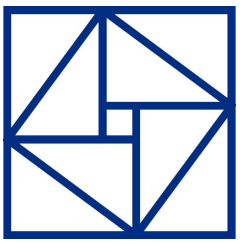
International Program on Regularity Structures and Stochastic Systems

July 9th-August 3rd, 2018, Beijing, China

Academy of Mathematics and Systems Science, CAS

Conference manual



Sponsors

AMSS, Chinese Academy of Sciences

National Natural Science Foundation of China

Contents

1. Conference Presentation

Organizer:
Academy of Mathematics and Systems Science, CAS
Imperial College London (London, UK)

Registration： 14:00-20:00 on July 9 @ New Office Building, AMSS, CAS

Date: 2018.07.09—2018.08.03

Date of Workshop: 07.10—07.14

Venue: New Office Building, AMSS, CAS
Mini Course and Seminars: Room 204 & Room 109
Workshop: Room 204

Homepage: https://www.wjx.top/jq/22713673.aspx

Hotel for Conference Speakers:
Junma International Hotel(骏马国际酒店)

Scientific Committee：
Zhi-Ming Ma, AMSS, CAS (Co-Chair)
Martin Hairer, Imperial College London (Co-Chair)
Fuzhou Gong, AMSS, CAS
Xuemei Li, Imperial College London

Local Organizers:
Fuzhou Gong
Yan Fu
Kai He
Liping Li
Yuan Liu
Dejun Luo
Yongsheng Song

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Academy of Mathematics and Systems Science, CAS
National Natural Science Foundation of China, NSFC 11688101, "Geometry, analysis, and computation on manifolds"

II. Conference Schedule

Calendar of RSSS

Jul 9-Aug 3, 2018											
Mon		Tue		Wed		Thu		Fri		Sat	
Jul 9 Registration 14:00-20:00 New Office Building		Jul 10—Jul 14 WORKSHOP									
Jul 16	Hairer Hairer Matetski Matetski	Jul 17	Hairer Hairer	Jul 18	Hairer Hairer	Jul 19	Hairer Hairer	Jul 20	Hairer Hairer Matetski	Jul 21	
Jul 23	Shen Holding	Jul 24	Xu Bruned	Jul 25	Bruned Bruned	Jul 26	Holding Holding	Jul 27	Xu Xu	Jul 28	
Jul 30	Shen Shen	Jul 31		Aug 1	Zhu Zhu	Aug 2		Aug 3	Zhu Zhu	Aug 4 The end	

Time Table

Class 1 09:15-10:15
Class 2 10:45-11:45
LUNCH
Class 3 13:30-14:30
Class 4 15:00-16:00

Venue

Workshop: New Office Building, AMSS, CAS
Room 204
Mini Courses : New Office Building, AMSS, CAS
Room 204: C1
Room 109: C2, C3, C4, C5, C6, C7

Mini Courses

C1: Martin Hairer
C2: Yvain Bruned
C3: Thomas James Holding
C4: Konstantin Matetski
C5: Hao Shen
C6: Weijun Xu
C7: Xiangchan Zhu

Notice:
On July 18, Prof. Fraydoun Rezakhanlou will give a talk titled "Kinetic Limit for Interacting Particle Systems".

Workshop Schedule

Date: Jul 10th, Tuesday Venue: Room 204 of New Office Building, AMSS, CAS		
Time	**Content**	**Chair**
8:10-8:30	Opening Ceremony Zhiming Ma (Chairman of the Academic Committee of AMSS, CAS) Xuemei Li (Chair in Probability and Stochastic Analysis, IC)	Jia-an Yan
8:30-9:15	David Elworthy (University of Warwick, UK) Title: Towards higher order derivative formulae	Zhiming Ma
9:15-10:00	Kening Lu (Brigham Young University) Title: TBA	
10:00-10:15	Tea Break	
10:15-11:00	Tusheng Zhang (University of Manchester, UK) Title: Small time asymptotics of Brownian motion with singular drifts	Kening Lu
11:00-11:45	Zhenqing Chen (University of Washington) Title: A priori Holder estimate for non-local parabolic SPDE	
	Lunch	
14:00-14:45	Marc Arnaudon (University of Bordeaux) Title: A duality formula and a particle Gibbs sampler for continuous time Feynman-Kac measures on path spaces	Federica Dragoni
14:45-15:30	Nicolas Peter Dirr (Cardiff University, UK) Title: Gradient flows and stochastic particle systems	
15:30-15:45	Tea Break	
15:45-16:30	Federica Dragoni (Cardiff University, UK) Title: Stochastic Homogenization in Carnot Groups	Nicolas Peter Dirr
16:30-17:15	Hiroshi Kawabi (Keio University, Yokohama, Japan) Title: Functional central limit theorems for non-symmetric random walks on nilpotent covering graphs	
17:15-18:00	Stefania Ugolini (University of Milan) Title: A stochastic approach to Bose-Einstein Condensation	
18:30	Dinner	

Date: Jul 11th, Wednesday Venue: Room 204 of New Office Building, AMSS, CAS		
Time	**Content**	**Chair**
8:30-9:15	Michael Röckner (Bielefeld University and AMSS. CAS) Title: Nonlinear Fokker-Planck-Kolmogorov equations and distribution dependent SDE	Nizar Touzi
9:15-10:00	Anton Thalmaier (University of Luxembourg) Title: Characterization of Ricci curvature and Ricci flow by Brownian motion	
10:00-10:15	Tea Break	
10:15-11:00	Nizar Touzi (Ecole Polytechnique, France) Title: Branching particles representation for nonlinear PDEs	Michael Röckner
11:00-11:45	Hirofumi Osada (Kyushu University, Japan) Title: Infinite-dimensional stochastic differential equations with symmetry	
	Lunch	
14:00-14:45	Thierry Lévy (Sorbonne Université) Title: Quantum spanning forests	Barbara Rüdiger
14:45-15:30	Seiichiro Kusuoka (Okayama University) Title: The invariant measure and flow associated to the Phi4-quantum field model on the three-dimensional torus	
15:30-15:45	Tea Break	
15:45-16:30	Barbara Rüdiger (University Wuppertal) Title: The Boltzmann Process	Thierry Lévy
16:30-17:15	Sonia Mazzucchi (University of Trento, Italy) Title: Generalized Feynman-Kac formulae	
17:15-18:00	Martin Grothaus (Technical University of Kaiserslautern, Germany) Title: Approximation of the stochastic heat equation with sticky reflected boundary condition	
18:30	Dinner	

Date: Jul 12th, Thursday Venue: Room 204 of New Office Building, AMSS, CAS		
Time	**Content**	**Chair**
8:30-9:15	Yuri Kifer (Hebrew University, Jerysalem) Title: Geometric law for multiple returns until a hazard	Paulo Régis Caron Ruffino
9:15-10:00	Fengyu Wang (Tianjin University) Title: Estimates of Invariant Probability Measures for Singular SDEs	
10:00-10:15	Tea Break	
10:15-11:00	Alain-Sol Sznitman (ETH Zurich) Title: On macroscopic holes in some dependent percolation models	Fengyu Wang
11:00-11:45	Paulo Régis Caron Ruffino (University of Campinas, Brazil) Title: Geodesic jumps in non-continuous SDE: applications to an averaging principle on foliated space	
	Lunch	
14:00-14:45	James Thompson (University of Luxembourg) Title: Quantitative gradient estimates by Bismut formulae	Ben Hambly
14:45-15:30	Bin Xie (Shinshu University) Title: On the space-time white noise driven SPDE with reflection	
15:30-15:45	Tea Break	
15:45-16:30	Ben Hambly (University of Oxford) Title: SPDEs and systemic risk	Bin Xie
16:30-17:15	Atsushi Atsuji (Keio University, Japan) Title: Leafwise Brownian motions and some function theoretic properties of laminations	
17:15-18:00	Hao Shen (Columbia University/University of Wisconsin - Madison) Title: TBA	
18:30	Dinner	

Date: Jul 13th, Friday Venue: Room 204 of New Office Building, AMSS, CAS		
Time	**Content**	**Chair**
8:30-9:15	Jean-Dominique Deuschel (Technical University of Berlin) Title: Isomorphism Theorems For Ginzburg-Landau Fields	Jürgen Angst
9:15-10:00	Jinqiao Duan (Illinois Institute of Technology, Chicago & HUST, Wuhan) Title: Geometrical Methods for Stochastic Dynamics	
10:00-10:15	Tea Break	
10:15-11:00	Jürgen Angst (University of Rennes 1) Title: On the long time behavior of relativistic diffusions	Jinqiao Duan
11:00-11:45	Rama Cont (Oxford and Imperial College London) Title: TBA	
	Lunch	
14:00-14:45	Naotaka Kajino (Kobe University, Japan) Title: The Laplacian on some round Sierpi\'{n}ski carpets and Weyl's asymptotics for its eigenvalues	Xin Chen
14:45-15:30	Francesco Carlo De Vecchi (University of Bonn) Title: Gauge symmetries of semimartingales	
15:30-15:45	Tea Break	
15:45-16:30	Xin Chen (Shanghai Jiao Tong University) Title: Random conductance models with stable-like jumps	Naotaka Kajino
16:30-17:15	Ionel Popescu (Georgia Institute of Technology) Title: Free Functional Inequalitites on the Circle	
18:30	Banquet	

Date: Jul 14th, Saturday Venue: Room 204 of New Office Building, AMSS, CAS		
Time	**Content**	**Chair**
8:30-9:15	Martin Hairer (Imperial College London) Title: Stochastic quantization of Yang-Mills	Jia-an Yan
9:15-10:00	Xicheng Zhang (Wuhan University) Title: Singular Brownian diffusion processes	
10:00-10:30	Tea Break and Group Photo	
10:30-11:15	Jonas Tölle (Augsburg University, Germany) Title: Stochastic nonlinear PDEs with singular drift and gradient noise	Xicheng Zhang
11:15-12:00	Thomas Cass (Imperial College London) Title: Generalisations of the Ito-Stratonovich conversion formula using rough paths	
	Lunch	
14:00-14:45	Fraydoun Rezakhanlou (University of California, Berkeley) Title: Hamilton-Jacobi PDE and Hamiltonian ODE: A Tale of Two Homogenization	Robert Weston Neel
14:45-15:30	Massimiliano Gubinelli (University of Bonn, Germany) Title: Gamma convergence and Euclidean QFT	
15:30-15:45	Tea Break	
15:45-16:30	Robert Weston Neel (Lehigh University) Title: Geometric and Martin Boundaries on Cartan-Hadamard Manifolds	Massimi-liano Gubinelli
16:30-17:15	Xuemei Li (Imperial College London) Title: Uniform CLT under Hörmander's conditions	
18:30	Dinner	

III. Titles and Abstracts

1. Mini Courses

Yvain Bruned
Imperial College London

Title: Renormalisation in Regularity Structures
Abstract: Renormalisation plays an important role in the theory of regularity structures. It appears in different forms. One renormalisation is used for recentering new monomials around a certain point and the other renormalises these ill-defined monomials. They are both described by two Hopf algebras. We will present in this mini-course examples and their constructions.

Martin Hairer
Imperial College London

Title: Introduction to Regularity Structure
Abstract: A 10 hours mini course on Regularity Structures.

Thomas James Holding
Imperial College London

Title: Non-local regularity structures
Abstract: The theory of regularity structures has been very successful in solving stochastic partial differential equations of parabolic or elliptic type whose Greens functions are smooth away from the origin. However, in many cases, for example in stochastic wave equations, the Greens function is singular on a much larger set which means the usual theory does not apply. This course will introduce a non-local variant of regularity structures which allows these problems to be tackled.

Konstantin Matetski
University of Toronto

Title: The KPZ fixed point
Abstract: The KPZ universality class contains one dimensional growth models, directed random polymers, stochastic Hamilton-Jacobi equations. It is characterized by unusual scale of fluctuations, some of which come from random matrix theory, and which are model independent but do depend on the initial data. The physical explanation is that in the space of Markov processes, these models are all being rescaled to a universal fixed point. This scaling invariant fixed point was completely unknown until this year, when we managed to compute it in joint work with J. Quastel and D. Remenik. In the talk I will describe it, as well as how it was obtained by solving a special model in the KPZ universality class called TASEP.

Hao Shen
Columbia University/University of Wisconsin - Madison

Title: TBA
Abstract: TBA

Weijun Xu
New York University Shanghai

Title: Weak universalities
Abstract: One of the motivations to study singular stochastic PDEs is that many of them are expected to be universal objects in crossover regimes in their respective universality classes. We will use the KPZ equation and the three dimensional stochastic quantisation equation as two primary examples, and demenstrate how they naturally arise as the universal limits from a large class of interface growth models and phase coexistence models.

Xiangchan Zhu
Beijing Jiao Tong University

Title: Paracontrolled Distributions
Abstract: In this lecture I will give an introduction for the paracontrolled distribution method which can be used to solve a large class of singular SPDEs introduced by Gubinelli-Imkeller-Perkowski. The idea comes from paradifferential calculus and on ideas from the theory of controlled rough paths. As an application, I will use it to give a meaning to the famous KPZ equations.

2. Workshop

Jürgen Angst

University of Rennes 1

Title： On the long time behavior of relativistic diffusions

Abstract： We will describe the long time asymptotic behavior of relativistic diffusions i.e. diffusion processes with values in Lorentzian manifolds whose law is equivariant under the action of isometries. In particular, we will compare the random compactification of the base manifold given by the exit points of the process, to purely geometric compactifications such as the conformal or causal boundaries.

Marc Arnaudon

University of Bordeaux

Title: A duality formula and a particle Gibbs sampler for continuous time Feynman-Kac measures on path spaces

Abstract: Continuous time Feynman-Kac measures on path spaces are central in applied probability, partial differential equation theory, as well as in quantum physics. I will present a new duality formula between normalized Feynman-Kac distribution and their mean field particle interpretations. Among others, this formula will allow to design a reversible particle Gibbs-Glauber sampler for continuous time Feynman-Kac integration on path spaces. This result extends the particle Gibbs samplers introduced by Andrieu-Doucet-Holenstein in the context of discrete generation models to continuous time Feynman-Kac models and their interacting jump particle interpretations. I will also provide new propagation of chaos estimates for continuous time genealogical tree based particle models with respect to the time horizon and the size of the systems. These results allow to obtain sharp quantitative estimates of the convergence rate to equilibrium of particle Gibbs-Glauber samplers.

Atsushi Atsuji

Keio University, Japan

Title: Leafwise Brownian motions and some function theoretic properties of laminations

Abstract： In 1983 L.Garnett introduced the notion of leafwise Brownian motions and harmonic measures on foliated manifolds. We construct a diffusion process on general foliated spaces, called laminations, whose invariant measure is harmonic. We will see some properties of the diffusion process and discuss some function theoretic properties such as Liouville properties and Picard type theorems of leafwise functions using stochastic calculus of the diffusion process.

Thomas Cass

Imperial College London

Title： Generalisations of the Ito-Stratonovich conversion formula using rough paths
Abstract： Lyons' theory of rough paths allows one to solve stochastic differential equations driven by a Gaussian processes X under certain conditions on the covariance function. The rough integral of these solutions against X again exist, and a natural question is to find a closed-form conversion formula between this rough integral and the Skorohod integral of the solution which generalises the classical Stratonovich-Ito conversion formula. Previous works in the literature assumes the integrand to be the gradient of a smooth function of X; our formula again recovers these results as special cases. Joint work with Nengli Lim.

Xin Chen

Shanghai Jiao Tong University

Title: Random conductance models with stable-like jumps
Abstract: We study the quenched invariance principle and two-sided heat kernel estimates for random conductance models with long range jumps on $Zˆ d$, where the transition probability from x to y is in average comparable to $|x-y|^{-d-\alpha}$ with $\alpha\in (0,2)$ and the associated conductances are not uniformly elliptic. Under some moment conditions on the conductance, we prove that the scaling limit of the Markov process is a symmetric α-stable Lévy process on R^d. We also prove that (elliptic) Harnack inequalities do not hold in the present setting. Our results could be applied to general discrete metric measure space. The talk is based on a joint paper with Takashi Kumagai and Jian Wang.

Zhenqing Chen

University of Washington

Title： A priori Holder estimate for non-local parabolic SPDE
Abstract： In this talk, I will present an L^∞ estimate for non-local parabolic SPDE with measurable jumping kernel, using an improved version of stochastic De Giorgi iteration. Then a priori Holder estimates will be given for solutions of these SPDEs. Joint work with Zhenan Wang.

Rama Cont

Oxford and Imperial College London

Title： TBA
Abstract： TBA

Jean-Dominique Deuschel

Technical University of Berlin

Title: Isomorphism Theorems For Ginzburg-Landau Fields
Abstract: We derive certain identities in law relating functionals of convex gradient

fields to the local times of corresponding random walks in the associated Helffer-Sj\"ostrand representation. When restricting these identities to Gaussian measures, one recovers classical isomorphism theorems due to Dynkin, Ray-Knight and Le Jan. We apply these results to prove the existence of mass gaps for a class of anharmonic models with suitable single-spin distribution, thus extending results of Brydges, Fr\"ohlich and Spencer. This is a joint work with P.-F. Rodriguez.

Nicolas Peter Dirr

Cardiff University, UK

Title: Gradient flows and stochastic particle systems

Abstract: We explore the connections between macroscopic gradient flows and microscopic particle system and how they can be exploited for numerical methods.

Federica Dragoni

Cardiff University, UK

Title: Stochastic Homogenization in Carnot Groups

Abstract: We present recent homogenization results for Hamilton-Jacobi equations which are not coercive, i.e. classical techniques cannot be applied. Instead, the relation of these Hamiltonians with the geometry of Carnot groups is used.

JinQiao Duan

Department of Applied Mathematics, Illinois Institute of Technology, Chicago &
Center for Mathematical Sciences, Huazhong Univ of Sci and Tech, Wuhan

Title: Geometrical Methods for Stochastic Dynamics

Abstract: Dynamical systems arising in engineering and science are often subject to random fluctuations. The noisy fluctuations may be Gaussian or non-Gaussian, which are modeled by Brownian motion or α-stable Levy motion, respectively. Non-Gaussianity of the noise manifests as nonlocality at a ``macroscopic'' level. Stochastic dynamical systems with non-Gaussian noise (modeled by α-stable Levy motion) have attracted a lot of attention recently. The non-Gaussianity index α is a significant indicator for various dynamical behaviors.

The speaker will overview recent advances in geometrical methods for stochastic dynamical systems, including random invariant sets, random invariant manifolds, stochastic bifurcation, mean exit time, escape probability, tipping time, most probable orbits, and transition pathways between metastable states.

David Elworthy

Mathematics Institute, University of Warwick, UK

Title： Towards higher order derivative formulae

Abstract： I will discuss methods of obtaining formulae for higher order derivatives of

heat semigroups based on techniques from earlier work with XueMei Li and Yves LeJan. A basic example will be for the heat semigroup on spheres. I will aim to show that the problem is both more complicated and more interesting than might first be expected.

Martin Grothaus

Technical University of Kaiserslautern, Germany

Title： Approximation of the stochastic heat equation with sticky reflected boundary condition

Abstract: In this talk we study the stochastic heat equation with sticky reflected boundary condition. Dirichlet form techniques are used to construct 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 competing on the boundary. In this talk it is planned to discuss also about the recent progress on this problem.

Massimiliano Gubinelli

University of Bonn, Germany

Title： Gamma convergence and Euclidean QFT

Abstract： I will describe a new approach to prove existence of the Euclidean $Phiˆ 4_3$ measure in a periodic domain using variational methods and estimates inspired by the theory of singular SPDEs. The variational problem is formally related to an Hamilton-Jacobi equation first introduced by Wilson in the context of the renormalization group method.

Ben Hambly

Maths Institute，University of Oxford

Title： SPDEs and systemic risk

Abstract： We consider a simple model for systemic risk in a financial market. The individual financial institutions are assumed to be connected in such a way that losses in one institution affect others. By taking a large portfolio limit in the market we derive stochastic McKean-Vlasov equations that describe the financial system as a whole. The effect of the losses introduces feedback effects and the model can capture systemic events as breakdowns in the solutions to these equations.

Martin Hairer

Imperial College London

Title: Stochastic quantization of Yang-Mills

Abstract: We construct the natural dynamic associated to the Yang-Mills measure in dimension 3. In particular, we show that among the many notions of solution provided by the theory of regularity structures, exactly one yields a gauge-equivariant process.

Naotaka Kajino
Kobe University, Japan

Title: The Laplacian on some round Sierpi\'{n}ski carpets and Weyl's asymptotics for its eigenvalues

Abstract : The purpose of this talk is to present the speaker's recent research in progress on the construction of a ``canonical'' Laplacian on round Sierpi\'{n}ski carpets invariant with respect to certain Kleinian groups (i.e., discrete groups of M\"{o}bius transformations on $\widehat{\mathbb{C}}:=\mathbb{C}\cup\{\infty\}$) and on Weyl's asymptotics for its eigenvalues. Here a \emph{round Sierpi\'{n}ski carpet} refers to a subset of $\widehat{ \mathbb{C}}$ homeomorphic to the standard Sierpi\'{n}ski carpet, such that its complement in $\widehat{\mathbb{C}}$ consists of disjoint open disks in $\widehat{\mathbb{C}}$.

The construction of the Laplacian is based on the speaker's preceding study of the simplest case of the \emph{Apollonian gasket}, the compact fractal subset of $\mathbb{C}$ obtained from an ideal triangle (a triangle formed by mutually tangent three circles) by repeating indefinitely the process of removing the interior of the inner tangent circles of the ideal triangles. On this fractal,
Teplyaev (2004) had constructed a canonical Dirichlet form as one with respect to which the coordinate functions on the gasket are harmonic, and the author later proved its uniqueness and discovered an explicit expression of it in terms of the circle packing structure of the gasket.

The expression of the Dirichlet form obtained for the Apollonian gasket in fact makes sense on round Sierpi\'{n}ski carpets and defines (a candidate of) a ``canonical'' Laplacian on such fractals.
When the round Sierpi\'{n}ski carpet is the limit set (i.e., the minimum invariant non-empty compact set) of a certain class of Kleinian groups, some explicit combinatorial structure of the fractal is known and makes it possible to prove Weyl's asymptotic formula for the eigenvalues of this Laplacian, which is of the same form as the circle-counting asymptotic formula by Oh and Shah [Invent.\ Math.\ \textbf{187} (2012), 1--35].

The difficulty in the case of a round Sierpi\'{n}ski carpet is that, since it is \emph{infinitely ramified}, i.e., the cells in its cellular decomposition intersect on infinite sets, it is highly non-trivial to show that the principal order term of the eigenvalue asymptotics is not affected by the cellular decomposition, namely by assigning the Dirichlet boundary condition on the boundary of the cells.

Hiroshi Kawabi
Keio University, Yokohama, Japan

Title: Functional central limit theorems for non-symmetric random walks on

nilpotent covering graphs

Abstract: The long time asymptotics for random walks on infinite graphs is a principal topic in both geometry and probabilty theory. A covering graph of a finite graph with a nilpotent covering transformation group is called a nilpotent covering graph, regarded as a generalization of a crystal lattice or the Cayley graph of a finite generated group of polynomial growth.

In this talk, we discuss non-symmetric random walks on nilpotent covering graphs from a view point of the theory of discrete geometric analysis developed by Kotani and Sunada, and give functional central limit theorems for them. We also mention a relationship between the limiting diffusions and distorted Brownian rough paths.

This talk is based on joint work with Satoshi Ishiwata (Yamagata University) and Ryuya Namba (Okayama University).

Yuri Kifer

Hebrew University, Jerysalem

Title： Geometric law for multiple returns until a hazard

Abstract： For a ψ-mixing stationary process we consider the number of multiple returns to a set until the moment (which we call a hazard) when the first multiple return to another set takes place. It turns out that if probabilities to arrive to these sets are of the same order then the above number has asymptotically a geometric distribution. Similar results are obtained in the dynamical systems setup considering ψ-mixing shifts on the sequence space. The work is motivated by the research on single and multiple returns to shrinking sets, as well as by the research on open systems studying their behavior until an exit through a "hole". The work is joint with my student A.Rapaport.

Seiichiro Kusuoka

Okayama University

Title： The invariant measure and flow associated to the Phi4-quantum field model on the three-dimensional torus

Abstract: We consider the invariant measure and flow of the Phi4-model on the three-dimensional torus, which appears in the quantum field theory. By virtue of Hairer's breakthrough, such a nonlinear stochastic partial differential equation became solvable and is studied as a hot topic. In the talk, we also apply Hairer's reconstruction of equations and directly construct the global solution and the invariant measure by using the invariant measures of approximation equations and the technique of solving the nonlinear dissipative parabolic equations.

Thierry Lévy

Sorbonne Université

Title： Quantum spanning forests

Abstract：I will report on a work in progress with Adrien Kassel about an extension of Kirchhoff's matrix-tree theorem and determinantal point processes to the framework of vector bundles over graphs.

Xuemei Li

Imperial College London

Title：Uniform CLT under Hörmander's conditions

Abstract：We discuss CLT for a family of operators satisfying Hoermandets conditions, and the the uniform rate of convergence.

Kening Lu

Brigham Young University

Title：TBA

Abstract：TBA

Sonia Mazzucchi

University of Trento, Italy

Title：Generalized Feynman-Kac formulae

Abstract：Generalized Feynman-Kac formulae, i.e. probabilistic representations for the solution of PDEs that do not satisfy maximum principle, can be constructed by replacing the ``traditional" concept of Lebesgue integral with respect to a $\sigma$-additive bounded measure with the more general concept of linear functional on a suitable space of ``integrable functions". In the present talk I shall present the technical difficulties as well as some possible solutions of this problem, showing that the mathematical theory of Feynman path integrals has a wider scope and can be applied to the construction of integral representation for the solution of N-order heat-type equations.

Robert Weston Neel

Department of Mathematics, Lehigh University

Title：Geometric and Martin Boundaries on Cartan-Hadamard Manifolds

Abstract：We recall results on the solvability of the Dirichlet problem at infinity and the identification of the geometric and Martin boundaries for Cartan-Hadamard manifolds, by both stochastic and non-stochastic methods. The situation is rather different in the two-dimensional and higher-dimensional cases. In the two-dimensional case, by studying the behavior of Brownian motion, we show that any upper radial curvature bound yielding transience also yields solvability of the Dirichlet problem at infinity, and we indicate what this implies for the relationship between the geometric boundary and the Martin boundary. Further, if the curvature is bounded from below, we show that any upper radial curvature bound giving

transience also gives that the Martin boundary is homeomorphic to the sphere at infinity.

Hirofumi Osada

Kyushu University, Japan

Title: Infinite-dimensional stochastic differential equations with symmetry

Abstract： I talk a method to solve infinite-dimensional stochastic differential equations(ISDE) with symmetry. This class of ISDE naturally appears in statistical physics and describes infinite particle systems.

Ionel Popescu

Georgia Institute of Technology

Title: Free Functional Inequalitites on the Circle

Abstract: We will present some free functional inequalities on the circle. For instance we will present a transportation inequality, a Log-Sobolev type and HWI. All these inequalities have a little different form from the classical case which seems to be due to the fact that the circle acts on itself. This begs several questions in the classical counterparts which have not been investigated yet.

Fraydoun Rezakhanlou

University of California, Berkeley

Title： Hamilton-Jacobi PDE and Hamiltonian ODE: A Tale of Two Homogenization

Abstract： A Hamilton-Jacobi PDE is closely related to a Hamiltonian ODE. If the Hamiltonian function is random and translation invariant with respect to space shifts, then the long time/space asymptotic of solutions can be studied and is related to the homogenization phenomenon. When the Hamiltonian function is convex in the momentum variable, the homogenization question for the Hamiltonian-Jacobi PDE and the corresponding Hamiltonian ODE is more or less equivalent. This is no longer the case when the Hamiltonian function is not convex. The homogenization question for Hamiltonian ODE only when the Hamiltonian function is periodic in spatial variable has been established with the help of techniques from symplectic geometry (Viterbo 2007). It remains open in the stochastic case.

Michael Röckner

Bielefeld University and AMSS. CAS

Title： Nonlinear Fokker-Planck-Kolmogorov equations and distribution dependent SDE

Abstract： By Ito’s formula the time marginals of a solution to a distribution dependent SDE solve a nonlinear Fokker-Planck-Kolmogorov equation. This talk is about the converse: we present a general technique how to identify a solution to a nonlinear Fokker-Planck-Kolmogorov equation consisting of probability densities as

the time marginals of a solution to a distribution dependent SDE. We apply this to the special case of a porous media equation perturbed by the divergence of a vector field depending nonlinearly on the solution. More precisely, we construct a generalized entropic solution u to this equation and apply the above general technique to find the corresponding distribution dependent SDE which has a weak solution with marginals given by u. We thus gain a probabilistic representation of u. (joint work with Viorel Barbu, Romanian Academy of Sciences, Iasi) Reference: arXiv:1801.10510

Barbara Rüdiger

University Wuppertal

Title： The Boltzmann Process

Abstract： We derive a McKean-Vlasov equation for which the solution is distributed according to the Boltzmann equation. We call its solution the Boltzmann process. This means that the Kolmogorov equation associated to a Boltzmann process is the Boltzmann equation. We analyse smooth conditions under which the solution of the Boltzmann equation guarantees the existence of a Boltzmann process. This is based on a joint work with S. Albeverio, P. Sundar.

Paulo Régis Caron Ruffino

University of Campinas, Brazil

Title： Geodesic jumps in non-continuous SDE: applications to an averaging principle on foliated space

Abstract： Semimartingales with jumps have been treated among others, by Kurtz, Pardoux and Protter, 1995, using the so called Marcus approach for jumps. Marcus interpretation describes the jumps as following an artificial deterministic flow of a vector field along a hidden time. Here we propose jumps of cadlag trajectories along geodesics, hence depending only on the point where the jumps start at. We get a generalized Itô-Kunita decomposition of the corresponding flow of local diffeomorphism and apply this approach to decomposition of flows and averaging along foliated manifolds.

Hao Shen

Columbia University/University of Wisconsin - Madison

Title: TBA

Abstract: TBA

Alain-Sol Sznitman

ETH Zurich

Title：On macroscopic holes in some dependent percolation models

Abstract： We consider on Z ^ d, with d ⩾ 3, the vacant set of random interlacements in the strongly percolative regime, the vacant set of the simple random walk, and the excursion set of the Gaussian free field in the strongly percolative regime. We present asymptotic upper and lower exponential bounds for the large deviation probability that the adequately thickened component of the boundary of a large box centered at the origin in the respective vacant sets or excursion set leaves in the box a macroscopic volume in its complement, as well as some geometric controls on the shape of the left-out volume.

Anton Thalmaier
University of Luxembourg

Title：Characterization of Ricci curvature and Ricci flow by Brownian motion

Abstract： We present recent work on describing Ricci curvature and Ricci flow in terms of functional inequalities for heat semigroups on manifolds. The inequalities are strong enough to characterize in particular Einstein manifolds and Ricci solitons. The talk includes extensions of these methods to geometric flows on manifolds, as well as to the path space of Riemannian manifolds evolving under a geometric flow.

James Thompson
University of Luxembourg

Title：Quantitative gradient estimates by Bismut formulae

Abstract： For a C^2 function u and an elliptic operator L on a smooth manifold, we will use stochastic analysis to prove a quantitative local estimate for the derivative du in terms of local bounds on u and Lu. This extends the recent work of G\"{u} neysu and Pigola [1], in which analytic methods were used. An integral version of our estimate can be used to derive a zero-mean value condition for Δu. Extensions to differential forms and manifolds with a boundary are also possible.

Although there is a long history of using stochastic analysis to study solutions to partial differential equations with various boundary conditions, it is nonetheless surprising that explicit estimates of this type can be obtained from the stochastic analysis of Brownian motion in such a simple and versatile way.

This is joint work with Prof. Dr. A. Thalmaier and Dr. L.-J. Cheng. Our main results are covered by the following two preprints: arXiv:1707.07121 and arXiv:1803.08844.

[1] B. G\"{u} neysu and S. Pigola. Quantitative C^1-estimates on Manifolds. {\it International Mathematics Research Notices}, 2017.

Jonas Tölle
Augsburg University, Germany

Title： Stochastic nonlinear PDEs with singular drift and gradient noise

Abstract： We shall discuss well-posedness results for stochastic nonlinear parabolic PDEs with singular drift and gradient Stratonovich noise with coefficients that may depend on the spatial variable. The drift term is given by a realization of a p-Laplace-type operator (for the singular cases $1\le p \le 2$), including also the more general case of non-homogeneous or multi-valued nonlinearities. For initial data in $L^ 2$, we prove the unique existence of a continuous process solving the SPDE in the sense of stochastic variational inequalities. The results are based on geometric conditions on the spatial domain and its boundary symmetries being related to the Itô-Stratonovich-corrector of the gradient noise. By imposing a curvature-dimension condition as well as a defective commutation condition, we obtain the higher order a priori estimates that allow us to pass to the limit in the approximation of the solution.

The results are partially based on a joint work with Ioana Ciotir (Normandie Université, INSA Rouen).

References:

1. V. Barbu, Z. Brzeźniak, E. Hausenblas, and L. Tubaro. Existence and convergence results for infinite dimensional nonlinear stochastic equations with multiplicative noise. Stochastic Process. Appl., 123(3):934--951, 2013.

2. V. Barbu, Z. Brzeźniak, and L. Tubaro. Stochastic nonlinear parabolic equations with Stratonovich gradient noise. Appl. Math. Optim., 188(3):1--17, 2017.

3. Ciotir, I. and Tölle, J. M., Nonlinear stochastic partial differential equations with singular diffusivity and gradient Stratonovich noise, J. Funct. Anal., 271(7):1764--1792, 2016.

4. I. Munteanu and M. Röckner. The total variation flow perturbed by gradient linear multiplicative noise. Infin. Dimens. Anal. Quantum. Probab. Relat. Top., 21(1):18500030 (28 pages), 2018.

5. Tölle, J. M., Estimates for nonlinear stochastic partial differential equations with gradient noise via Dirichlet forms. In "Stochastic Partial Differential Equations and Related Fields", In Honor of Michael Röckner, SPDERF, Bielefeld, Germany, October 10--14, 2016, in press, Springer Proceedings in Mathematics & Statistics, 2018.

6. Tölle, J. M., Stochastic evolution equations with singular drift and gradient noise via curvature and commutation conditions, preprint (2018), http://arxiv.org/abs/1803.07005.

Nizar Touzi

Ecole Polytechnique, France

Title： Branching particles representation for nonlinear PDEs

Abstract： We provide a probabilistic representations of the solution of some semilinear hyperbolic and high-order PDEs based on branching diffusions. These representations pave the way for a Monte-Carlo approximation of the solution, thus bypassing the curse of dimensionality. We illustrate the numerical implications in the context of some popular PDEs in physics such as nonlinear Klein-Gordon equation, a

simplified scalar version of the Yang-Mills equation, a fourth-order nonlinear beam equation and the Gross-Pitaevskii PDE as an example of nonlinear Schrödinger equations.

Stefania Ugolini

Department of Mathematics, University of Milan

Title： A stochastic approach to Bose-Einstein Condensation

Abstract ： A well-posed probabilistic way of looking at the Bose-Einstein condensation consists in rigorously associating a N-dimensional diffusion process to the ground state eigenfunction of the N-body Hamiltonian through Nelson map. We describe some probability measures convergence problems related to the Gross-Pitaevskii scaling limit of infinite particles. We discuss the entropy chaos for the symmetric probability law of the N interacting diffusion system and the weak convergence on the path space of the one particle probability law to the probability measure uniquely associated with the minimizer of the nonlinear Gross-Pitaevskii functional. The talk is based on a joint work with Sergio Albeverio and Francesco Carlo De Vecchi.

Francesco Carlo De Vecchi

University of Bonn

Title： Gauge symmetries of semimartingales

Abstract: In this talk we introduce the concept of gauge symmetry group of a general semimartingale with jumps. This concept was originally proposed for explaining the idea of weak symmetries of Brownian-motion-driven SDEs and it is exemplified by the group of random rotations of a Brownian. Then we explain some practical methods, exploiting the characteristic triplet of a semimartingale, for verifying the presence of gauge symmetries for specific semimartingales. Finally we use this notion to introduce a definition of weak symmetry for SDEs driven by general semimartingales with jumps and we show some concrete examples of weak symmetric SDEs.

The talk is based on the paper "Symmetries and invariance properties of stochastic differential equations driven by semimartingales with jumps" (arXiv:1708.01764) written in collaboration with Sergio Albeverio, Paola Morando and Stefania Ugolini.

Fengyu Wang

Tianjin University

Title： Estimates of Invariant Probability Measures for Singular SDEs

Abstract： In terms of a nice reference probability measure, integrability conditions on the path-dependent drift are presented for (infinite-dimensional) degenerate PDEs to have regular positive solutions. To this end, the corresponding stochastic (partial) differential equations are proved to possess the weak existence and uniqueness of solutions, as well as the existence, uniqueness and entropy estimates

of invariant probability measures. When the reference measure satisfies the log-Sobolev inequality, Sobolev estimates are derived for the density of invariant probability measures. Some results are new even for non-degenerate SDEs with path-independent drifts. The main results are applied to nonlinear functional SPDEs and degenerate functional SDEs/SPDEs.

Bin Xie

Shinshu University

Title： On the space-time white noise driven SPDE with reflection

Abstract: The stochastic partial different equation with reflection is one kind of random parabolic obstacle problems, which is also very important in applications. In this talk, we will discuss the dimension-free Harnack inequality for the Markov semigroup associated with the reflected SPDE driven by multiplicative space-time white noise. In addition, we will also consider the hypercontractive property relative to the reflected SPDE driven by additive noise.

Tusheng Zhang

University of Manchester, UK

Title： Small time asymptotics of Brownian motion with singular drifts

Abstract： In this talk I will present a recent result on small time large deviations and a varadhan type small time asymptotics for Brownian motion with measure drift.

Xicheng Zhang

Wuhan University

Title： Singular Brownian diffusion processes

Abstract ： In this talk we survey some recent progress about the SDEs with distributional drifts and singular measured-valued drifts. In particular, we show the well-posedness of martingale solutions or weak solutions, and obtain sharp two-sided and gradient estimates of the heat kernel associated to the above SDE. In one dimensional case, we also discuss the strong uniqueness of the solutions. Moreover, we also study the ergodicity and global regularity of the invariant measures of the associated semigroup under some dissipative assumptions.

IV. Participants

Speakers of Mini Courses:

No	Name	Affiliation
1.	Yvain Bruned	Imperial College London
2.	Martin Hairer	Imperial College London
3.	Thomas James Holding	Imperial College London
4.	Konstantin Matetski	University of Toronto
5.	Hao Shen	Columbia University / University of Wisconsin-Madison
6.	Weijun Xu	New York University Shanghai
7.	Xiangchan Zhu	Beijing Jiao Tong University

Speakers of Workshop:

No	Name	Affiliation
8.	Jürgen Angst	University of Rennes 1
9.	Marc Arnaudon	University of Bordeaux
10.	Atsushi Atsuji	Keio University, Japan
11.	Thomas Cass	Imperial College London
12.	Xin Chen	Shanhai Jiao Tong University
13.	Zhenqing Chen	University of Washington
14.	Rama Cont	Oxford and Imperial College London
15.	Jean-Dominique Deuschel	Technical University of Berlin

16.	Nicolas Peter Dirr	Cardiff University, UK
17.	Federica Dragoni	Cardiff University, UK
18.	Jinqiao Duan	Illinois Institute of Technology, Chicago & Huazhong Univ of Sci and Tech, Wuhan
19.	David Elworthy	Mathematics Institute, University of Warwick
20.	Martin Grothaus	Technical University of Kaiserslautern, Germany
21.	Massimiliano Gubinelli	University of Bonn, Germany
22.	Ben Hambly	Maths Institute, University of Oxford
23.	Martin Hairer	Imperial College London
24.	Naotaka Kajino	Kobe University, Japan
25.	Hiroshi Kawabi	Keio University, Yokohama, Japan
26.	Yuri Kifer	Hebrew University, Jerysalem
27.	Seiichiro Kusuoka	Okayama University
28.	Thierry Lévy	Sorbonne Université
29.	Xuemei Li	Imperial College London
30.	Kening Lu	Brigham Young University
31.	Sonia Mazzucchi	University of Trento, Italy
32.	Robert Weston Neel	Department of Mathematics, Lehigh University
33.	Hirofumi Osada	Kyushu University, Japan
34.	Ionel Popescu	Georgia Institute of Technology
35.	Fraydoun Rezakhanlou	University of California, Berkeley
36.	Michael Röckner	Bielefeld University and AMSS (CAS)
37.	Barbara Rüdiger	University Wuppertal
38.	Paulo Régis Caron Ruffino	University of Campinas, Brazil
39.	Hao Shen	Columbia University / University of Wisconsin-Madison
40.	Alain-Sol Sznitman	ETH Zurich

41.	Anton Thalmaier	University of Luxembourg
42.	James Thompson	University of Luxembourg
43.	Jonas Tölle	Augsburg University, Germany
44.	Nizar Touzi	Ecole Polytechnique, France
45.	Stefania Ugolini	University of Milan, Italy
46.	Francesco Carlo De Vecchi	University of Bonn, Germany
47.	Fengyu Wang	Tianjin University
48.	Bin Xie	Shinshu University
49.	Tusheng Zhang	University of Manchester, UK
50.	Xicheng Zhang	Wuhan university

V. Transportation

There are mainly three ways to AMSS or recommended hotels from the Beijing Captital International Airport (BCIA):

1. Taxi (highly recommended)

The most convenient way to AMSS or recommended hotels is by taxi. Normally it costs about CNY 100 (roughly USD 15 or GBP 10) from BCIA to arrive at AMSS or hotels. You can easily find taxi stops by following the taxi signs at the Airport. Please present the map to Taxi driver who should then be able to take you to the destination easily.

Note: The minimum charge for taxi is CNY 10 covering the first 3km, and the rest will be charged at CNY 2 per km together with CNY 3 extra fuel charge. Additional 50% of the total fee will be charged as an allowance for the return trip if the single trip has exceeded 15km. The minimum charge will be RMB 11 from 23:00pm to 5:00am, and there is also a rise of 20% per kilometer. You are also required to pay CNY 10 for the toll at BCIA.

Please pay according to the amount displayed on the fare calculator on the taxi plus some possible extra fees mentioned above. Please always ask for the taxi receipt for your record (in case you lose some personal stuff on the taxi, we can find the taxi through the information on the receipt). Tips are not necessary.

2. Airport Express Railway & Subway (Recommended)

You can also take Airport Express Railway and then transfer to Subway. This is a good choice especially during the peaking hour. The closest Subway station to AMSS or recommended hotels is **Zhichunli (知春里)**. More precisely, first take Airport Express Railway at Terminals 2 or 3 to **Sanyuanqiao (三元桥)**, and transfer to Subway Line 10 to **Zhichunli (知春里)** station. Then you can choose to walk to

AMSS or hotels. The total fare for a single trip is about CNY 35, including CNY 25 for Ariport Express Railway and CNY 6 for Subway.

A gentle reminder: please keep your train/subway ticket during your travel. When you get off the train, you need return your ticket to pass through the Subway exit control.

3. Airport Shuttle

Charge Standard (Local buses) : CNY 30 per single trip.

Tickets Offices (from BCIA) :

Terminal 1: Gate No. 7 (inside) on F1 (the First Floor)

Terminal 2: Gate No. 9 to No.11 (outside) on F1

Terminal 3: Exit of Zone A, opposite to the exit of Zone C on F2; next to Gate5, 7&11 on F1

Timetable: The first bus leaves the airport at 6:50am, and the second one leaves at 7:00am, then during 7:00~24:00 there will be one bus for every 20 minutes

Routes: Line 5 : **BCIA (T3/T2/T1)** -----> **Zhongguancun (中关村) (Fourth Bridge (四号桥))**. Then you can walk to AMSS or recommended hotels or take a taxi (costs CNY 10) about 1.5km.

机场巴士5号线 中关村站 Airport Shuttle, Line 5, Zhongguancun Stop

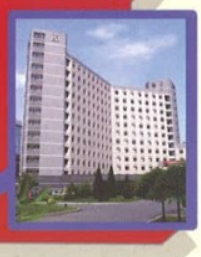
北四环西路辅路
North 4th Ring Road

北门
North Gate

科苑公寓
Scientist House

中科院数学与系统科学研究院
Academy of Math and Systems Science, CAS

国家数学与交叉科学中心
National Center for Math and Interdisciplinary Sciences, CAS



中关村东路
Zhongguancun East Road

N

晨兴数学中心
Morningside Center of Mathematics, CAS

中科院计算数学所
Institute of Computational Math and Scientific/Engineering Computing, CAS

东门
East Gate

园区餐厅
Campus cafeteria

中科院物理研究所
Institute of Physics, CAS

中科院基础科学园区
Campus of Basic Sciences, CAS

东门
East Gate

物科餐厅
Wuke cafeteria

物科宾馆
Wuke Hotel

恒兴大厦
Heyday Center

南门
South Gate

中关村南一条 Zhongguancun South 1st Alley

中科院数学与系统科学研究院新办公楼
New Office Building of Academy of Math and Systems Science, CAS

中科院研究生院教学楼
Teaching Building of Graduate School of CAS

比例尺= 1:2000.000
Scale = 1:2000.000

- （Office building, AMSS, CAS）：中科院数学与系统科学研究院
- 餐厅（Restaurant）：俏江南、宝庆码头、湘临天下、绫罗岛、吉野家、苏浙汇
- 咖啡厅（Coffee Shop）：浮士德、上岛咖啡
- 宾馆（Hotel）：辽宁大厦、物科宾馆、青年公寓、恒兴大厦、翠宫饭店、科苑公寓、中关村假日酒店、骏马国际酒店
- 超市（Supermarket）：家乐福、沃尔玛
- 银行（Bank）：中国银行、工行、农行、建行
- 地铁：（subway）
- 换乘站：（Transfer station）

比例尺= 1:1500.000
Scale = 1:1500.000