic counterparts. The talk will concentrate on these effects in the case of nonlinear scalar conservation laws and stochastic porous media equations.

Martin Hairer (The University of Warwick)

Ergodic theory of singular stochastic PDEs

We show that a large class of singular stochastic PDEs gives rise to Markov processes satisfying the strong Feller property. This is the case even in situations where global existence of solutions is either unknown or is known to fail. By combining this with adequate support theorems, one can conclude that these processes are uniquely ergodic. Two prototypical examples covered by our results are the KPZ equation and the stochastic quantisation equation in dimensions 2 and 3.

Martina Hofmanovà (TU Berlin)

Rough Gronwall Lemma and weak solutions to RPDEs

In this talk, I will present recent results that give the necessary mathematical foundation for the study of rough path driven PDEs in the framework of weak solutions. The main tool is a new rough Gronwall Lemma argument whose application is rather wide: among others, it allows to derive the basic energy estimates leading to the proof of existence. Besides, we develop a suitable tensorization method which is the key for establishing uniqueness. The talk is based on a joint work with Aurelien Deya, Massimiliano Gubinelli and Samy Tindel.

Peter Imkeller (HU Berlin)

A Fourier analytic approach to stochastic analysis

In 1961, Ciesielski established a remarkable isomorphism of spaces of Hölder continuous functions and Banach spaces of real valued sequences. The isomorphism can be constructed along Fourier type expansions of (rough) H ölder continuous functions by means of the Haar-Schauder wavelet. We use Schauder representations for a path- wise approach of the integral of one rough function with respect to another one. In a more general and analytical setting, this pathwise approach of rough path analysis can be understood in terms of Paley- Littlewood decompositions of distributions, and Bony paraproducts in Besov spaces. The resulting calculus of para-controlled distributions allows to approach singular SPDE, arising for instance in the mathe- matical treatment of quantum fields. This talk is based on work with M. Gubinelli (U Bonn) and N. Perkowski (HU Berlin).

Arnulf Jentzen (ETH Zürich)

On the mild Ito formula and weak convergence rates for stochastic partial differential equations

This talk presents a certain class of stochastic processes, which we suggest to call mild Ito processes, and a new, somehow mild, Ito type formula for such processes. We will use the mild Ito formula to establish essentially sharp weak convergence rates for numerical approximations of different types of stochastic partial differential equations such as the parabolic Anderson model, the hyperbolic Anderson model, and stochastic Burgers equations. The talk is based on joint works with Daniel Conus, Sonja Cox, Arnaud Debussche, Giuseppe Da Prato, Ryan Kurniawan, Thomas Müller-Gronbach, Michael Röckner, Timo Welti, and Larisa Yaroslavtseva. More details on this topic can also be found at `https://www.math.ethz.ch/sam/research/projects.html?details=35`.

Yuri Kondratiev (Universität Bielefeld)

Fractional stochastic dynamics in the continuum

We start with Markov dynamics of interacting particle systems in the continuum. A fractional time evolution in such systems corresponds to random time changes. In the Vlasov type scaling, it leads to a fractional mesoscopic hierarchy for correlation functions. Corresponding state evolutions are obtained by means of a subordination of Poisson flows (which describe the kinetic behavior of initial Markov dynamics). We will discuss subordination effects, in particular, the notion of intermittency which appear as a result of fractional evolution and never is possible in the Markov kinetics.

Nicolai Krylov (University of Minnesota, Minneapolis)

Poisson stochastic process and basic Schauder and Sobolev estimates in the theory of parabolic equations

We show how knowing Schauder and Sobolev-space estimates for the one-dimensional heat equation allows one to derive their multidimensional analogs for equations with coefficients depending only on time variable with the SAME constants as in the case of one-dimensional heat equation. The method is based on using the Poisson stochastic process. It looks like no other method is available at this time and it is a very challenging problem to find a purely analytic approach to proving such results. Joint work with E. Priola.

Takashi Kumagai (Kyoto University)

Stability of heat kernel estimates and parabolic Harnack inequalities for symmetric non-local Dirichlet forms on metric measure spaces

We consider mixed-type symmetric non-local Dirichlet forms 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 for $\alpha \geq 2$, which has been one of the major open problems in this area. This is a joint work with Z.Q. Chen (Seattle) and J. Wang (Fuzhou).

Alessandra Lunardi (University of Parma)

Surface measures in Banach spaces

Let X be a Banach space endowed with a probability measure m. I will describe different approaches for the construction of surfaces measures associated to m, and related integration by parts formulae on smooth enough subsets of X.

The available literature deals mainly with non-degenerate Gaussian measures in separable Banach spaces. In that case, integration by parts formulae are similar (as far as possible) to the finite dimensional case. They may be extended to Sobolev functions since a trace theory for Sobolev functions on smooth surfaces is available. For non Gaussian measures the theory is not as well developed, and several basic questions remain open.

Terry Lyons (University of Oxford)

Rough paths, expected signatures and the potential theory of higher order elliptic operators

Joint work with Sina Nejad and Danyu Yang

The relationship between Brownian motion and the Laplace operator is a rich and complex one. Core to this relationship is the connection between harmonic functions and martingales. Another is the way the heat semigroup induces measures on path space that converge to Wiener measure.

A translation invariant pde is always associated via Fourier transform with a polynomial. We will say it is elliptic if that polynomial has a real part that converges to $-\infty$ off compact sets I.e. is not like $-(X-Y^2)^2$. Such an operator has a good semigroup Q_t. In all but the obvious case the kernel is not positive although it has a density and integrates to one.

For any partition P of time the semigroup induces a signed measure on piecewise linear paths. The total variation of the measure grows geometrically with the number of time steps in P.

Levin and L showed that the expected signature of the measures associated to the different partitions converge. Loosely, that the expected values of key functions on unparameterised rough path space have limits against these exploding measures on parameterised path space.

More recently, Danyu Yang and L identified and normed the class of functions on unparameterised rough path space that are previsible integrals of slowly varying one forms as a core space of functions on path space. Fixing p they form a Banach algebra of functions on unparameterised path space corresponding to the notion of lip function in finite dimensions.

Nejad has proved that the expectation operators are uniformly uniformly bounded operators and converge weakly against these lip functions as well as the iterated integrals. In other words the limit exists as a current on unparameterised rough path space even though it is exploding if though of as parameterised path space. The concrete nature of the function space of slowly varying cocyclic (or exact) one forms allows one to identify finite vector valued measures associating rough paths to these operators and solving pde semigroups by expectation.

This work is supported by the erc.

Zhi-Ming Ma (Academy of Math and Systems Science, Beijing)

Distribution flows associated with positivity preserving coercive forms

For a given quasi-regular positivity preserving coercive form, we construct a family of (sigma finite) distribution flows associated with the semigroup of the form. The canonical cadlag process equipped with the distribution flows behaves like a strong Markov process. Therefore we can perform a kind of stochastic analysis related to the positivity preserving coercive form.

The talk is based on a recent joint work by Xian Chen, Zhi-Ming Ma and Xue Peng.

David Nualart (The University of Kansas)

Stochastic heat equation with rough multiplicative noise

We present some results on the existence and uniqueness of a solution for the one-dimensional heat equation driven by a Gaussian noise which is white in time and it has the covariance of a fractional Brownian motion with Hurst parameter less than 1/2 in the space variable. In the linear case we establish a Feynman-Kac formula for the moments of the solution and discuss intermittency properties.

Etienne Pardoux (Aix-Marseille Université)

Homogenization of a semilinear heat equation with highly oscillating random potential

Consider a semilinear heat equation whose spatial variable lives in [0,1], with Dirichlet boundary conditions, and a highly oscillating random (non Gaussian) potential. We establish both a Law of Large Numbers and a Central Limit Theorem for this problem.

This is joint work with Martin Hairer.

Shige Peng (Shandong University)

A fully nonlinear supermartingale decomposition theorem and its applications

In this talk, we present our recent result of nonlinear decomposition theorem of Doob-Meyer's type under the framework of fully nonlinear linear expectation—G-expectation. We prove that, given a super G-martingale Y, there exists a unique pair of processes (Z,A) such that the triple (Y,Z,A) is a super solution of the corresponding backward stochastic differential equation driven by a G-Brownian motion. This deep result plays an important role for the construction and calculation of dynamically consistent robust pricing.

Nicolas Perkowski (HU Berlin)

Universality of martingale solutions to the KPZ equation

The KPZ equation is the only example of a singular SPDE for which a well-posed martingale problem has been formulated. The martingale problem is a powerful tool for establishing convergence to the KPZ equation, and in particular for proving the weak KPZ universality conjecture which claims that the equation universally describes the fluctuations in weakly asymmetric interface growth models. I will discuss how to apply the martingale formulation in order to establish the conjecture for different models. Based on joint works with Joscha Diehl and Massimiliano Gubinelli.

Francesco Russo (ENSTA ParisTech)

Probabilistic aspects of a porous media type equation with irregular coefficient

The object of this talk is a porous media type equation (PME) with monotone irregular possibly discontinuous coefficients and some stochastic perturbation.

- We will recall some recent results about the representation of (PME) via an associated non-linear diffusion describing the microscopic model associated with (PME).
- An important tool for the representation is a uniqueness lemma for partial differential equations for Fokker-Planck type equations with measurable coefficients.
- The probabilistic representation is used for approaching the solutions of (PME) using simulations of a stochastic process.
- We will also discuss (PME) perturbed by multiplicative noise. In this case the microscopic model is constituted by a double probabilistic representation. The basic tool is the uniqueness of a stochastic version of Fokker-Planck equation with measurable coefficients.
- The SPDE described above is the corresponding *Zakai* equation corresponding to a non-linear filtering problem related to a McKean-Vlasov type diffusion.
- Some perspectives about the probabilistic representation of some associated non-conservative PDEs investigated by A. Le Cavil, N. Oudjane and the speaker will be mentioned.

This talk is based essentially on collaborations with V. Barbu and M. Röckner.

Karl-Theodor Sturm (Universität Bonn)

Heat flow on time-dependent metric measure spaces and super Ricci flows

We study the heat equation on time-dependent metric measure spaces (being a dynamic forward gradient flow for the energy) and its dual (being a dynamic backward gradient flow for the Boltzmann entropy). Monotonicity estimates for transportation distances and for gradients will be shown to be equivalent to the so-called dynamical convexity of the Boltzmann entropy on the Wasserstein space. For time-dependent families of Riemannian manifolds the latter is equivalent to be a super-Ricci flow. This includes all static manifolds of nonnegative Ricci curvature as well as all solutions to the Ricci flow equation. The latter will also be characterized in terms of coupled pairs of Brownian motions.

Feng-Yu Wang (Beijing Normal University & Swansea University)

From Weak Poincaré to Weak Hypocoercivity

For a contraction C_0-semigroup on a separable Hilbert space, the decay rate is estimated tby using the weak Poincaré inequalities for the symmetric and ant-symmetric parts of the generator. As applications, non-exponential convergence rate is characterized for a class of degenerate diffusion processes, so that the study of hypocoercivity is extended. Concrete examples are presented.

Hendrik Weber (The University of Warwick)

Quasilinear SPDEs via rough paths

In this talk I will present a new approach to solve singular stochastic PDE which extends directly Gubinelli's notion of controlled rough paths and is also closely related to Hairer's theory of regularity structures. The approach is implemented for the variable-coefficient uniformly parabolic PDE

$$\partial_2 u - a(u)\partial_1^2 u - \sigma(u) f = 0,$$

where f is an irregular random distribution. The assumptions allow, for example, for an f which is white in time and only mildly coloured in space.

The key result is a deterministic stability result (in the spirit of the Lyons-Itô map) for solutions of this equation with respect to f but also the products vf and $v\partial_1^v$, with v solving the constant-coefficient equation $\partial_2 v - a_0\partial_1^2 v = f$. On the stochastic side it is shown how these (renormalised) products can be constructed for random f.

This talk is based on joint work with F. Otto.

Lorenzo Zambotti (UPMC-Paris 6)

Renormalisation of SPDEs

I want to present a general construction of the renormalisation group in regularity structures based on Hopf algebras of decorated rooted forests. This construction allows to unify the renormalisation group and the structure group giving further insight in the algebraic properties of regularity structures. This is based on joint work with Yvain Bruned and Martin Hairer.

Tusheng Zhang (The University of Manchester)

Global solutions of stochastic heat equations

In this talk, I will present recent results on global existence of solutions of stochastic heat equations driven by multiplicative space-time white noise.

Xicheng Zhang (Wuhan University)

Singular Multidimensional Stochastic Differential Equations

In this report I will survey some recent progress about multidimensional stochastic differential equations with singular drifts and Sobolev diffusion coefficients. In particular, degenerate stochastic Hamiltonian system will be addressed. Moreover, some applications in the probabilistic approach to Navier-Stokes equations will also be introduced.

Session talks (25 min)

Sigurd Assing (The University of Warwick)

On the collapse of wave functions satisfying a damped driven non-linear Schrödinger equation

We study the collapse of physically motivated trial solutions of a damped driven non-linear Schrödinger equation. Our method is based on, first, a time-change construction of the solution to a singular 2nd-order SDE associated with this Schrödinger-type equation, and, second, studying the solution's long-time behaviour.

Lucian Beznea (Institute of Mathematics of the Romanian Academy and University of Bucharest)

On the existence of invariant measures for Markovian semigroups

We present a two-step approach to prove existence of finite invariant measures for a given Markovian semigroup. First, we identify a convenient auxiliary measure and then we prove conditions equivalent to the existence of an invariant finite measure which is absolutely continuous with respect to it. We show that any uniformly bounded semigroup on L^p possesses an invariant measures and we give applications to sectorial perturbations of Dirichlet forms. The talk is based on joint works with Iulian Cîmpean and Michael Röckner.

Dirk Blömker (Universität Augsburg)

A surface Growth SPDE and Lack of Regularity

We review results on the existence and uniqueness for a surface growth model with or without space–time white noise.If the surface is a graph, then this model has striking similarities to the three dimensional Navier-Stokes equations in terms of energy estimates and scaling properties, and in both models the question of uniqueness of global weak solutions remains open.

In the physically relevant dimension d=2 and with the physically relevant space–time white noise driving the equation, the direct fixed-point argument for mild solutions fails, as there is not sufficient regularity for the solution. The situation is one of the simplest cases where the method of regularity structures introduced by Martin Hairer can be applied, although we follow a significantly simpler approach. Using spectral Galerkin method or any other type of regularization of the noise, one can give a rigorous meaning to the stochastic PDE and show existence and uniqueness of local solutions in that setting. We finally comment briefly on the possibility of blow up phenomena.

Zdzislaw Brzezniak (The University of York)

Existence of weak and stationary solutions as well as of invariant measures for stochastic Navier-Stokes Equations with multiplicative noise

I will speak about Stochastic Navier-Stokes Equations (SNSEs) in unbounded domains with slightly irregular multiplicative noise. I will explain how the proof of the existence of a weak martingale solution can be rewritten as a proof of a an invariant measures and stationary solutions for damped SNSEs in the whole euclidean space $\mathbb{R}^3$. It turns out that even in the case of bounded domains, our approach improves a classical result by Flandoli and Gatarek. This talk will be based on three papers. One is a joint work with with M Ondrejat and Ela Motyl and two other are joint works with B Ferrario.

Yana A. Butko (Universität des Saarlandes)

Chernoff approximation of evolution semigroups corresponding to Markov processes

An evolution semigroup $\left(e^{tL}\right)_{t\geq 0}$ with a given generator L (on a given Banach space), on the one hand, allows to solve an initial (or initial-boundary) value problem for the corresponding evolution equation $\frac{\partial f}{\partial t}=Lf$, on the other hand, defines the transition probability $P(t,x,dy)$ of an underlying Markov process $(\xi_t)_{t\geq 0}$ (if there is any) through $e^{tL}f(x)=\mathbb{E}^x[f(\xi_t)]=\int f(y)P(t,x,dy)$. Usually the desired semigroup is not known explicitly but can be approximated, e.g., with the help of the Chernoff Theorem. This theorem provides conditions for a family of bounded linear operators $(F(t))_{t\geq 0}$ to approximate the considered semigroup $\left(e^{tL}\right)_{t\geq 0}$ via the formula $e^{tL}=\lim_{n\to\infty}[F(t/n)]^n$. This formula is called *Chernoff approximation of the semigroup* $\left(e^{tL}\right)_{t\geq 0}$ *by the family* $(F(t))_{t\geq 0}$. Chernoff approximations have the following advantage. If families $(F(t))_{t\geq 0}$ are given explicitly, the expressions $[F(t/n)]^n$ can be directly used for calculations and hence for simulations of underlying stochastic processes. Moreover, if all operators $F(t)$ of a given family $(F(t))_{t\geq 0}$ are integral operators with elementary kernels (or pseudo-differential operators with elementary symbols) the identity $e^{tL}=\lim_{n\to\infty}[F(t/n)]^n$ leads to a representation of the semigroup $\left(e^{tL}\right)_{t\geq 0}$ by limits of n-fold iterated integrals of elementary functions when n tends to infinity. Such representations are called *Feynman formulae*; the limits in Feynman formulae usually coincide with functional (path) integrals with respect to probability measures (Feynman–Kac formulae) or with respect to Feynman pseudomeasures (Feynman path integrals). Therefore, the method of Chernoff approximation allows also to establish new path-integral-representations for solutions of evolution equations; different Chernoff approximations (in the form of Feynman formulae) for the same semigroup allow to establish relations between different path integrals. One further advantage is that the method is applicable for a broad class of evolution semigroups corresponding to different types of dynamics on different geometrical structures.

It is supposed to present the technique of constructing Chernoff approximations for semigroups related to some original (known or already Chernoff approximated) semigroups through the following procedures: additive or/and multiplicative perturbations of original generators, subordination (in the sense of Bochner). It is planned to illustrate this technique by discussing Chernoff approximations and, in particular, Feynman formulae for subordinated diffusions and Feller type processes in $\mathbb{R}^d$, metric graphs and Riemannian manifolds. It is planned to discuss also some related Feynman–Kac formulae and Feynman path integrals.

References

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[5] Ya.A. Butko. Feynman formulas and functional integrals for diffusion with drift in a domain on a manifold, *Math. Notes* **83** N3 (2008), 301–316.

Le Chen (University of Kansas)

Regularity and positivity of densities for the stochastic (fractional) heat equation

In this talk, I will present a recent study on the the density of the solution to a semilinear stochastic (fractional) heat equation (SHE), which includes the *parabolic Anderson model* as a special case. In the first part, we prove that the solution to a semilinear SHE with measure–valued initial data has a smooth joint density at multiple points. This result extends the work by Mueller and Nualart [EJP'08] from the density at single point to the joint density at multiple points and from function–valued initial data to more general initial data. This is achieved by proving that solutions to a related stochastic partial different equation have negative moments of all orders. In the second part, we establish the strict positivity of the density in the interior of the support of the joint law. This result extends the known results to allow measure–valued initial data and unbounded diffusion coefficient (e.g., the parabolic Anderson model).

This talk is based on a joint work with Yaozhong Hu and David Nualart.

Carsten Chong (Ludwig-Maximilians-University of Munich)

Stochastic PDEs with Heavy–tailed noise

We analyze the nonlinear stochastic heat equation driven by heavy–tailed noise in free space and arbitrary dimension. The existence of a solution is proved even if the noise only has moments up to an order strictly smaller than its Blumenthal–Getoor index. In particular, this includes all stable noises with index $\alpha<1+2/d$. Although we cannot show uniqueness, the constructed solution is natural in the sense that it is the limit of the solutions to approximative truncated equations. The techniques are shown to apply to Volterra equations with kernels bounded by generalized Gaussian densities, which includes a large class of uniformly parabolic stochastic PDEs.

The talk is based on a recent paper with the same name, which you can find on arXiv under `https://arxiv.org/abs/1602.00257`

Iulian Cimpean (Institute of Mathematics of the Romanian Academy)

On semimartingale functionals of Markov processes associated to lower bounded semi-Dirichlet forms

Based on a semigroup description for quasimartingale functionals of general Markov processes, we present a new approach to Fukushima's characterization of such functionals, extending it to lower bounded semi-Dirichlet forms.

Petru A. Cioica-Licht (University of Otago)

On the regularity of stochastic partial differential equations on non–smooth domains

Although there exists an (almost) fully-edged regularity theory for (semi-)linear second order stochastic partial differential equations (SPDEs, for short) on smooth domains, very little is known about the regularity of these equations on domains with non-smooth boundaries that have singularities, such as corners or edges. In this talk we present an approach for analysing the behaviour of the solution to SPDEs in the direct vicinity of boundary singularities. We focus on a simplifed setting that is still general enough to reveal some of the main issues: We consider the stochastic heat equation with additive noise and zero Dirichlet boundary condition on a planar angular domain. In this way we deal with a basic but typical example of a second order parabolic SPDE that is forced to vanish on the boundary of a domain which is smooth except at one point, the vertex. In order to capture the singular behaviour of the solution and its derivatives at the vertex, we use weighted Sobolev spaces, where the weights are appropriate powers of the distance to the vertex. Our approach relies on suitable Green function estimates, which we use to prove a fundamental weighted L_p-estimate for the stochastic convolution associated to the corresponding equation.

(*) This is joint work with Kyeong-Hun Kim (Korea University, Korea), Kijung Lee (Ajou University, Korea), and Felix Lindner (TU Kaiserslautern, Germany).

Robert C. Dalang, (Ecole Polytechnique Fédérale de Lausanne)

Hitting probabilities for systems of stochastic partial differential equations: an overview

We consider a d-dimensional random field that solves a possibly non-linear system of stochastic partial differential equations, such as stochastic heat or wave equations. We present results on upper and lower bounds on the probabilities that the random field visits a deterministic subset of $\mathbb{R}^d$, in terms, respectively, of Hausdorff measure and Newtonian capacity of the subset. These bounds determine the critical dimension above which points are polar, but do not, in general, determine whether points are polar in the critical dimension. For linear spde's, we resolve, in joint work with Carl Mueller and Yimin Xiao, the issue of polarity of points in the critical dimension, and also address the question of existence of multiple points in critical dimensions.

Jean-Dominique Deuschel (TU Berlin)

Quenched invariance principle for random walk in time-dependent non-elliptic balanced random environment

We prove a central limit theorem for balanced random walks in time dependent ergodic non elliptic balanced environments. The proof is based on the use of a new maximum principle for degenerate parabolic difference operators.

Joint work with N. Berger, X. Guo and A. Ramirez

Jinqiao Duan (Illinois Institute of Technology, Chicago)

Effective Dynamics for Stochastic Partial Differential Equations

This presentation is about extracting effective dynamical behaviors for a class of stochastic partial differential equations.

David Elworthy (The University of Warwick)

Ramer's finite co-dimensional forms and stochastic analysis

A major motivation for Ramer's development of his non-linear change of variable formula for Gaussian measures in his thesis "Integration on infinite dimensional manifolds" was his construction of a theory of "finite co-dimensional differential forms". I'll briefly describe these, discuss how they could relate to certain non-linear but smooth elliptic pdes $F(u)=f$ where f is random, and sketch their application to a quick but interesting proof of the Gauss- Bonnet-Chern theorem for vector bundles based on an approach by Liviu Nicolaescu.

Torben Fattler (TU Kaiserslautern)

Stochastic quantization of the fractional Edwards measure

We prove existence of a diffusion process whose invariant measure is the fractional polymer or Edwards measure for fractional Brownian motion in dimension $d \in \mathbb{N}$ with Hurst parameter $H \in (0,1)$ fulfilling $dH < 1$. The diffusion is constructed via Dirichlet form techniques in infinite dimensional (Gaussian) analysis. By providing a Fukushima decomposition for the stochastic quantization of the fractional Edwards measure we show that the constructed process solves weakly a stochastic differential equation in infinite dimension for quasi–all starting points. Moreover, the solution process is driven by an Ornstein–Uhlenbeck process taking values in an infinite dimensional space and is unique, in the sense that the underlying Dirichlet form is Markov unique. The equilibrium measure, which is by construction the fractional Edwards measure, is specified to be an extremal Gibbs state. The talk bases on a jointed work with W. Bock and L. Streit.

Stefan Geiss (University of Jyväskylä)

Besov spaces and quadratic BSDEs

The aim of this talk is to present recent results about quadratic and sub–quadratic backwards stochastic differential equations and related stochastic analysis. We present an extension of classical Besov spaces, where the extension is based on a general decoupling technique on the Wiener space, discuss some basic properties of these spaces, and apply these spaces to a quantitative analysis of (sub)–quadratic BSDEs. As ingredients we use Muckenhoupt weights and an improvement of Fefferman's inequality. This is joint work with Juha Ylinen. Part of the results are contained in [1], the upcoming updated version will contain all the presented results.

[1] S. Geiss and J. Ylinen: Decoupling on the Wiener space and applications to BSDEs. arXiv:1409.5322v2 (78 pages)

Máté Gerencsér (IST Austria)

Representation of solutions of SPDEs and approximations

We discuss Feynman-Kac formulae in the setting when, due to the adaptedness of the data of the equation whose solution is to be represented, the backward characteristics do not make (Itô) sense. We then outline how such representation can help in dealing with some very natural problems arising in the numerical analysis of stochastic partial differential equations.

This is a joint work with I. Gyöngy.

Maria Gordina (University of Connecticut)

Non-smooth perturbations of the Ornstein-Uhlenbeck operators

We consider an infinite-dimensional Ornstein-Uhlenbeck operator perturbed by a non-linear and non-smooth drift. We prove new estimates on solutions of such equations and smoothness (Cameron-Martin quasi-invariance) of the perturbed semi-group. Furthermore, we prove uniform integral estimates of the corresponding Girsanov densities in terms of the estimates of the drift. We only assume that the non-smooth drift is maximal monotone and locally finite, but no assumptions are made about the growth rate at infinity. This is a joint work with M. Röckner and A. Teplyaev.

Istvan Gyöngy (University of Edinburgh)

Accelerated finite element schemes for stochastic PDEs

Richardson's extrapolation is implemented for a class of finite elements schemes to approximate the solutions of stochastic linear PDEs of parabolic type. It is shown that the accuracy of the approximations can be made as high as one wishes if suitable mixtures of finite element approximations are used.

The talk is based on a joint work with Annie Millet.

Erika Hausenblas (University of Leoben)

The nonlinear Schrödinger Equation driven by Levy noise

In the talk, I will introduce first the nonlinear Schrödinger equation and explain the deterministic background. After I will point out under which conditions a unique strong solution to the nonlinear Schrödinger equation with pure jump process of finite activity exists. By this result one can show the existence of a weak solution to the the nonlinear Schrödinger equation with jump noise of infinite activity. Finally, as the last point, I will explain under which conditions there exists a unique strong solution. Here we used an abstract result of Tom Kurtz and show under which conditions the equation fits into his framework. This is a joint work with de Bouard and Ondrejat.

Michael Hinz (Universität Bielefeld)

Some applications of vector analysis for Dirichlet forms

We present some applications of the vector analysis for Dirichlet forms as recently studied joint with Dan Kelleher, Michael Röckner, Luke Rogers, Alexander Teplyaev and others. One application is the definition and study of magnetic Schrödinger operators associated with Dirichlet forms and some related stochastic analysis. Another particularly simple application deals with Ventsell boundary value problems for second order operators on domains with fractal boundary such as the classical snowflake domain. This is also connected to related choices of metrics and Lipschitz functions. We will discuss some recent results joint with Maria Rosaria Lancia and Paola Vernole.

Antoine Hocquet (TU Berlin)

Singularities of the stochastic harmonic map flow

The deterministic Harmonic Map Flow (HMF) was originally used by geometers in the early sixties as a tool to build harmonic maps between two manifolds $u: M \to N$. The case where M is two dimensional is energy-critical, meaning that singularity by concentration of energy is possible.

Perturbing the dynamics by adding a coloured Gaussian noise (which relates thermal fluctuations in micromagnetics), we show that oppositely to the deterministic case, solutions can explode no matter how the initial data is chosen.

Peng Jin (Bergische Universität Wuppertal)

Stable Process with Singular Time-Dependent Drift

In this talk, we consider weak solutions for the following type of stochastic differential equation

$$\begin{cases} dX_t = dS_t + b(s+t, X_t)dt, & t \geq 0, \\ X_0 = x, \end{cases}$$

where $(s,x) \in [0,\infty) \times \mathbb{R}^d$ is the initial starting point, $b: [0,\infty) \times \mathbb{R}^d \to \mathbb{R}^d$ is measurable, and $S = (S_t)_{t \geq 0}$ is a d-dimensional α-stable process with index $\alpha \in (1,2)$. We show that if the α-stable process

S is non-degenerate and $b \in L^{\infty}_{loc}(\mathbb{R}_+;L^{\infty}(\mathbb{R}^d)) + L^{q}_{loc}(\mathbb{R}_+;L^{p}(\mathbb{R}^d))$ for some $p,q>0$ with $d/p+\alpha/q<\alpha-1$, then the above SDE has a unique weak solution for every starting point $(s,x)\in[0,\infty)\times\mathbb{R}^d$.

Hiroshi Kawabi (Okayama University)

Riemannian Wasserstein geometry on the space of Gaussian measures over the Wiener space

The space of Gaussian measures on an abstract Wiener space being equivalent to the Wiener measure becomes a Hilbert manifold, and the manifold admits a non-positive Riemannian metric derived from the information geometry. We consider another geometric structure on the manifold, called the Wasserstein geometry, which is a metric geometry on the space of probability measures. We first show the convexity of the manifold with respect to the Wasserstein geometry, which enables us to restrict the Wasserstein geometry to the manifold naturally. We then construct a Riemannian metric on the manifold, which induces the Wasserstein distance function. The Riemannian manifold has a non-negative sectional curvature, which provides the difference from the information geometry. This talk is based on joint work with Asuka Takatsu (Tokyo Metropolitan University).

Panki Kim (Seoul National University)

Estimates of Dirichlet heat kernel for subordinate Brownian motions

The transition density (if it exists) of a Markov process is the heat kernel of the generator of the process. The transition density of a general Markov process rarely admits an explicit expression. Thus obtaining sharp estimates on the transition density is a fundamental problem both in probability theory and in analysis. In this talk, we discuss the behavior of the transition density (Dirichlet heat kernel) for subordinate Brownian motions in $C^{1,1}$-open subsets whose scaling orders are not necessarily strictly less than 2. Our estimate is sharp and explicitly expressed in terms of the distance to the boundary, Laplace exponent of subordinator and its derivative. This is a joint work with Ante Mimica.

Alexander Kolesnikov (Steklov Mathematical Institute of the Russian Academy of Sciences

Sobolev estimates for mass transportation mappings with application to transport equations and spectral gap

We study Sobolev regularity of mass transportation mappings on finite- and infinite-dimensional spaces. The problem is motivated by various applications, in our talk we concentrate on two of them: well-posedness of the transport equations and sharp spectral gap estimates for convex bodies. We make special emphasis on the optimal mass transportation mappings with quadratic cost. In this case our estimates can be viewed as a priori estimates for the corresponding Monge-Ampere equation. We discuss, in particular, new infinite-dimensional aspects of this classical problem.

Yuri Kozitzky (Maria Curie-Skłodowska University, Lublin)

Solving Fokker-Planck equations for continuum infinite particle systems

We discuss the way of constructing the global evolution of states $\mu_0 \mapsto \mu_t$ of a number of continuum models of interacting particle systems based on the Fokker-Planck equation. It consists in the following steps: (i) passing from the Fokker-Planck equation to the evolution equation for the corresponding correlation functions; (ii) constructing the solution of this equation k_t, existing in a scale of Banach spaces $\mathcal{K}_t$ on a bounded time interval; (iii) proving that each k_t lies in the cone $\mathcal{K}_t^{\star}$ of correlation function and thereby identifying the unique state μ_t such that $k_t = k_{\mu_t}$; (iv) constructing the continuation of k_{μ_t} to all $t>0$ lying in $\mathcal{K}^{\star} = \cup_{t>0}\mathcal{K}_t^{\star}$.

Xiang-Dong Li (AMSS, Chinese Academy of Sciences)

On a new stochastic characterization of the incompressible Navier-Stokes equation

In 1966, V. I. Arnold proved that the incompressible Euler equation is the geodesic equation on the group of volume preserving diffeomorphisms. In this talk I will first review some known results on the stochastic characterization of the incompressible Navier-Stokes equation. Then I will present a new stochastic characterization of the incompressible Navier-Stokes equation via the stochastic dynamic program principle over the group of volume preserving diffeomorphisms. Joint work with Songzi Li and Guoping Liu.

Xue-Mei Li (The University of Warwick)

Some comments on the Feynman-Kac Kernel

Recently there had been renewed interest on the weighted Laplacian and volume comparison associated to it.

We consider the Feynman-Kac kernel associated to (1/2)Delta+Gradient h +V for manifolds whose exponential maps are diffeomorphic to Rn. Assuming conditions only on the geometric data, without strict ellipticity, we show that derivative of the weighted Feyman-Kac heat kernel is given by the Euclidean kernel, using the Riemannian distance, and the semi-classical bridge.

This is joint work with J. Thompson.

Ananta Kumar Majee (Universität Tübingen)

On Stochastic Optimal Control in Ferromagnetism

In this presentation, we study an optimal control problem for the stochastic Landau-Lipschitz-Gilbert equation on a bounded domain in $\mathbb{R}^d$ (d=1;2;3). We establish existence of a relaxed optimal control for relaxed version of the problem. As the control acts in the equation linearly, we then establish existence of an optimal control for the underlying problem. Furthermore, convergence of a Galerkin approximation for $d=1$ and physically relevant computational studies will be discussed.

Carlo Marinelli (University College London)

Semilinear stochastic evolution equations on L_p spaces

We report on recent results about well-posedness for a class of stochastic semilinear evolution equations on L_p spaces, driven by multiplicative Wiener noise, with a drift term given by an evaluation operator that is assumed to be quasi-monotone and polynomially growing, but not necessarily continuous. Related results for variational solutions to equations on L_2 without any growth condition will also be discussed.

Bohdan Maslowski (Charles University in Prague)

Stochastic PDEs driven by general Volterra noise

Stochastic differential equations in Hilbert spaces where the noise is (not necessarily Gaussian) Volterra process are studied. Examples of such processes are cylindrical fractional Brownian motion or more generally, cylindrical mutifractional Brownian motion (in the Gaussian case) or Rosenblatt process (in the non-Gaussian case). For linear equations, we distinguish two levels of regularity of kernels of the driving processes (regular and strictly regular). Under the stronger conditions on regularity of the kernel we have less restrictive assumptions on the incremental covariance operator of the processes and vice versa. We show, under appropriate hypotheses generalizing the classical ones (for

Wiener process), measurability and continuity of the solution to the corresponding linear equation (i.e. of the stochastic convolution integral). In the second part, bilinear noise is considered. Existence, uniqueness and large time behaviour of solutions are discussed in the cases of linear and semilinear drift term. The results are compared with their standard counterparts (in the Markov case).

The talk is based on joint results with P. Coupek, M. Garrido and J. Snuparkova.

Marvin Müller (ETH Zürich)

Stochastic Moving Boundary Problems

Moving boundary problems allow for modeling of multi–phase systems with separating boundaries evolving in time. While the deterministic problems are, in general, well understood, introducing additional stochastic terms to the equations makes the analysis more complicated. Motivated from applications in economics and finance, as models for demand, supply and price formation in electronic stock markets, we study a class of stochastic perturbations of second-order PDEs with non-linear Stefan-type boundary interaction. Applying Ito–Wentzell formula, the problem can be transformed into a stochastic evolution equation, where the boundary interaction introduces additional drift and noise terms. Using tools from theory of interpolations spaces, maximal L^p regularity and stochastic equations in infinite dimension, we establish a rigorous existence theory and provide a framework for further analysis of this class of semilinear stochastic moving boundary problems.

Alexandra Neamtu (Friedrich Schiller University Jena)

Dynamics of Stochastic Evolution Equations in Banach Spaces

We analyze the long-time behavior of stochastic evolution equations driven by an infinite- dimensional fractional Brownian motion in separable Banach spaces. A suitable transformation based on the stationary Ornstein-Uhlenbeck process allows us to reduce the stochastic equation into a pathwise problem, from which we can derive a random dynamical system and investigate the existence of attractors and invariant manifolds. As applications, we consider parabolic equations with nonlinear boundary conditions.

Alexander Nerlich (University of Ulm)

A randomized weighted p-Laplacian evolution equation with Neumann Boundary conditions

In this talk, we consider the randomized version of a weighted p-Laplacian evolution equation in $L_1(\Omega;L_1(S))$, where $S\subseteq R^n$ and $(\Omega,\mathcal{F},\mathbb{P})$ is a probability space. This equation models the evolution of fluvial landscapes. The initial value describes a fluvial landscape, the occurring weight function is a (stationary) water depth and the solution u represents the fluvial landscapes' change over time. As it seems reasonable to view the water depth as well as the fluvial landscape as random quantities, this equation is of great interest.

We obtain unique strong solutions u for arbitrary initial values $u_0\in L_1(\Omega;L_1(S))$. Moreover, we prove that the solution converges (in $L^q(\Omega;L^q(S))$, for any $q\geq 1$) to the average $\overline{(u_0)}$ of the initial value as long as $u_0\in L^q(\Omega;L^q(S))$. In addition, an almost sure upper bound for $\|u(t)-(u_0)\|_{L^1(S)}$ and an upper bound for the tail function of $\|u(t)-(u_0)\|_{L^2(S)}$ will be derived. If the initial value is suciently integrable then the bound for the tail function is of exponential order. The latter holds particularly if u_0 is either bounded or Gaussian.

Hirofumi Osada (Kyushu University)

Infinite-dimensional stochastic differential equations with symmetry

We talk about infinite-dimensional stochastic differential equations (ISDE) with symmetry. Such ISDEs arise from statistical physics and, in particular, random matrix theory. I explain the method called "Schemes and tails" and the role of Dirichlet form theory in it.

Youssef Ouknine (Cadi Ayyad University, Marrakesh)

On Semimartingale local time inequalities and Applications in SDE's

Using the balayage formula, we prove an inequality between the measures associated to local times of semimartingales. Our result extends the "comparison theorem of local times" of Ouknine (1988), which is useful in the study of stochastic differential equations. This can be seen as an elegant proof of Nakao's result on pathwise uniqueness (1972). The inequality presented in this paper covers the discontinuous semimartingale case. Moreover, we study the pathwise uniqueness of some stochastic differential equations involving local time of unknown process.

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[3] M. Benabdallah, S. Bouhadou and Y. Ouknine.On the Pathwise Uniqueness of Solutions of One-Dimensional Stochastic Differential Equations with Jumps, in *Statistical Methods and Applications in Insurance and Finance. CIMPA School, Marrakech and El Kelaa M'gouna, Morocco*, April 2013.

Barbara Rüdiger (Bergische Universität Wuppertal)

The Enskog Process

The existence of a weak solution to a McKean–Vlasov type stochastic differential system corresponding to the Enskog equation of the kinetic theory of gases is established under natural conditions. The distribution of any solution to the system at each fixed time is shown to be unique. The existence of a probability density for the time–marginals of the velocity is verified in the case where the initial condition is Gaussian, and is shown to be the density of an invariant measure. This is joint work with S. Albeverio and P. Sundar.

Michael Scheutzow (TU Berlin)

Minimal random attractors

It is well-known that a random attractor of a random dynamical system which attracts all compact sets is unique while this is not true for a random point attractor (which attracts all deterministic points). We show that if a random point attractor exists then there is always a smallest such point attractor (no matter whether the attraction is in the pullback sense or in probability). We also provide generalizations to other families of attracted sets. This is joint work with Hans Crauel (Frankfurt).

Björn Schmalfuß (Friedrich Schiller University Jena)

Dynamics of SPDE driven by Young integrals

Under particular regularity assumptions on the coefficients of an SPDE driven by an fractional Brownian motion with Hurst Parameter $H > \frac{1}{2}$ we show that this equation generates a random dynamical system. We discuss exponential stability and random attractors for this random dynamical system.

Stanislav Shaposhnikov (Moscow State University)

On the uniqueness of solutions to continuity equations

We present a new approach to specify a class of measures which, under reasonable assumptions about coefficients and initial data, there is a unique solution to the Cauchy problem. The main result can be briefly formulated as follows: uniqueness holds in a certain class of measures with respect to which the given drift coefficient can be suitably approximated by smooth vector fields. We describe such approximations. It turns out that even in the one-dimensional case in the present framework new results can be obtained. We also consider several examples of infinite-dimensional equations.

Masayoshi Takeda (Tohoku University)

Spectral Properties of Symmetric Markov Processes with Tightness Property

Let X be an irreducible, strong Feller, m-symmetric Markov process on a locally compact separable metric space E. In addition, we assume that X has a tightness property, i.e., for any $\varepsilon > 0$, there exists a compact set K such that $\sup_{x \in E} R_1 1_{K^c}(x) \leq \varepsilon$. Here 1_{K^c} is the indicator function of the complement of K and R_1 is the 1-resolvent of X. We show that under these conditions on X its semi-group p_t is a compact operator on $L^2(E;m)$. Moreover, we show that every eigenfunction has a bounded continuous version.

Alexander Teplyaev (University of Connecticut)

Vector analysis for Dirichlet forms and related questions

The talk will give an overview of several questions related to the recent progress in vector analysis for Dirichlet forms. One of the applications of such analysis is the existence and uniqueness of solutions of the non-linear heat equation that appears in the hydrodynamic limit of weakly non-symmetric simple exclusion processes on non-smooth spaces. In fact, a large class of nonlinear vector PDEs can be defined and studied on spaces that have no differential structure but only a Dirichlet form. If time permits, Hodge theorem, Dirac semigroup, magnetic Schrodinger semigroup and related stochastic analysis, and some estimates for SPDEs and infinite dimensional SDEs will be discussed. This work has been done in collaboration with Joe Chen, Masha Gordina, Michael Hinz, Dan Kelleher, Michael Röckner.

Jonas Tölle (Aalto University)

Nonlinear, singular SPDE perturbed by noise acting along infinitesimal motions on domains with symmetries

We study existence and uniqueness of a variational solution in terms of stochastic variational inequalities (SVI) to stochastic nonlinear diffusion equations with a highly singular diffusivity term and multiplicative Stratonovich gradient-type noise. We derive a commutator relation for the unbounded noise coefficients in terms of a geometric Killing vector condition. We shall precisely discuss the geometric methods used in the a priori estimates for an approximating equation, related to heat

kernel estimates on convex manifolds with boundary by Wang. The drift term is given by the total variation flow, respectively, by a singular p-Laplace-type operator. We impose nonlinear zero Neumann boundary conditions and precisely investigate their connection with the coefficient fields of the noise, where we employ a commutator theorem for Dirichlet forms by Shigekawa. For example, Neumann boundary conditions remain invariant under the infinitesimal vector field action, if the vector fields are infinitesimal generators of a group of rotations on a ball. The case without boundary on the flat torus in turn requires that the vector fields generate a group of translations. Other domains with symmetries leaving certain rigid motions invariant shall also be discussed. This solves an open problem posed by Barbu, Brzeźniak, Hausenblas and Tubaro and Barbu and Röckner respectively.
This talk is based on joint work with Ioana Ciotir (INSA Rouen, Normandie Université), see

Robert Voßhall (TU Kaiserslautern)

On the stochastic heat equation with sticky reflected boundary condition

In this talk we study the stochastic heat equation with sticky reflected boundary condition. Dirichlet form techniques are used in order to construct and characterize its solution. The obtained process already for some time is conjectured to be the scaling limit of the dynamical wetting model, also known as Ginzburg–Landau dynamics, with pinning and reflection at the boundary. These competing effects result in the so–called sticky reflection. For the second part of this talk it is planned to discuss the progress on this problem.

Minoru W. Yoshida (Kanagawa University)

On L^2 properties of the drift coefficient of operator corresponding to Φ_3^4 stochastic quantization

L^2 properties of the drift coefficient of a symmetric operator that corresponds with symmetric form, through which a stochastic quantization of Φ_3^4 is considered, are discussed in detail. This is a foundation of the study of closability of the symmetric form.

Wen Yue (TU Wien)

Discrete Beckner inequalities via the Bochner-Bakry-Emery approach for Markov chains

Discrete convex Sobolev inequalities and Beckner inequalities are derived for time-continuous Markov chains on finite state spaces. Beckner inequalities interpolate between the modified logarithmic Sobolev inequality and the Poincaré inequality. Their proof is based on the Bakry-Emery approach and on discrete Bochner-type inequalities established by Caputo, Dai Pra, and Posta and recently extended by Fathi and Maas for logarithmic entropies. The abstract result for convex entropies is applied to several Markov chains, including birth-death processes, zero-range processes, Bernoulli-Laplace models, and random transposition models, and to a finite-volume discretization of a one-dimensional Fokker-Planck equation, applying results by Mielke.

Deng Zhang (Shanghai Jiao Tong University)

The stochastic logarithmic Schrödinger equation

We prove global existence and uniqueness to the stochastic logarithmic Schrödinger equation with linear multiplicative noise. The approach is mainly based on the rescaling approach and the method of maximal monotone operators. Moreover, uniform estimates of solutions in the energy space and in an appropriate Orlicz space will also be given. This is joint work with Viorel Barbu and Michael Röckner.

Anna Zhigun (TU Kaiserslautern)

The Malliavin derivative and compactness: an application to a degenerate PDE – SDE coupling

Compactness is one of the most versatile tools of the analysis of nonlinear PDEs and systems. Usually, compactness is established by means of some embedding theorem between functional spaces. Such results in turn rely on appropriate estimates of a function and its derivatives. While a similar result based on simultaneous estimates for the Malliavin and weak derivatives is available for the Wiener–Sobolev spaces, it seems that it has not yet been widely used in the analysis of highly nonlinear parabolic problems with stochasticity. In my talk I will discuss the advantages of an approach based on this result and show how it could be applied to a degenerate PDE– SDE coupling.

Rongchan Zhu (Beijing Institute of Technology & Bielefeld University)

Restricted Markov uniqueness and ergodicity for the stochastic quantization of $p(\Phi)_2$ and its applications

In this talk we obtain restricted Markov uniqueness of the generator and uniqueness of martingale (probabilistically weak) solutions for the stochastic quantization problem in both the finite and infinite volume case by clarifying the precise relation between the solutions to the stochastic quantization problem obtained by the Dirichlet form approach in [AR91] and those obtained in [DD03] and in [MW15]. We prove that the solution $X-Z$, where X is obtained by the Dirichlet form approach and Z is the corresponding O-U process, satisfies the corresponding shifted equation. Moreover, we obtain that the infinite volume $p(\Phi)_2$ quantum field is an invariant measure for the $X_0=Y+Z$, where Y is the unique solution to the shifted equation. Furthermore, we establish unique ergodicity of the solutions to the stochastic quantization problem on the two dimensional torus.

Xiangchan Zhu (Beijing Jiaotong University & Bielefeld University)

Dirichlet form associated with Φ^4_3 model

We construct the Dirichlet form associated with the dynamical Φ^4_3 model. The Dirichlet form on cylinder functions is the classical gradient bilinear form. As a consequence, the classical gradient bilinear form is closable. Its closure is a quasi-regular Dirichlet form.

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Brahim Baadi	(Ibn Tofail University Kenitre, Morocco)
Volker Bach	(TU Braunschweig)
Salwa Bajja	(National School of Applied Sciences of Marrakesh)
Viorel Barbu	(Romanian Academy, Iasi)
Meriem Ben Hadj Khalifa	(Faculty of Sciences of Monastir, Tunisia)
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Xiang-Dong Li	(AMSS, Chinese Academy of Sciences)
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Alessandra Lunardi	(University of Parma)
Terry Lyons	(University of Oxford)

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Ludger Overbeck	(Universität Gießen)
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Andreas Sojmark	(University of Oxford)
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Herry Suryawan	(Universität Zürich)
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Stefania Ugolini	(University of Milan)
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Hui Wang	(Nanjing Normal University)
Wei Wang	(Nanjing University)

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Xicheng Zhang	(Wuhan University)
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Maria Ziemlanska	(Leiden University)
Raphael Zimmer	(Universität Bonn)

Tram map


3
Babenhausen Süd
Voltmannstraße
Koblenzer Straße
Lange Straße
Auf der Hufe
Nordpark
Witte-
kind-
straße
1
Schildesche
Heidegärten
Kattenkamp
Deciusstraße
Johannesstift
Sudbrackstraße
2
Milse
Schelpmilser Weg
Baumheide
Seidenstickerstraße
Schüco
Ziegelstraße
Finkenstraße
Schillerstraße
Stadtheider Straße
Beckhausstraße
4
Lohmannshof
Wellensiek
Universität
Bültmannshof
Graf-von-Stauffenberg-Straße
Rudolf-Oetker-Halle
Siegfriedplatz
Hauptbahnhof
Jahnplatz
4
Rathaus
University
Line 4 - direction
'Lohmannshof'
August-Schroeder-Straße
Ravensberger Straße
Krankenhaus Mitte
Oststraße
Hartlager Weg
Sieker Mitte
Luther-Kirche
Roggenkamp
Elpke
Gesamtschule Stieghorst
Stieghorst
3
Adenauerplatz
Landgericht
August-Bebel-Straße
Teutoburger Straße
Mozartstraße
Prießallee
Sieker
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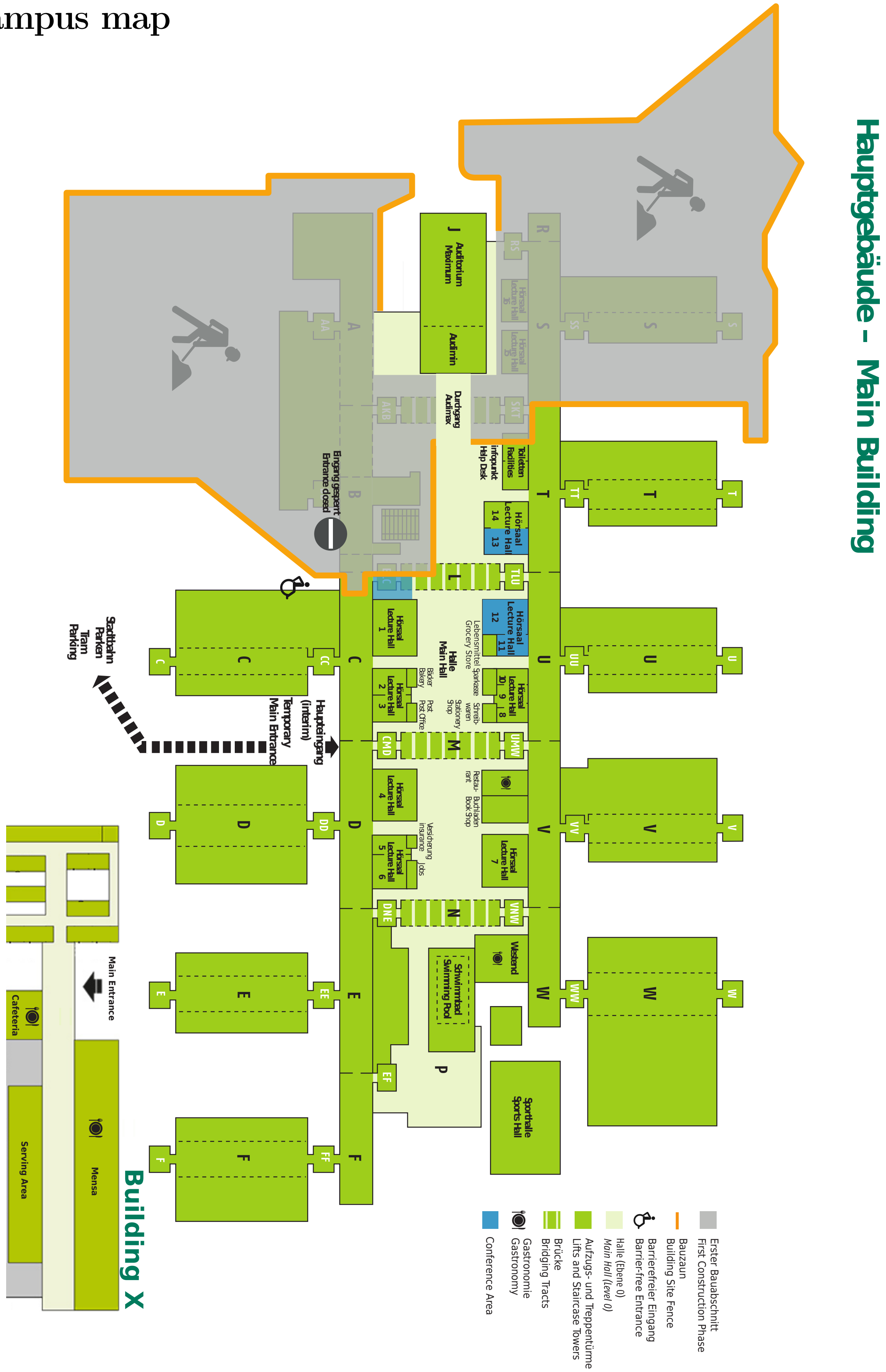
Bethel
Friedrich-List-Straße
Eggeweg
Brackwede Bahnhof
Gaswerkstraße
Normannenstraße
Brackwede Kirche
Windelsbleicher Straße
Rosenhöhe
Sennefriedhof
Senne
1
1 Senne – Jahnplatz – Schildesche
2 Sieker – Jahnplatz – Milse
3 Stieghorst – Jahnplatz – Babenhausen Süd
4 Rathaus – Jahnplatz – Universität – Lohmannshof

Campus map


Hauptgebäude - Main Building
Auditorium Maximum
Audimin
Durchgang Audimax
Toiletten Facilities
Infopunkt Help Desk
Eingang gesperrt Entrance closed
Halle Main Hall
Haupteingang (interim) Temporary Main Entrance
Stadtbahn Parken Tram Parking
Westend
Schwimmbad Swimming Pool
Sporthalle Sports Hall
Building X
Main Entrance
Cafeteria
Mensa
Serving Area
Erster Bauabschnitt First Construction Phase
Bauzaun Building Site Fence
Barrierefreier Eingang Barrier-free Entrance
Halle (Ebene 0) Main Hall (level 0)
Aufzugs- und Treppentürme Lifts and Staircase Towers
Brücke Bridging Tracts
Gastronomie Gastronomy
Conference Area