Program GER-JAP Conference Leipzig

Moday Sep 09	
8.30—9.05	Takeda
9.05 – 9.40	Otto
09.40 –10.10	**Coffee**
10.10 – 10.35	Bianchi
10.35 – 11.10	Kawabi
11.10 – 11.35	Cotar
11.35 – 12.10	**Coffee**
12.10 – 12.45	Shigekawa
12.45 – 13.10	Sasada
13.10 – 15.00	**Lunch**
15.00 – 15.35	Nagahata
15.35 – 16.00	Jansen
16.00 – 16.25	Neukamm
16.25 – 17.00	**Coffee**
17.00 – 17.25	Fattler
17.25 – 18.00	Grothaus
18.00 – 18.35	Kassmann

Tuesday Sept 10	
8.30—9.05	Uemura
9.05 – 9.40	Zähle
09.40 –10.10	**Coffee**
10.10 – 10.35	Kajino
10.35 – 11.00	Hinz
11.00 – 11.25	Shiozawa
11.35 – 12.00	**Coffee**
12.00 – 12.25	Kusuoka
12.25 – 13.00	Yano
13.00 – 15.00	**Lunch**
15.00 – 15.25	Franke
15.25 – 15.50	Tanaka
15.50 – 16.15	H. Döring
16.15 – 16.50	**Coffee**
16.50 – 17.25	Kumagai
17.25 – 18.00	Deuschel
18.00 – 18.25	Andres

Wednesday Sept 11	
8.30—9.05	Kuwae
9.05 – 9.40	Thalmaier
09.40 –10.10	**Coffee**
10.10 – 10.45	Beiglböck
10.45 – 11.10	Huesmann
11.10 – 11.35	**Coffee**
11.35 – 12.00	Philipowski
12.00 – 12.25	Kuwada
12.25 – 13.30	**Lunch**
13.30 – 19.00	Excursion
19.00 – 23.00	Dinner & Return

Thursday Sept 12	
8.30 – 9.05	Guillin
9.05 – 9.40	Eberle
09.40 –10.10	**Coffee**
10.10 – 10.45	Buckwar
10.45 – 11.10	Dereich
11.10 – 11.35	Lang
11.35 – 12.10	**Coffee**
12.10 – 12.45	Jentzen
12.45 – 13.10	Yaroslavtseva
13.10 – 15.00	**Lunch**
15.00 – 15.35	Stannat
15.35 – 16.10	Röckner
16.10 – 16.35	R. Zhu
16.35 – 17.00	**Coffee**
17.00 – 17.25	Gess
17.25 – 17.50	X. Zhu
17.50 – 18.25	Hairer

Friday Sept 13	
8.15 – 8.50	Osada
8.50 – 9.25	Schmalfuss
9.25 – 10.00	Li
10.00 – 10.30	**Coffee**
10.30 – 10.55	Weber
10.55 – 11.20	Mimica
11.20 – 11.45	L. Döring
11.45 – 12.10	**Coffee**
12.10 – 12.35	Diehl
12.35 – 13.10	Friz
13.10 – 13.15	**Closing**

Sebastian Andres

Local limit theorem for the random conductance model in a degenerate ergodic environment

Consider the Euclidean lattice $(\mathbb{Z}^d, E^d)$ for $d \geq 2$. We study the nearest-neighbor random conductance model, that is a reversible continuous-time Markov process $\{X_t : t \geq 0\}$ on $\mathbb{Z}^d$ with jump rates proportional to edge conductances given by a random environment of stationary ergodic random variables $(\omega_e)_{e \in E^d}$. In this talk, we present a elliptic and a parabolic Harnack inequality in the case of unbounded degenerate conductances under some moment conditions. The proof is based on an application of Moser's iteration method. One application of the Harnack inequality is to prove the Hölder regularity of the transition density, which is a key ingredient to establish a quenched local limit theorem. This joint work with Jean-Dominique Deuschel and Martin Slowik.

Mathias Beiglböck

Optimal Transport, Martingales, and Skorokhod embedding.

We will explain a recently discovered connection between Optimal Transport and the areas of model independence / martingale inequalities in probability. This link has a number of fruitful consequences. For instance, the duality theorem from optimal transport leads to new super-replication results. Optimality criteria from the theory of mass transport can be translated to the martingale setup and allow to characterize minimizing/maximizing models in finance. Moreover, the transport viewpoint provides new insights to the classical inequalities of Doob / Burkholder-Davis-Gundy and Skorokhod embedding problem.

Alessandra Bianchi

Metastability in Markovian systems via quasi-stationary measures and capacities

In this talk I will present some recent results, obtained in collaboration with A. Gaudilliere,concerning the characterization of metastability for Markovian systemson finite configuration spaces. The two main objects entering this characterization are quasi-stationary measures and capacities. After recalling their definition (and useful generalizations), I will discuss their connection withmetastable systems and review the main results, including sharpestimates on mean exit time and transition time, and the proof of their asymptotic exponential laws. Some examples and applications of the method will be finally discussed.

Evelyn Buckwar

Aspects of stability investigations for numerical methods for SDEs

Asymptotic stability investigations are an important issue in establishing qualitative properties of numerical methods for differential equations, deterministic and stochastic. In this talk we review several approaches for establishing asymptotic stability properties for numerical methods for SDEs.

Codina Cotar

Uniqueness of gradient Gibbs measures with disorder

We consider two versions of random gradient models. In model A) the interface feels a bulk term of random fields while in model B) the disorder enters though the potential acting on the gradients itself. It is well known that without disorder there are no Gibbs measures in infinite volume in dimension d = 2, while there are gradient Gibbs measures describing an infinite-volume distribution for the increments of the field, as was shown by Funaki and Spohn. Van Enter and Kuelske proved that adding a disorder term as in model A) prohibits the existence of such gradient Gibbs measures for general interaction potentials in d = 2. Cotar and Kuelske proved the existence of shift-covariant gradient Gibbs measures for model A) when $d \geq 3$ and the expectation with respect to the disorder is zero, and for model B) when $d \geq 2$. In the current work, we prove uniqueness of shift-covariance gradient Gibbs measures with expected given tilt under the above assumptions. We also prove decay of covariances for both models.This is based on joint work with Christof Kuelske.

Steffen Dereich

A CLT for multilevel Monte Carlo for Levy-driven SDEs

Joscha Diehl

Stochastic control with rough paths

We study a class of controlled rough differential equations. It is shown that the value function satisfies a HJB type equation; we also establish a form of the Pontryagin maximum principle. Deterministic problems of this type arise in the duality theory for controlled diffusion processes and typically involve anticipating stochastic analysis. We propose a formulation based on rough paths and then obtain a generalization of Roger's duality formula [L. C. G. Rogers, 2007] from discrete to continuous time. We also make the link to old work of [Davis–Burstein, 1987]. This is joint work with Peter Friz and Paul Gassiat

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Hanna Döring

Connection times in large ad hoc networks

We consider the following dynamic continuum percolation model: A large number of participants move randomly in a given large domain. A prime example of the movement schemes that we consider is the random waypoint model. Messages are instantly transmitted according to a relay principle, i.e., they are iteratedly forwarded from participant to participant over distances $\leq 2R$, with $2R$ the communication radius, until they reach the recipient. We study the connection time of two sample participants, the amount of time over which these two are connected with each other. We quantify its limiting behaviour and give large deviation results.

Leif Döring

Jump-SDEs with Singular Coefficients

In recent years classical questions for Brownian SDEs have been extended to SDEs driven by Lvy processes. In this talk we will discuss a class of SDEs that arise naturally from self-similar Markov processes and discuss how their singular coefficients can be treated.

Andreas Eberle

Contractivity w.r.t. Kantorovich distances for diffusion processes and Markov chain approximations in high dimensions

We consider contractivity for diffusion semigroups and transition kernels of Markov chains w.r.t. Kantorovich (L^1 Wasserstein) distances based on appropriately chosen concave functions. The focus is on the derivation of contraction rates that do not depend on the dimension. Applications include overdamped Langevin diffusions with locally non-convex potentials, products of these processes, and systems of weakly interacting diffusions. For logconcave perturbations of a Gaussian reference measure, dimension independent bounds are also obtained for the Metropolis adjusted Langevin algorithm with semi-implicit Euler proposals - a Metropolis method that can be seen as a sufficiently close discrete time approximation of a correponding Langevin diffusion.

Torben Fattler

A dynamical wetting model: Construction and analysis via Dirichlet forms

We give a Dirichlet form approach for the construction of a distorted Brownian motion, where the behavior on the boundary is determined by the competing effects of reflection from and pinning at the boundary. In providing a Skorokhod decomposition of the constructed process we are able to show that the stochastic process is solving the underlying stochastic differential equation weakly for quasi every starting point with respect to the associated Dirichlet form. That the boundary behavior of the constructed process indeed is sticky, we obtain by proving ergodicity of the constructed process. Therefore, we are able to show that the occupation time on specified parts of the boundary is positive. In particular, our considerations enable us to construct a dynamical wetting model (also known as Ginzburg–Landau dynamics) on a bounded set.

Brice Franke

Trajectory homogenization for diffusions with fast incompressible drift

(joint work with Shuenn-Jyi Sheu (NCU Taiwan)).

A Brownian motion moves in an incompressible deterministic flow on a compact Riemannian manifold. What happens if we accelerate the flow while keeping the diffusivity fixed? In this talk we present some limit theorem which states that as the speed of the drift goes to infinity the diffusion converges toward some limit process on some reduced state space. The state space consists of equivalence classes which are defined through the trajectories of the incompressible flow. The limit process is a symmetric Markov process which can be characterized through a Dirichlet form.

Peter Friz

Physical Brownian motion in magnetic field as rough path

The indefinite integral of the homogenized Ornstein-Uhlenbeck process is a well-known model for physical Brownian motion, modelling the behaviour of an object subject to random impulses [L. S. Ornstein, G. E. Uhlenbeck: On the theory of Brownian Motion. In: Physical Review. 36, 1930, 823-841]. One can scale these models by changing the mass of the particle and in the small mass limit one has almost sure uniform convergence in distribution to the standard idealized model of mathematical Brownian motion. This provides one well known way of realising the Wiener process. However, this result is less robust than it would appear and important generic functionals of the trajectories of the physical Brownian motion do not necessarily converge to the same functionals of Brownian motion when one takes the small mass limit. In presence of a magnetic field the area process associated to the physical process converges - but not to Levy's stochastic area. We compute explicitly the area correction term and establish convergence, in the small mass limit, of the physical Brownian motion in the rough path sense. Viewing the trajectory of a charged Brownian particle with small mass as a rough path is informative and allows one to retain information that would be lost if one only considered it as a classical trajectory. Joint with Paul Gassiat and Terry Lyons.

Benjamin Gess

Finite speed of propagation for stochastic porous media equations

We prove finite speed of propagation for stochastic porous media equations perturbed by linear multiplicative space-time rough signals. Explicit and optimal estimates for the speed of propagation are given. The estimates are then used to prove that the corresponding random attractor has infinite fractal dimension.

Martin Grothaus

Scaling limit of interface models

(joint work with Torben Fattler (TU Kaiserslautern) Robert Voßhall (TU Kaiserslautern))

Starting point is the dynamical wetting model, also known as Ginzburg-Landau dynamics with pinning and reflection competing on the boundary, on a bounded set. From the abstract point of view this is a distorted Brownian motion with sticky, reflecting boundary condition. Scaling limits of the corresponding invariant measures have been studied by Deuschel, Giacomin and Zambotti. In this talk we consider the scaling limit of the dynamics in the critical regime.

Arnaud Guillin

Ornstein-Uhlenbeck pinball: Poincaré inequalities in a punctured domain

In this talk we will study the Poincaré constant for the Gaussian measure restricted to $D = \mathbb{R}^d - B(y, r)$ where $B(y, r)$ denotes the Euclidean ball with center y and radius r, and $d \geq 2$. We also study the case of the l^∞ ball (the hypercube). This is the first step in the study of the asymptotic behavior of a d-dimensional Ornstein-Uhlenbeck process in the presence of obstacles with elastic normal reflections (the Ornstein-Uhlenbeck pinball). (joint work with E. Boissard, P. Cattiaux, L. Miclo)

Martin Hairer

Dynamics near criticality

Heuristically, one can give arguments why the fluctuations of classical models of statistical mechanics near criticality are typically expected to be described by nonlinear stochastic PDEs. Unfortunately, in most examples of interest, these equations seem to make no sense whatsoever due to the appearance of infinities or of terms that are simply ill-posed. I will give an overview of a new theory of "regularity structures" that allows to treat such equations in a unified way, which in turn leads to a number of natural conjectures. One interesting byproduct of the theory is a new (and rigorous) interpretation of "renormalisation group techniques" in this context. At the technical level, the main novel idea involves a complete rethinking of the notion of "Taylor expansion" at a point for a function or even a distribution. The resulting structure is useful for encoding "recipes" allowing to multiply distributions that could not normally be multiplied. This provides a robust analytical framework to encode renormalisation procedures.

Michael Hinz

Metrics and spectral triples for Dirichlet and resistance forms

The talk deals with intrinsic metrics, Dirac operators and spectral triples induced by regular Dirichlet and resistance forms. We show in particular that if a resistance form is given and the space is compact in resistance metric, then the intrinsic metric yields a length space. Further, given a regular Dirichlet form it is possible to define associated Dirac operators using the first order calculus by Cipriani and Sauvageot. We investigate some spectral properties. If the Dirichlet form admits a carr operator then we can construct a spectral triple, and in the compact and strongly local case the associated Connes metric coincides with the intrinsic metric.

Martin Huesmann

Optimal transport and Skorokhod embedding

It is well known that several solutions to the Skorokhod problem optimize certain "cost"- or "payoff"-functionals. We use the theory of Monge-Kantorovich transport to study the corresponding optimization problem. We formulate a dual problem and establish duality based on the duality theory of optimal transport. Notably the primal as well as the dual problem have a natural interpretation in terms of model-independent no arbitrage theory. In optimal transport the notion of c-monotonicity is used to characterize the geometry of optimal transport plans. We derive a similar optimality principle that provides a geometric characterization of optimal stopping times. We then use this principle to derive several solutions to the Skorokhod embedding problem. (joint work with Mathias Beiglböck)

Sabine Jansen

Duality of Markov processes with respect to a function

There are several notions of duality for Markov processes. Duality with respect to a measure has been introduced in the context of potential theory, and there is by now a rich theory for this notion. Duality with respect to a function is a powerful tool in interacting particle systems and population genetics, but a general theory for this notion is still missing. This talk will present some first steps towards a systematic investigation of duality with respect to a function, with a focus on the functional analytic structures that are involved. The talk is based on joint work with Noemi Kurt (TU Berlin).

Arnulf Jentzen

Regularity, strong completeness and approximations for nonlinear stochastic differential equations and their Kolmogorov partial differential equations

In this talk we analyze how smooth the solution of a nonlinear stochastic differential equation (SDE) depends in the strong L^p-sense on the initial value as well as the related question of regularity preservation of the associated second-order linear Kolmogorov partial differential equation (PDE). In the first part of this talk we give an example of a second-order linear Kolmogorov PDE with a globally bounded and smooth drift coefficient, a constant diffusion coefficient and a smooth initial function with compact support such that the unique globally bounded viscosity solution of the PDE is not even locally Hoelder continuous and, thereby, we disprove the existence of globally bounded classical solutions of this PDE. This, in particular, shows that there exist an SDE with a globally bounded and smooth drift coefficient and a constant diffusion coefficient whose solution does in the strong L^p sense not depend smoothly on the initial value. In the second part of this talk we present a result that gives sufficient conditions to ensure that the solutions of nonlinear SDEs depend smoothly on the initial values. We briefly illustrate this result by a few example SDEs from finance, physics and biology. The first part of this talk is based on a joint work with Martin Hairer and Martin Hutzenthaler (see [http://arxiv.org/abs/1209.6035]). The second part of this talk is based on a joint work with Sonja Cox and Martin Hutzenthaler.

Naotaka Kajino

Periodic and non-periodic aspects of the heat kernel asymptotics on Sierpiński carpets

The purpose of this talk is to present the author's recent results in [2, 3] on various short time asymptotics of the canonical heat kernel on Sierpiński carpets.

Let K be a generalized Sierpiński carpet, which is a compact subset of $\mathbb{R}^d$ for some $d \in \mathbb{N}$, and let $p_t(x,y)$ be the transition density of the Brownian motion on K (the canonical heat kernel). Then it is well-known that there exist $c_1, c_2 \in (0,\infty)$ and $d_{\mathrm{w}} \in (2,\infty)$ such that for any $x \in K$,

$$c_1 \leq t^{d_{\mathrm{f}}/d_{\mathrm{w}}} p_t(x,x) \leq c_2, \qquad t \in (0,1],$$

where d_{f} is the Hausdorff dimension of K with respect to the Euclidean metric. d_{w} is called the *walk dimension of* K, which is defined through the *time scaling factor* τ for the Brownian motion on K. Then it is natural to ask how $t^{d_{\mathrm{f}}/d_{\mathrm{w}}} p_t(x,x)$ behaves as $t \downarrow 0$ and in particular whether the limit $\lim_{t\downarrow 0} t^{d_{\mathrm{f}}/d_{\mathrm{w}}} p_t(x,x)$ exists. In fact, this limit does *not* exist for "generic" $x \in K$, and more strongly we have the following theorem. Recall that $f : (0,\infty) \to (0,\infty)$ is said to *vary regularly at* 0 if and only if the limit $\lim_{t\downarrow 0} f(\alpha t)/f(t)$ exists in $(0,\infty)$ for any $\alpha \in (0,\infty)$.

Theorem 1 ([2, Theorem 5.11]). *There exist $c_3 \in (0,\infty)$ and a Borel subset N of K satisfying $\nu(N) = 0$ for any self-similar measure ν on K, such that for any $x \in K \setminus N$,*

$$p_{(\cdot)}(x,x) \text{ does } \textbf{not} \text{ vary regularly at } 0, \tag{NRV}$$

$$\limsup_{t\downarrow 0} \left| t^{d_{\mathrm{f}}/d_{\mathrm{w}}} p_t(x,x) - G(-\log t) \right| \geq c_3 \qquad \text{for } \textbf{any} \text{ periodic function } G : \mathbb{R} \to \mathbb{R}. \tag{NP}$$

On the other hand, the (spectral) partition function $Z(t)$, which is the trace of the associated heat semigroup at time t, is expected to exhibit $\log$-periodic behavior, since $Z(t)$ can be written as $Z(t) = \sum_{n\in\mathbb{N}} e^{-\lambda_n t}$ by using the eigenvalues $\{\lambda_n\}_{n\in\mathbb{N}}$ of the associated Laplacian on K and $\{\lambda_n\}_{n\in\mathbb{N}}$ should strongly reflect the self-similarity of the space. Indeed, we have the following $\log$-periodic asymptotic expansion of Z, which is essentially a refinement of [1, Theorem 4.1].

Theorem 2 ([3, Theorem 4.10]). *Set* $d_k := \dim_{\mathrm{H}}\big(K \cap ([0,1]^{d-k} \times \{0\}^k)\big)$ *for* $k \in \{0,\ldots,d\}$, *where* $\dim_{\mathrm{H}}$ *denotes Hausdorff dimension with respect to the Euclidean metric* (note that $d_0 = d_{\mathrm{f}}$, $d_{d-1} = 1$ and $d_d = 0$). *Then there exist* $c_4 \in (0,\infty)$ *and continuous* $\log\tau$*-periodic functions* $G_k : \mathbb{R} \to \mathbb{R}$, $k \in \{0,\ldots,d\}$, *with* G_0, G_1 *being* $(0,\infty)$*-valued, such that*

$$Z(t) = \sum_{k=0}^{d} t^{-d_k/d_{\mathrm{w}}} G_k(-\log t) + O\Big(\exp\big(-c_4 t^{-\frac{1}{d_{\mathrm{w}}-1}}\big)\Big) \qquad \text{as } t \downarrow 0.$$

[1] B. M. Hambly, Asymptotics for functions associated with heat flow on the Sierpinski carpet, *Canad. J. Math.* **63** (2011), 153–180.

[2] N. Kajino, Non-regularly varying and non-periodic oscillation of the on-diagonal heat kernels on self-similar fractals, *Contemporary Mathematics*, 2013, in press.

[3] N. Kajino, Log-periodic asymptotic expansion of the spectral partition function for self-similar sets, *Comm. Math. Phys.*, 2013, in press.

Moritz Kassmann

The Dirichlet problem for nonlocal operators

In the talk we set up the Dirichlet problem for symmetric and nonsymmetric nonlocal operators. We discuss solvability of this problem with the help of classical tools like the Fredholm alternative and the weak maximum principle. The talk ist based on a joint preprint with M. Felsinger and P. Voigt, both from Bielefeld University.

Hiroshi Kawabi

Uniqueness of Dirichlet forms related to stochastic quantization under exponential interaction in two-dimensional finite volume

In this talk, we consider Dirichlet forms given by two-dimensional space-time quantum fields with interactions of exponential (and trigonometric) type in finite volume. We discuss L^p-uniqueness of the corresponding Dirichlet operator and construct a weak solution (in the probability sense) of the stochastic quantization equation under a suitable condition on the regularization parameter. This talk is based on ongoing jointwork with Sergio Albeverio, Stefan Michalache and Michael Röckner.

Takashi Kumagai

Biased random walk on critical Galton-Watson trees conditioned to survive

We consider the biased random walk on a critical Galton-Watson tree conditioned to survive, and confirm that this model with trapping belongs to the same universality class as certain one-dimensional trapping models with slowly-varying tails. Indeed, in each of these two settings, it is possible to establish closely-related functional limit theorems involving an extremal process and also demonstrate extremal aging occurs. This is a joint work with David Croydon (Warwick) and Alexander Fribergh (Toulouse).

Seiichiro Kusuoka

Pinned diffusion processes and Hölder continuity of the fundamental solutions to parabolic equations with irregular coefficients

We consider uniformly elliptic second-order differential parabolic partial differential equations of parabolic type with bounded measurable coefficients (not necessary continuous). It is known that the fundamental solution to the equations exists and is locally Hölder continuous. In this talk, we concern the lower bound of the index for the Hölder continuity. We use the pinned diffusion processes for the probabilistic representation of the fundamental solutions and the coupling method to obtain the regularity of them. Under some assumptions on the regularity of the coefficient of the second-order differential term we obtain a lower bound.

Kazumasa Kuwada

Entropic curvature-dimension condition and Bochner's inequality We prove the equivalence of the curvature-dimension bounds of Lott-Sturm-Villani (via entropy and optimal transport) and of Bakry–Emery (via energy and Γ_2-calculus) in complete generality for infinitesimally Hilbertian metric measure spaces. In particular, we establish the full Bochner inequality on such metric measure spaces. Moreover, we deduce new contraction bounds for the heat flow on Riemannian manifolds and on mms in terms of the L^2-Wasserstein distance.

Kazuhiro Kuwae

Resolvent flows for convex functionals and p-harmonic maps

I will talk on the unique existence of the (non-linear) resolvent associated to a coercive proper lower semi continuous function satisfying a weaker notion of p-strong λ-convexity on a complete metric space and establish the existence of the minimizer of such functions for $\lambda \geq 0$ as the large time limit of the reolvents, which generalizes the pioneering works by J. Jost for convex functionals on complete CAT(0)-spaces. The results can be applied to L^p-Wasserstein space over complete p-uniformly convex spaces. As an application, we solve an initial boundary value problem for p-harmonic maps into CAT(0)-spaces in terms of Cheeger type p-Sobolev spaces.

Annika Lang

Covariance structure of parabolic stochastic partial differential equations

In applications, expectations of functionals of solutions of stochastic partial differential equations are of interest, which mainly have to be obtained by simulation. In this talk, efficient methods for the simulation of the expectation of infinite-dimensional stochastic processes are presented, with a special emphasis on the covariance of the solution of parabolic partial differential equations. The covariance is related to the solution of a deterministic, tensorized evolution equation, which is considered in a space-time weak variational formulation.

Xue-Mei Li

Mckean-Vlasov SDE with singular interaction

We study stochastic differential equations whose coefficients depending on the probability distribution of the solution. We will in particular consider a Mckean-Vlasov type interaction with irregular potential.

Ante Mimica

Unavoidable collections of balls for isotropic Levy processes

A collection of pairwise disjoint balls in the Euclidean space is said to be avoidable with respect to a transient process if the process with positive probability escapes to infinity without hitting any ball. We study suffcient and necessary conditions for avoidability with respect to unimodal isotropic Levy processes satisfying a certain scaling hypothesis. This is joint work with Zoran Vondracek.

Yukio Nagahata

On hydrodynamic limit for simple exclusion process with degenerate rates.

Simple exclusion process with degenerate rates is one of the simplest system called *kinetically constrained lattice gases*, which have been introduced in the physical literature as simplified models for some peculiar phenomena of the "glassy" dynamics.

Let us consider discrete torus $T_n = \{1, 2, \dots n\}$ (n is identified with 0). We define the set of configurations by $\Sigma_n := \{0, 1\}^{T_n}$, the set of configurations conditioned by the number of particles by $\Sigma_{n,k} := \{\eta \in \Sigma_n; \sum_{x \in T_n} \eta_x = k\}$.

For $\eta \in \Sigma_n$ and $x, y \in T_n$, we define the configuration $\eta^{x,y} \in \Sigma_n$ by $(\eta^{x,y})_x = \eta_y$, $(\eta^{x,y})_y = \eta_x$, and $(\eta^{x,y})_z = \eta_z$ for $z \neq x, y$, and the operator $\pi^{x,y}$ by $\pi^{x,y} f(\eta) = f(\eta^{x,y}) - f(\eta)$. We set $c(\eta) := \eta_{-1} + \eta_2$. Let τ_x be a shift operator. Given a local function g, which is strictly positive and does not depend on the value of η_0 nor η_1, we define the generator of simple exclusion process with degenerate rate $L = L_g$ by

$$Lf(\eta) = \sum_{x \in T_n} \tau_x(c(\eta)g(\eta))\pi^{x,x+1} f(\eta)$$

for all local function f.

This model is "non-gradient" type. To establish the hydrodynamic limit for non-gradient model, "gradient replacement" lemma plays a key role. I will talk on "gradient replacement" lemma for this model.

Stefan Neukamm

Stochastic Homogenization: An optimal quantitative two-scale expansion

Consider a discrete elliptic equation on the discrete torus of size L, with iid con- ductivities. We show that the L2 -norm in probability of the discrete H1 -norm in space of the first two terms of the two-scale expansion decays with the same rate as in the case of deterministic, periodic coefficients (up to a logarithm in dimension 2). The proof relies on moment bounds on the corrector and its gradient, an estimate of the error on the approximation of the homogenized coefficients by periodization, and annealed estimates on derivatives of the random Green's function. This is joint work with Antoine Gloria and Felix Otto.

Hirofumi Osada

Ginibre random point field

Ginibre random point field is a translation and rotation invariant random point field (a probability measure on configuration space) over $\mathbb{R}^2$. It is an infinitely many particle system interacting via the 2D Coulomb potential with inverse temperature $\beta = 2$. I talk about several interesting geometric properties of Ginibre random point field. In particular, I explain "Palm decomposition and density restore formulae", which is a very specific property of Ginibre random point field. This property is a key to the dynamical rigidity of Ginibre interacting Brownian motions.

Felix Otto

A quantitative theory in stochastic homogenization

In many applications, one has to solve an elliptic equation with coefficients that vary on a length scale much smaller than the domain size. We are interested in a situation where the coefficients are characterized in statistical terms: Their statistics are assumed to be translation invariant and to decorrelate over large distances. As is known by qualitative theory, the solution operator behaves – on large scales – like the solution operator of an elliptic problem with *homogeneous, deterministic* coefficients!

We are interested in several quantitative aspects: How close is the actual solution to the homogenized one — we give an optimal answer, and point out the connections with elliptic regularity theory (input from Nash's theory, a new outlook on De Giorgi's theory).

We are also interested in the quantitative ergodicity properties for the process usually called "the environment as seen from the random walker". We give an optimal estimate that relies on a link with (the Spectral Gap for) another stochastic process on the coefficient fields, namely heat-bath Glauber dynamics. This connection between statistical mechanics and stochastic homogenization has previously been used in opposite direction (i. e. with qualitative stochastic homogenization as an input).

Theory provides a formula for the homogenized coefficients, based on the construction of a "corrector", which defines harmonic coordinates. This formula has to be approximated in practise, leading to a random and a systematic error. If time permits, we point out optimal estimates of both.

This is joint work with A. Gloria, S. Neukamm, and D. Marahrens.

Robert Philipowski

Martingales on manifolds with time-dependent connection

Martingales on manifolds with a fixed connection have been studied for a long time. Moreover, they have been successfully applied to the study of harmonic maps between Riemannian manifolds. Motivated by Perelman's proof of the Poincar conjecture using Ricci flow there is nowadays a strong interest in stochastic analysis on manifolds with time-dependent geometry. In this talk we define martingales in such a time-dependent context and show how they can be applied to the study of the harmonic map heat flow.

Michael Röckner

An Analytic Approach to Infinite Dimensional Continuity and Fokker–Planck–Kolmogorov Equations

(joint work with Vladimir Bogachev, Giuseppe Da Prato and Stanislav Shaposhnikov)

We present a new uniqueness result for solutions to Fokker–Planck–Kolmogorov (FPK) equations for probability measures on infinite-dimensional spaces. We consider infinite-dimensional drifts that admit certain finite dimensional approximations. In contrast to most of the previous work on FPK-equations in infinite dimensions, we include cases with non-constant coefficients in the second order part and also include degenerate cases where these can even be zero, i.e. we prove uniqueness of solutions to continuity equations. Also new existence results are proved. Applications to proving well- posedness of Fokker-Planck-Kolmogorov equations associated with SPDEs and of continuity equations associated with PDE are discussed.

Makiko Sasada

On the spectral gap of binary interaction processes having product reversible measures

We give a general strategy to obtain a lower bound on the spectral gap for a class of binary interaction processes having product reversible measures. In 2008, Caputo showed that, for a class of binary collision processes on the complete graph, the analysis of the spectral gap of an N-component system can be reduced to that of the same system for N = 3. In this talk, we give a comparison technique to reduce the analysis of the spectral gap on d -dimensional lattice to that on the complete graph for binary collision processes. Also, we show another type of comparison theorem which allows us to reduce the spectral gap estimate for binary interaction processes to that for binary collision processes. The method applies to a number of interesting processes on the complete graph and also on d -dimensional lattice, including stochastic energy exchange models, Ginzburg-Landau models and interacting particle models.

Björn Schmalfuß

Dynamics of stochastic evolution equations driven by a fractional Brownian motion.

We discuss the generation of random dynamical systems generated by a stochastic evolution equation driven by a fractional Brownian motion. In addition, we mention some cases where these random dynamical systems have a random invariant manifold or a random attractor.

Ichiro Shigekawa

Spectra of 1-dimensoinal diffusion operators: some examples

It is well-known that the Hermite polynomials are eigenfunctions of Ornstein-Uhlenbeck operator. Here the Hermite polynomials are defined by

$$H_n(x) = \frac{(-1)^n}{n!} e^{x^2/2} \frac{d^n}{dx^n} e^{-x^2/2}, \quad n = 0, 1, \ldots$$

They satisfy the identities $H_n'(x) = H_{n-1}(x)$, $n = 1, 2, \ldots$. This relation suggests that the differentiation gives rise to a correspondence between two families of eigenfunctions. In this talk, we will give a general framework of this fact for diffusion operators of the form $\frac{1}{p}(apu')'$. We also discuss some examples including Bessel functions, Laguerre polynomials, etc.

Yuichi Shiozawa

Upper escape rate of Markov chains on weighted graphs

This talk is based on the joint work with Xueping Huang (FSU Jena). We obtain an upper escape rate function for a continuous time minimal symmetric Markov chain defined on a locally finite weighted graph. This upper rate function, which has the same form as the manifold setting, is given in terms of the volume growth with respect to an adapted path metric. Our approach also gives a weak form of Folz's theorem on the conservativeness as a consequence.

Wilhelm Stannat

Stochastic stability of traveling waves in nerve axon equations

We consider stochastic partial differential equations modeling the propagation of the action potential along the nerve axon of a single neuron subject to channel noise uctuations, including stochastic FitzHugh-Nagumo systems. Stochastic stability of the action potential is proven using functional inequalities and an implicitly defined phase adaption. Our approach is new even for the deterministic case. A stochastic differential equation for the speed of the action potential is derived that allows to decompose the stochastic dynamics into the propagating action potential and noise fluctuations. Our approach also allows to calculate the probability of a propagation failure w.r.t. the to underlying channel noise fluctuations.

Masayhoshi Takeda

A Variational Formula for Dirichlet Forms and Existence of Ground States

Let L be the generator of a symmetric Markov process on a locally com- pact separable metric space. Employing a variational formula for Dirichlet forms, we show that if the Markov process has a tightness property, then the ground state of L exists. Moreover, for a certain measure μ in the Kato class we show the existence of the ground state of the time-changed operator μL or the Schrödinger-type operator $L + \mu$.

Ryokichi Tanaka

Discrete random walks on the group Sol

We study a discrete random walk on a certain solvable Lie group Sol of exponential volume growth. The boundary behavior of the random walk highly depends on the step distribution ?. We show that the harmonic measure ? on the boundary can be both regular and singular with respect to Lebesgue measure according to the random walks we consider. This gives a counterexam- ple for a problem raised by Kaimanovich and Le Prince, and a discrete counter part of Brownian motion which is studied by Broffero, Salvatori and Woess. We will emphasize the connection to Bernoulli convolutions. The talk is based on the joint work with J. Brieussel (Universite Montpellier).

Anton Thalmaier

Brownian motion, moving metrics and entropy formulas

We discuss notions of stochastic differential geometry in the framework of manifolds evolving along a geometric flow. In particular, stochastic versions of entropy formulas are presented for positive solutions of the heat equation (or conjugate heat equation) under forward/backward Ricci flow. This is joint work with Hongxin Guo and Robert Philipowski.

Toshihiro Uemura

On Recurrence of Symmetric Jump Processes

Let E be a locally compact separable metric space equipped with a metric d, m a positive Radon measure on E with full topological support and $\kappa(x, dy)$ be a kernel over $E \times \mathcal{B}(E)$ so that

$$\kappa(x, dy)m(dx) = \kappa(y, dx)m(dy).$$

In this talk we show the recurrence of the symmetric jump process associated with the Dirichlet form constructed from the kernel $\kappa(x, dy)$ on $L^2(E; m)$.

This is a joint work with Ryuji Kinoshita and Hiroyuki Okura.

Hendrik Weber

Invariant measure of the stochastic Allen-Cahn equation: the regime of small noise and large system size

We study the invariant measure of the one-dimensional stochastic Allen-Cahn equation for a small noise strength and a large but finite system with so-called Dobrushin boundary conditions, i.e., inhomogeneous ± 1 Dirichlet boundary conditions that enforce at least one transition layer from -1 to 1. (Our methods can be applied to other boundary conditions as well.) We are interested in the competition between the "energy" that should be minimized due to the small noise strength and the "entropy" that is induced by the large system size.

Specifically, in the context of system sizes that are exponential with respect to the inverse noise strength—up to the "critical" exponential size predicted by the heuristics—we study the extremely strained large deviation event of seeing *more than the one transition layer* between ± 1 that is forced by the boundary conditions. We capture the competition between energy and entropy through upper and lower bounds on the probability of these unlikely extra transition layers. Our bounds are sharp on the exponential scale and imply in particular that the probability of having one and only one transition from -1 to $+1$ is exponentially close to one. Our second result then studies the *distribution of the transition layer*. In particular, we establish that, on a super-logarithmic scale, the position of the transition layer is approximately uniformly distributed.

In our arguments we use local large deviation bounds, the strong Markov property, the symmetry of the potential, and measure-preserving reflections

This is a joint work with F. Otto and M. Westdickenberg.

Kouji Yano

Functional limit theorem for processes pieced together from excursions

By Ito's excursion theory, a process can be constructed by piecing together from excursions. The joint law of the process and its local time may be characterized by the pair consisting of the excursion measure and the stagnancy rate.

In this talk we discuss a general limit theorem for the joint laws of such processes and their local times via convergence of their excursion measures and stagnancy rates. We also give some applications to homogenization theorems.

Larisa Yaroslavtseva

A deterministic algorithm based on discretized Wagner-Platen steps for quadrature of marginals of SDEs.

We consider the problem of approximating the expectation $Ef(X_1)$ of a function f of the solution X_1 of a d-dimensional system of stochastic differential equations (SDE) at time point 1. We present a deterministic algorithm, which is based on a quadrature rule obtained by iteratively applying a discretized Wagner-Platen step together with strategies to reduce the diameter and the size of the support of a discrete measure. For Lipschitz continuous integrands f and smooth enough coefficients of the SDE this algorithm almost achieves an error of order $1/d$ in terms of its computational cost. We further present lower bounds for the error of arbitrary deterministic algorithms in worst case settings with respect to classes of SDEs and classes of integrands defined in terms of smoothness constraints. In particular, it turns out that our algorithm is almost asymptotically optimal.

This is joint work with Thomas Mller-Gronbach (Passau) and Klaus Ritter (Kaiserslautern).

Martina Zähle

SPDE in metric measure spaces - regularity of the solution

(joint work with E. Issoglio)

We consider parabolic SPDE in metric measure spaces associated with heat semigroups and multiplicative fractional space-time noise. The unique mild solutions with function values in fractional Sobolev spaces (see [1]) are shown to be Hölder regular in time. Some optimal relationships between the parameters are established, where fractional calculus is used as a main tool. In particular, the results can be applied to certain fractal spaces.

[1] Michael Hinz, Martina Zähle: Semigroups, Potential spaces and Applications to (S)PDE, Potential Anal. 36 (2012), 483-515.

Rongchan Zhu

Stochastic semilinear equations and their associated Fokker-Planck equations

The main purpose of this talk is to prove existence and uniqueness of (probabilistically weak and strong) solutions to stochastic differential equations (SDE) on Hilbert spaces under a new approximation condition on the drift, recently proposed in [BDR10] to solve Fokker-Planck equations

(FPE), extended in this paper to a considerably larger class of drifts. As a consequence we prove existence of martingale solutions to the SDE (whose time marginals then solve the corresponding FPE). Applications include stochastic semilinear partial differenti al equations with white noise and a non-linear drift part which is the sum of a Burgers-type part and a reaction diffusion part. The main novelty is that the latter is no longer assumed to be of at most linear, but of at most polynomial growth. This case so far had not been covered by the existing literature. We also give a direct and more analytic proof for existence of solutions to the corresponding FPE, extending the technique from [BDR10] to our more general framework, which in turn requires to work on a suitable Gelfand triple rather than just the Hilbert state space. [BDR10]V. Bogachev, G. Da Prato, M. Röckner, Existence and uniqueness of solutions for Fokker-Planck equations on Hilbert spaces, J.Evol.Equ. 10 (2010),487-509

Xiangchan Zhu

Local existence and non-explosion of solutions for semilinear stochastic equations driven by multiplicative noise

In this paper we prove the local existence and uniqueness of solutions for a class of semilinear stochastic equations driven by multiplicative noise. We also establish that, for such a class of equations the addition of linear multiplicative noise provides a regularizing effect: the solutions will not blow up with high probability if the initial data is sufficiently small, or if the noise coefficient is sufficiently large.
