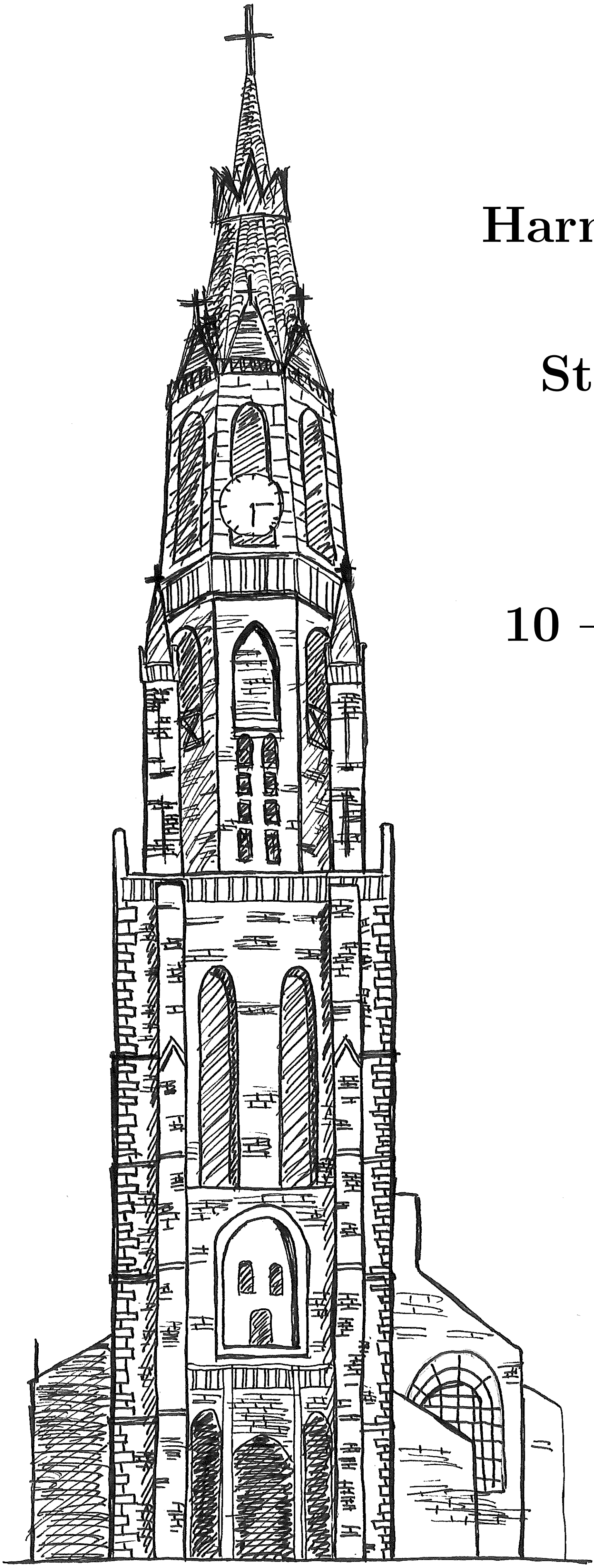

Harmonic Analysis for Stochastic PDEs

10 – 13 July, 2018
TU Delft

Local organising committee:
Alex Amenta
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Ivan Yaroslavtsev

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Netherlands Organisation for Scientific Research (NWO)
TU Delft

Cover and poster sketch by Ziping Rao

General information

Programme

See the following pages for titles and abstracts.

	Tuesday	Wednesday	Thursday	Friday
9:00 - 9:45	Gyöngy	Priola	Brzeźniak	Weis
9:50 - 10:30	Kim	Romito	Marinelli	Gess
10:30 - 11:00	**Coffee**			
11:00 - 11:40	S. Geiss	Kunze	Dirksen	Cox
11:45 - 12:15	C. Geiss	Hamster	Antoni	Yaroslavtsev
12:30 - 14:30	**Lunch**			
14:30 - 15:10	Jentzen	Basse-O'Connor	*Excursions*	Frey
15:15 - 15:55	Cipriani	Cioica		Hummel
15:55 - 16:25	**Coffee**			**Coffee**
16:25 - 16:55	Chong	Hornung		Kevei
17:00 - 17:30	Redmann	Agresti		Versendaal
17:45 - 18:45	**Drinks**			
19:00 -			**Dinner**	

Location

All talks will take place in Room Pi (π) at the EEMCS (EWI) building on the TU Delft campus. The address is **Mekelweg 4, 2628 CD, Delft**; by the university's numbering scheme it is **Building 36**. The building is easy to find: it is the tallest building on campus, and has a striking red and blue design. It is a 30 minute walk from the centre of Delft, and is also accessible by bus from Delft station: the nearest bus stations are **TU - Mekelpark** and **TU - Aula**. See `9292.nl` for live bus times and other public transport information.

Lunch, Drinks, and Dinner

Lunch will be provided every day at 12:30 on the first floor of the EEMCS building. On Tuesday, after the last talk, we will have some drinks next to the lecture hall. On Thursday evening we will have a workshop dinner, starting from 19:00, at the restaurant *'t Postkantoor* in the centre of Delft. The address is **Hippolytusbuurt 14, 2611 HN, Delft**.

Excursions

A choice of two excursions will take place on Thursday afternoon. Further details will be provided at the workshop.

Titles and abstracts

A quasilinear approach to fully nonlinear parabolic SPDEs on $\mathbb{R}^d$
Antonio Agresti, University Sapienza of Rome

In this talk we discuss the well-posedness for fully nonlinear parabolic SPDEs on $\mathbb{R}^d$ using the theory of quasilinear parabolic evolution equations. The key idea is the use of paradifferential calculus to reduce the fully nonlinear problem into a quasilinear one. We prove that the realization of the paradifferential operator enjoys many properties of standard differential operators.

In the last part of the talk, we discuss some extensions and related problems.

Pathwise regularity for stochastic evolution equations in L^p spaces
Markus Antoni, University of Otago / Karlsruhe Institute of Technology (KIT)

In this talk we consider stochastic evolution equations of the form

$$\mathrm{d}X(t) + AX(t)\,\mathrm{d}t = F(t, X(t))\,\mathrm{d}t + \sum_{n=1}^{\infty} B_n(t, X(t))\,\mathrm{d}\beta_n(t)$$

for random fields $X\colon \Omega \times [0,T] \times U \to \mathbb{R}$. More precisely, we concentrate on the parabolic situation where A is the generator of an analytic semigroup on $L^p(U)$. We look for mild solutions so that $X(\omega, \cdot, \cdot)$ has values in $L^p(U; L^q[0,T])$ for almost all $\omega \in \Omega$ under appropriate Lipschitz and linear growth conditions on the nonlinearities F and B_n, $n \in \mathbb{N}$. Compared to the classical semigroup approach, which gives $X(\omega, \cdot, \cdot) \in L^q([0,T]; L^p(U))$, the order of integration is reversed. We show that this new approach together with a strong Doob and Burkholder-Davis-Gundy inequality leads to strong regularity results in particular for the time variable of the random field $X(\omega, t, u)$, e.g. pointwise Hölder estimates for the paths $t \mapsto X(\omega, t, u)$, $\mathbb{P}$-almost surely. For less-optimal regularity estimates we only need the relatively mild assumption that the resolvents of A extend uniformly to $L^p(U; L^q[0,T])$. However, in the maximal regularity case the difficulty of the reversed order of integration in time and space makes extended functional calculi results necessary. In applications where A is an elliptic operator on a domain in $\mathbb{R}^d$ we show that for concrete examples of stochastic partial differential equations our theory leads to stronger results as known in the literature.

The Itô–Nisio theorem for the Wiener space of functions of bounded p-variation with applications to approximation of SDEs
Andreas Basse-O'Connor, Aarhus University

Series of independent and symmetric Banach space valued random variables play a key role for the theory of stochastic processes and stochastic PDEs. If all the random variables have

a *separable* range, the Itô–Nisio theorem states that various modes of convergence of the series are equivalent if a suitable candidate to a limit exists. Loosely speaking, we obtain functional convergence from pointwise convergence. In particular, the Itô–Nisio theorem implies uniform convergence of the Karhunen–Loève expansion of any Gaussian process with continuous sample paths.
The separability assumption of the Itô–Nisio theorem limits its applications since many stochastic processes with jumps have sample paths in non-separable spaces. On the other hand, by a simple example it can be shown that the Itô–Nisio theorem do not hold for general non-separable Banach spaces, as e.g. the space of bounded sequences $\ell^\infty(\mathbb{N})$. In this talk we will show that the Itô–Nisio theorem holds for the Wiener space of functions of bounded p-variation, which is non-separable. This result enables us to show convergence of Karhunen–Loève type representations of Lévy processes and other infinitely divisible processes in p-variation. In conjunction with the continuity of the Itô map in p-variation norm, we obtain approximations of SDEs through Karhunen–Loève type representations.
The talk is based on joint work with Jørgen Hoffmann-Jørgensen (Aarhus University) and Jan Rosiński (University of Tennessee).

Smoluchowski-Kramers approximation in the presence of constraints
Zdzisław Brzeźniak, University of York

Abstract: We show the existence of solutions to the following constrained stochastic wave equations

$$\begin{cases} \mu\, \partial_t^2 u_\mu(t,\xi) + \mu\, |\partial_t u_\mu(t)|^2_{L^2} u_\mu(t,\xi) = \Delta u_\mu(t,\xi) + |\nabla_\xi u_\mu(t)|^2_{L^2} u_\mu(t,\xi) \\ \qquad -\partial_t u_\mu(t,\xi) + \sum_{k=1}^N \big(f_j(\xi) - \langle f_j, u\rangle_{L^2} u_\mu(t,\xi)\big)\partial_t w_j(t), \\ u_\mu(0,\xi) = x(\xi), \\ \partial_t u_\mu(0,\xi) = y(\xi), \quad \xi \in D, \qquad u_\mu(t,\xi) = 0, \qquad t \geq 0, \quad \xi \in \partial D, \end{cases} \tag{1}$$

where $D \subset \mathbb{R}^d$ is a bounded domain, $W(t) = \big(W_j(t)\big)_{j=1}^N$ is a standard $\mathbb{R}^N$ valued Wiener process and $f = \big(f_j\big)_{j=1}^N \in L^2(D, \mathbb{R}^N)$ is given.
We will also discuss the convergence, as $\mu \searrow 0$, of the solution u_μ to the solution u of the parabolic problem

$$\begin{cases} \partial_t u(t,\xi) = \Delta u(t,\xi) + |\nabla_\xi u_\mu(t)|^2_{L^2} u_\mu(t,\xi) \\ \qquad + \sum_{k=1}^N \big(f_j(\xi) - \langle f_j, u\rangle_{L^2} u_\mu(t,\xi)\big)\partial_t w_j(t), \\ u(0,\xi) = x(\xi), \quad \xi \in D, \qquad u(t,\xi) = 0, \qquad t \geq 0, \quad \xi \in \partial D, \end{cases} \tag{2}$$

This talk is based on a joint work with Sandra Cerrai (Maryland).

Path properties of the solution to the stochastic heat equation with Lévy noise
Carsten Chong, École Polytechnique Fédérale de Lausanne

We consider sample path properties of the solution to the stochastic heat equation, in $\mathbb{R}^d$ or bounded domains of $\mathbb{R}^d$ driven by a Lévy space-time white noise. When viewed as a stochastic process in time with values in an infinite-dimensional space, the solution is shown to have a càdlàg modification in fractional Sobolev spaces of index less than $-\frac{d}{2}$. Concerning the partial regularity of the solution in time or space when the other variable is fixed, we determine critical values for the Blumenthal-Getoor index of the Lévy noise such that noises with a smaller index entail continuous sample paths, while Lévy noises with a larger index entail sample paths that are unbounded on any non-empty open subset. Our results apply to additive as well as multiplicative Lévy noises, and to light- as well as heavy-tailed jumps. This is joint work with Robert Dalang and Thomas Humeau.

Sharp L_p-estimates for the stochastic heat equation on polygonal domains
Petru Cioica, University of Otago

Although there exists an almost fully-fledged L_p-theory for (semi-)linear second order stochastic partial differential equations on smooth domains, very little is known about the regularity of these equations on non-smooth domains that have corners and/or edges. As it is already known from the deterministic theory, boundary singularities may have a negative effect on the regularity of the solution. For stochastic equations, this effect comes on top of the already known incompatibility of noise and boundary condition. In this talk I will show how a system of mixed weights consisting of appropriate powers of the distance to the vertexes and of the distance to the boundary can be used in order to deal with both sources of singularity and their interplay.

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

The scaling limit of the odometer in divisible sandpiles
Alessandra Cipriani, Delft University of Technology

The divisible sandpile model, a continuous version of the abelian sandpile model, was introduced by Levine and Peres to study scaling limits of the rotor aggregation and internal DLA growth models. The dynamics of the sandpile runs as follows: to each site of a graph there is an associated height (or mass). If the height exceeds a certain value then the site collapses by distributing the excessive mass uniformly to its neighbours. In a recent work Levine et al. addressed two questions regarding these models: the dichotomy between stabilizing and exploding configurations, and the behavior of the odometer (a function measuring the amount of mass emitted during stabilization). In this talk we will investigate the odometer function by showing that, under appropriate rescaling, it converges to either the continuum bi-Laplacian field or to an alpha-stable generalised field when the underlying graph is a discrete torus. Moreover we present some results about stabilization versus explosion for heavy-tailed initial distributions (joint work with Rajat Subhra Hazra and Wioletta Ruszel).

Stochastic integration in quasi-Banach spaces: what Besov regularity does the stochastic heat equation possess?
Sonja Cox, University of Amsterdam

In joint work with Petru Cioica and Mark Veraar, we set up a stochastic integration theory for quasi-Banach spaces. The motivation was to determine the spatial Besov regularity of solutions to stochastic partial differential equations, with Besov parameters in the range of quasi-Banach spaces. I will explain the main problems one encounters when a norm is replaced by a quasi-norm, and present the main results regarding Besov regularity of the stochastic heat equation.

L^p-valued Burkholder-Rosenthal inequalities and sharp estimates for stochastic integrals
Sjoerd Dirksen, RWTH Aachen University

In my talk, I will present Burkholder-Rosenthal type inequalities for discrete martingales taking values in an L^p-space with $1 < p < \infty$. These inequalities characterize the moments of the martingale in terms of the conditional moments of the associated martingale differences. As an application, I will show that these estimates can be used to prove sharp maximal inequalities for L^p-valued stochastic integrals with respect to Poisson random measures and (Hilbert space-valued) local martingales. These estimates carry over to stochastic convolutions under appropriate conditions. The latter bounds can, in turn, be used to prove existence, uniqueness and regularity of (mild) solutions to stochastic evolution equations in L^p-spaces driven by jump noise.

The talk is based on joint works with Ivan Yaroslavtsev (TU Delft) and Carlo Marinelli (UCL).

Paradifferential and paracontrolled calculus in rough settings
Dorothee Frey, Delft University of Technology

The paradifferential calculus plays an important roles in PDEs, in particular in the treatment of nonlinearities in Sobolev or Besov spaces. In recent years, it has found major applications in the rough path theory. Gubinelli, Imkeller and Perkowski have established a so-called paracontrolled calculus as an alternative approach to Hairers regularity struc-

tures in the context of singular stochastic PDEs.
We will discuss the basic principles of a paracontrolled calculus for singular stochastic PDEs, and show how it can be adapted to non-smooth settings where no Fourier transform is available.

Product and Moment Formulas for Iterated Stochastic Integrals associated with Lévy Processes
Christel Geiss, University of Jyväskylä

We present explicit product and moment formulas for products of iterated integrals which are generated by families of square integrable martingales associated with an arbitrary Lévy process. Applying the theory of compensated-covariation stable families of martingales, we propose a new approach which allows to derive these formulas for Lévy processes with both jump part and Gaussian part. Our main tool is a recursive representation formula for products of elements of a compensated-covariation stable family shown in [1]. This is joint work with Paolo di Tella (TU Dresden).

[1] Di Tella, P.; Engelbert, H.-J. *The predictable representation property of compensated-covariation stable families of martingales.* Teor. Veroyatnost. i Primenen., 60:99–130, 2016.

On Besov spaces on the Wiener space
Stefan Geiss, University of Jyväskylä

We study geometrical properties of anisotropic Besov spaces $\mathbb{B}_p^\Phi$ introduced in [2]. These spaces have been designed before in a more special form in [1] to investigate variational properties of backward stochastic differential equations. In the general form, $\Phi : C^+(\Delta) \to [0,\infty]$ is an admissible functional and Δ is a metric space that is obtained from the Hilbert space of the Wiener space that describes the co-variance structure, i.e. the 'supporting Hilbert space'. We continue from [2] by studying type, cotype, and duality properties of $\mathbb{B}_p^\Phi$. Moreover, we introduce a support of the admissible functional Φ and study its impact to the spaces $\mathbb{B}_p^\Phi$.
This is joint work with Henri Ylinen (University of Jyväskyä).

[1] C. Geiss, S. Geiss and E. Gobet: Generalized fractional smoothness and L_p-variation of BSDEs with non-Lipschitz terminal condition. *Stoch. Proc. Appl.* 122:2078-2116, 2012.
[2] S. Geiss, J. Ylinen: *Decoupling on the Wiener Space, Related Besov Spaces, and Applications to BSDEs.* arXiv:1409.5322v3. In Revision for Mem. AMS.

Optimal regularity for the porous medium equation
Benjamin Gess, Max Planck Institute

We prove optimal regularity for solutions to porous media equations in Sobolev spaces, based on velocity averaging techniques. In particular, the obtained regularity is consistent with the optimal regularity in the linear limit. This improves previous results by Tadmor and Tao [Tadmor, Tao; CPAM, 2007].

On the solutions of the Filtering Equations in L_p spaces
István Gyöngy, University of Edinburgh

Classical theorems on solvability of linear stochastic parabolic PDEs will be discussed and some recent results on existence and uniqueness of the solutions in various L_p spaces will be presented. A part of the talk is based on a joint work with Marta De Leon-Contreras and Sizhou Wu.

Travelling waves in the stochastic FitzHugh-Nagumo equation
Christian Hamster, Leiden University

We consider reaction-diffusion equations that are stochastically forced by a small multiplicative noise term. We show that spectrally stable travelling wave solutions to the deterministic system retain their orbital stability if the amplitude of the noise is sufficiently small. By applying a stochastic phase-shift together with a time-transform, we obtain a quasi-linear SPDE that describes the fluctuations from the primary wave. We subsequently develop a semigroup approach to handle the nonlinear stability question in a fashion that is closely related to modern deterministic methods.

Pathwise uniqueness for the stochastic nonlinear Schrödinger equation on 3d compact manifolds
Fabian Hornung, Karlsruhe Institute of Technology

We prove pathwise uniqueness for H^1-solutions of the nonlinear Schrödinger equation with conservative multiplicative noise on compact 3D manifolds. The proof employs spectrally localized deterministic and stochastic Strichartz estimates and the Littlewood-Paley decomposition. This is based on joint work with Zdzislaw Brzezniak and Lutz Weis.

Parabolic Equations with White Noise Boundary Conditions
Felix Hummel, University of Konstanz

When considering boundary value problems with white noise boundary conditions, one has to introduce a good solution concept and to explain in which sense it can satisfy the boundary conditions. The main problem is that the regularity of sample paths of a white noise is not good enough so that they do not appear as traces of functions in any classical

Sobolev scale. In this talk, we will discuss boundary value problems in dominating mixed-order spaces which will help us to overcome the difficulties concerning the traces. We will use these deterministic results in order to study pathwise solutions of equations with boundary noise and analyze the singularities at the boundary.

On deep learning based approximation algorithms for deterministic and stochastic PDEs
Arnulf Jentzen, ETH Zurich

Partial differential equations (PDEs), by which I mean both deterministic as well as stochastic PDEs, are among the most universal tools used in modelling problems in nature and man-made complex systems. In particular, PDEs are a fundamental tool in portfolio optimization problems and in the state-of-the-art pricing and hedging of financial derivatives. The PDEs appearing in such financial engineering applications are often high dimensional as the dimensionality of the PDE corresponds to the number of financial asserts in the involved hedging portfolio. Such PDEs can typically not be solved explicitly and developing efficient numerical algorithms for high dimensional PDEs is one of the most challenging tasks in applied mathematics. As is well-known, the difficulty lies in the so-called "curse of dimensionality" in the sense that the computational effort of standard approximation algorithms grows exponentially in the dimension of the considered PDE and there is only a very limited number of cases where a practical PDE approximation algorithm with a computational effort which grows at most polynomially in the PDE dimension has been developed. In the case of linear parabolic PDEs and approximations for a fixed space-time point the curse of dimensionality can be overcome by means of stochastic approximation algorithms and the Feynman-Kac formula. We first review some results for stochastic approximation algorithms for linear PDEs and, thereafter, we present stochastic approximation algorithms for high dimensional nonlinear PDEs whose key ingredients are deep artificial neural networks, which are widely used in data science applications. Numerical simulations and mathematical theorems illustrate the efficiency and the accuracy of the proposed stochastic approximation algorithms in the cases of several high dimensional PDEs from finance and physics.

Almost sure properties of the solution of the linear heat equation with Lévy noise
Peter Kevei, University of Szeged

We consider the almost sure behavior of the solution of the linear heat equation with Lévy noise at a fixed spatial point as time varies. We prove a surprisingly irregular behaviour even in the simplest case when the noise is a homogeneous Poisson point process. In particular, we show that the solution increases linearly on deterministic subsequences, while in continuous time it has huge peaks. We provide an integral test for the almost sure behavior, determining the large time asymptotics of the solution. This is joint work with Carsten Chong (EPFL)

A regularity theory for degenerate diffusion equations with stochastic noise
Ildoo Kim, Korea University

A diffusion equation is one of most famous partial differential equations. Lots of generalized diffusion equations have appeared on the basis of scientific meaning. One of generalizations is a degenerate diffusion equation with stochastic noise. In this talk, we are going to discuss change of regularity of solutions depending on degeneracy of diffusion and stochastic noise.

Martingale problems and well-posedness for some SPDE with measurable non-linearities
Markus Kunze, University of Konstanz

In this talk I will first give a brief introduction into the the concept of a *martingale problem* pointing out differences between finite and infinite dimensions. In the second part of the talk, we will use martingale problems and a perturbation theorem for transition semigroups with the strong Feller property to establish well-posedness for stochastic equations of the form

$$dX(t) = [AX(t) + F(X(t))]dt + GdW_H(t),$$

where A generates a strongly continuous semigroup on a Banach space E, the nonlinearity $F : E \to E$ is bounded and measurable and W_H is a cylindrical Wiener process. There are additional technical assumptions on A and G which ensure that the transition semigroup of the associated Ornstein–Uhlenbeck equation

$$dX(t) = AX(t)dt + GdW_H(t)$$

enjoys the strong Feller property.

Strong solutions to monotone semilinear SPDEs with semimartingale noise
Carlo Marinelli, University College London

We prove existence and uniqueness of strong solutions to a class of semilinear stochastic evolution equations driven by general Hilbertian semimartingales, with drift equal to the sum of a linear maximal monotone operator in variational form and of the superposition operator associated to a random time-dependent monotone function defined on the whole real line. Such a function is only assumed to satisfy a very mild symmetry-like condition, but its rate of growth towards infinity can be arbitrary. Moreover, the noise is of multiplicative type and can be path-dependent. The solution is obtained via a priori estimates on solutions to regularized equations, interpreted both as stochastic equations as well as deterministic equations with random coefficients, and ensuing compactness properties. A key role is played by an infinite-dimensional Doob-type inequality due to Métivier and Pellaumail. (Joint work with Luca Scarpa.)

Strong well-posedness for some classes of stochastic evolution equations in Hilbert spaces

Enrico Priola, University of Turin

I will present results on strong well-posedness for some classes of stochastic evolution equations in Hilbert spaces. These equations have additive cylindrical Wiener noise and irregular drift term.
In particular I will consider stochastic semilinear parabolic type equations and stochastic semilinear wave equations. In both cases the uniqueness may fail for the corresponding deterministic equation and well-posedness is restored by adding the external random force of white noise type.
To prove the result for stochastic semilinear parabolic equations one can use an Itô-Tanaka trick or Zvonkin type transformation. On the other hand, to study stochastic semilinear wave equations we use an approach based on backward stochastic differential equations. Both approaches require regularizing properties of the transition Ornstein-Uhlenbeck semigroup associated to the corresponding stochastic linear equation.

Some references:

G. Da Prato, F. Flandoli, E. Priola, M. Röckner, Strong uniqueness for stochastic evolution equations in Hilbert spaces perturbed by a bounded measurable drift, Annals of Probability, 2013.

F. Masiero, E. Priola, Well-posedness of semilinear stochastic wave equations with Hölder continuous coefficients, Journal of Differential Equations, 2017.

Numerical approximations of parabolic rough PDEs

Martin Redmann, Weierstrass Institute Berlin

In this talk, we discuss the numerical approximation of parabolic PDEs driven by a rough path which, e.g., can be the lift of a path of a fractional Brownian motion. By using the Feynman-Kac formula, the solution can be represented as the expected value of a functional of the corresponding hybrid Stratonovich-rough differential equation. A time-discretisation of this equation and a Monte Carlo regression in the spatial variable lead to an approximation of the solution to the rough PDE. We analyze the regression error and provide several numerical experiments to illustrate the performance of our method.

Random initial conditions for semi-linear PDEs

Marco Romito, University of Pisa

Semi–linear PDEs are used as a “proof of concept“ to investigate the effect of random initial conditions for the existence of partial differential equations of evolution type. These ideas have been pioneered by Bourgain, and recently there have been a lot of activity, since the seminal papers by Burq and Tzvetkov. In this setting we wish to be able to answer a series of relevant questions for the subject, such as if and when a random initial condition turns out to be useful, if super–critical data are allowed, if renormalization is needed, if further ideas from the theory of singular stochastic PDEs can be borrowed. Paracalculus will be used for the last issue.

Brownian motion on Riemannian manifolds

Rik Versendaal, Delft University of Technology

There are various ways to define Brownian motion on a Riemannian manifold. For example, one can consider the process generated by the Laplace-Beltrami operator. Another approach due to Eells, Elworthy and Malliavin, is to solve an appropriate (Stratonovich) stochastic differential equation on the frame bundle and project down to the manifold (see e.g. [1]). Finally, we discuss an approach generalizing the usual invariance principle. For this construction, due to Jørgensen [2], we discuss so called geodesic random walks, which when suitably rescaled converge to Brownian motion.

[1] Elton P. Hsu. *Stochastic analysis on manifolds.* Vol. 38. Graduate Studies in Mathematics. American Mathematical Society, Providence, RI, 2002.
[2] Erik Jørgensen. *The central limit problem for geodesic random walks.* Z. Wahrscheinlichkeitstheorie und Verw. Gebiete 32, 1975, pp. 1-64

TBA

Lutz Weis, Karlsruhe Institute of Technology

Abstract TBA

Burkholder-Davis-Gundy inequalities in UMD Banach spaces

Ivan Yaroslavtsev, Delft University of Technology

In this talk we show Burkholder-Davis-Gundy inequalities for general UMD Banach space-valued martingales. Namely we show that for any UMD Banach space X, for any X-valued martingale M with $M_0 = 0$, and for any $1 < p < \infty$

$$\mathbb{E} \sup_{0\leq s\leq t} \|M_s\|^p \eqsim_{p,X} \mathbb{E}\gamma([\![M]\!]_t)^p, \quad t \geq 0,$$

where $[\![M]\!]_t$ is the covariation bilinear form defined on $X^* \times X^*$, and $\gamma([\![M]\!]_t)$ is the L^2-norm of a Gaussian measure on X having $[\![M]\!]_t$ as its covariance bilinear form.
As a corollary we extend the theory by van Neerven, Veraar, and Weis on vector-valued stochastic integration with respect to a cylindrical Brownian motion to full generality.

Participants

Markus Antoni	Karlsruhe Institute of Technology
Agresti Antonio	University Sapienza of Rome
Andreas Basse-O'Connor	Aarhus University
Zdzisław Brzeźniak	University of York
Jae Hwan Choi	Korea University
Carsten Chong	École Polytechnique Fédérale de Lausanne
Petru Cioica	University of Otago
Alessandra Cipriani	Delft University of Technology
Sonja Cox	University of Amsterdam
Sjoerd Dirksen	RWTH Aachen University
Dorothee Frey	Delft University of Technology
Onno van Gaans	Leiden University
Christel Geiss	University of Jyväskylä
Stefan Geiss	University of Jyväskylä
Benjamin Gess	Max Planck Institute
Dylan Gonzalez Arroyo	Universiteit Leiden
István Gyöngy	University of Edinburgh
Christian Hamster	Leiden University
Beomseok Han	Korea University
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Rik Versendaal	Delft University of Technology
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Ivan Yaroslavtsev	Delft University of Technology