2012 Workshop on Stochastic Analysis and Related Topics

Academy of Mathematics and Systems Science, CAS

Titles and Abstracts of Talks

Ben Andrews, Tsinghua University and Austrilia National University

Title: Log-concavity and the fundamental gap

Abstract: I will discuss a sharp estimate on the log-concavity of the first eigenvalue for the Dirichlet Laplacian (or Laplacian with potential) on a convex Euclidean domain, and the application of this estimate to prove a sharp lower bound on the fundamental gap $\lambda_2-\lambda_1$ in terms of the diameter of the domain. Some recent extensions of the ideas to other operators will also be discussed. This is joint work with Julie Clutterbuck and David Shellard.

Daye Chen, Peking University

Title: The motion of a tagged particle in the simple exclusion process

Abstract: The simple exclusion process is an interacting particle system. There is no birth or death of particles. Each particle perform an independent random walk. The walk is suspended when a particle jumps to the site of another particle. Therefore a tagged particle behaviors very much like a random walk with a fixed rate of slow down. In this talk we shall review some limit theorems of a tagged particle in the simple exclusion and report our progress in this direction.

Zhao Dong, AMSS, CAS

Title: Malliavin Matrix of Degenerate PDE and Gradient Estimates

Abstract: In this talk, we present the bounded of the inverse for Malliavin Matrix of Degenerate PDE under a new condition, which is equivalent to the Hoermander condition as the coefficients are smooth. Also, the gradient estimates for the semigroup is given.

Weinan E, Princeton University and Peking University

Title: Stochastic Ginzburg-Landau equation

Abstract: I will present recent results with Arnulf Jentsen and Hao Shen on stochastic Ginzburg-Landau equation in 3D with white noise forcing.

E. Hsu, Northwestern University

Title: Maximal Coupling of Brownian Motion and Mass Transportation

Abstract: We show that in euclidean space a maximal coupling of Brownian motion is not unique. However, the mirror coupling is the unique maximal coupling with the Markov property. The proof involves using the Markov property to reduce the uniqueness question to one about a mass transportation problem of Gaussian measures with a concave function, whose solution is nontrivial but well known. The cost function is defined in terms of the heat kernel. On a general Riemannian manifold this cost function does not immediately fall into any well studied classes of cost functions. For this reason the uniqueness question for Brownian motion on a Riemannian manifold remains open. This is a joint work with Karl-Theodor Sturm.

Ka-Sing Lau, Chinese University in Hong Kong

Title: Martin Boundaries and Harmonic Structure on Fractals

Abstract: The limit behavior of a transient Markov chain can be described by its Martin boundary together with an elegant discrete potential theory. It is known that in fractal theory, a self-similar set K has a symbolic representation. In this talk we will introduce certain class of Markov chains on the symbolic spaces. Our objective is to identify the Martin boundary with K. This way we can induce harmonic structure and Dirichlet form on self-similar sets. The study relates to the current interest on the analysis on fractals.

Zenghu Li, Beijing Normal University

Title: Stochastic equations and self-similar processes

Abstract: A positive self-similar process can be constructed from a Levy process by a Lamperti transformation. A drawback of the transformation is that it only works up to the hitting time to zero of the self-similar process. We review some recent results on strong solutions of stochastic equations, which can be used to construct Markov processes and extend the range of applications of the Lamperti transformation.

Motoko Kotani, Tohoku University, Japan

Title: A mathematical challenge to materials science

Kazuhiro Kuwae, Kumamoto University, Japan

Title: Analytic characterizations of gaugeability for generalized Feynman-Kac functionals

Abstract: I will talk on the analytic characterizations of gaugeability for generalized Feynman-Kac functionals including continuous additive functional of zero quadratic variation in the framework of symmetric Markov processes. Our result improves the previous known work on the analytic characterization due to Z.-Q. Chen even if we restrict ourselves to deal with non-local perturbations. We also prove that such a characterization is also equivalent to semi- conditional gaugeability and to the subcriticality of the Schroedinger operator associated to our generalized Feynman-Kac semigroup under the semi-conditional Green tightness of related measures. We also give the characterization of the conditional gaugebility under the conditional Green tightness of related measures and a suitable condition. This is a joint work with Daehong Kim.

Zhenxin Liu, Jilin University

Title: Recurrent motions in stochastic differential equations

Abstract: Recurrent motions play an important role in the study of differential equations and dynamical systems. Almost periodic (AP) and almost automorphic (AA) motions are recurrent motions that are extensively studied. In the theory of stochastic processes, the ``recurrence'' has different but essentially similar meaning in some sense. In this talk, the AP processes will be recalled and AA processes will be introduced,both in sense of dynamical systems, to study stochastic differential equations. The concept of Poisson almost automorphy is introduced. The existence and uniqueness of AP or AA solutions to some linear and semilinear stochastic differential equations with infinite dimensional Levy noise are established provided the coefficients satisfy some suitable conditions. The global asymptotic stability of the unique AP or AA solution is discussed.

Wei Liu, Jiangsu Normal University

Title: Well-Posedness and Regularity Estimate of SPDE with Lyapunov Condition

Abstract: In this talk we will present some recent extensions on the classical result of Krylov and Rozovskii for the well-posedness of SPDE. More precisely, by replacing the standard monotonicity and coercivity conditions with some local monotonicity and Lyapunov type conditions we obtain the existence and uniqueness of strong solutions for a large class of SPDEs. Moreover, some new invariance result and stronger regularity estimate are also established for the solution. As examples, the main result is applied to stochastic tamed 3D Navier-Stokes equations, stochastic generalized curve shortening flow, singular stochastic p-Laplace equations, stochastic fast diffusion equations, stochastic Burgers type equations and stochastic reaction-diffusion equations.

Terry Lyons, Oxford University, UK

Title and abstract: TBA

Shunxiang Ouyang， University of Bielefeld

Title: Heat kernel estimates with singular drift and isoperimetric inequalities

Abstract: We show a upper bound heat kernel estimate for operator $\Delta + \nabla (-\frac{1}{|x|^\alpha}) \cdot \nabla$ ($\alpha>0$) on $\R^n\setminus \{0\}$. To this aim, we also show an isoperimetric inequality for weighted measure $\e^{-\frac{1}{|x|^\alpha}}dx$ via functional form isoperimetric inequality. This is a joint work with Alexander Grigor'yan and Michael Roeckner.

Shige Peng, Shangdong University

Title: On pathwise nonlinear PDE

Jiagang Ren, Zhongshan University

Title: A Remark on Hopf's Maximum Prnciple

Abstract: A useful tool for proving the unique solvability of the Neumann problem for second order linear partial differential equations is the maximum principle proved by Hopf. As a very special case of our main results in the present paper, we will extend Hopf’s maximum principle to nonsmooth context.

Zhonggen Su, Zhejiang Universiyu

Title: On Fluctuations for Deformed Random Wigner Matrices

Abstract: Let X_n be a standard real symmetric (complex Hermitian) Wigner matrix, $y_1, y_2,\cdots, y_n$ a sequence of independent real random variables independent of X_n. Consider the deformed Wigner matrix $H_{n,\alpha}=\frac{X_n}{\sqrt n}+ \frac{1}{n^{\alpha/2}}\mbox{diag}(y_1,\cdots, y_n)$ where $0<\alpha<1$. It is well-known that the average spectral distribution is the classical Wigner semicircle law, i.e., the Stieltjes transform $m_{n,\alpha}(z)$ converges in probability to the corresponding Stieltjes transform $m(z)$. In this talk we shall give the asymptotic estimate for the expectation $\mathbb{E}m_{n,\alpha}(z)$ and variance $Var(m_{n,\alpha}(z))$, and establish the central limit theorem for linear statistics

with sufficiently regular test function. A basic tool in the study is Stein's equation and its generalization which naturally leads to a certain recursive equation.

J. Tsai, University of Hong Kong

Title: Conformal invariance of the exploration path in 2-d critical bond percolation in the square lattice (joint work with S.C.P. Yam and Zhou Wang).

Fengyu Wang, Beijing Normal University

Title: Generalized Curvature Condition for Subelliptic Diffusion Processes

Abstract: By using a general version of curvature condition, derivative inequalities are established for a large class of subelliptic diffusion semigroups. As applications, the Harnack cost-entropy cost-variance inequalities for the diffusion semigroups, and the Poincare/log-Sobolev inequalities for the associated Dirichlet forms in the symmetric case, are derived.

Jieming Wang, Beijing Institute of Technology wangjm@bit.edu.cn

Title: Martingale Problems for Switched Processes

Abstract: The sufficient and necessary conditions are given for existence and uniqueness for the martingale problem associated with weakly coupled operator. Some result of convergence of martingale solutions is also obtained.

Ran Wang, University of Science and Technology of China

Title: Uniqueness of Fokker-Planck equations for spin lattice systems

Abstract: In recent years there has been a growing interest in the investigation of lattice systems when the spin space of every particle is a Riemannian manifold. Equilibrium states of such systems are described by Gibbs measures on infinite product of manifolds and the stochastic dynamics corresponding to these states is given by a semigroup. An important problem is the uniqueness of this dynamics, e.g. the uniqueness in the sense of martingale problem or in the sense of the essential self-adjointness. Here we further develop a method to prove the uniqueness of solutions of Fokker-Planck equation for continuous spin lattice systems. This is a joint work with Ludovic Dan Lemle and Liming Wu.

Jin Wu, Sun Yatsen University

Title: Multivalued Stochastic Differential Equations Driven by Semimartingales

Abstract: In this paper we consider multivalued stochastic differential equations (MSDEs in short) driven by semimartingales. We firtstly prove the existence and uniqueness of solutions to MSDEs with respect to continuous semimartingales when the coefficients satisfy locally Lipschitz continuity and linear growth. On this basis, by using random time change we obtain a unique solution to MSDEs of Stratonovich type driven by general semimartingales with summable jumps.

Kainan Xiang, Nankai University, **kainanxiang@gmail.com, kainanxiang@nankai.edu.cn**

Title: Random walk and percolation under a quasi-isometry viewpoint

Abstract: In this lecture, we will discuss some problems on random walks and percolations from a viewpoint of quasi-isometries, including rigidity of speed exponents and of cut-times/cut-points for random walks on finitely generated groups, and uniqueness and nonuniqueness for percolations on nonamenable quasi-transitive graphs.

Mingyu Xu, AMSS, CAS

Title: Skorohod Equation and Reflected Backward SDE.

Abstract: By using the Skorohod equation we derive an iteration procedure
which allows us to solve a class of reflected backward stochastic differential equations
with non-linear resistance induced by the reflected local time. In particular,
we present a new method to study the reflected BSDE proposed first by El Karoui
et al. (1997).

Litan Yan, Donghua University

Title and abstract: TBA

Xiangqun Yang, Hunan Normal University

Title: Markov Inversion Approach to Identify Q-Matrix of Markov Chain for Model of Ion Channel

Abstract: We consider how to identify Q-Matrix of Markov Chain for Model of Ion Channel . Markov inversion approach is developed to perform a difficult inversion to identify Q-Matrix from the parameters characterizing the lifetime distributions at a small number of states, although

it is straightforward to derive the lifetime distribution. The general explicit equations relating the parameters of the lifetime distribution to Q-Matrix are derived and Q-Matrix are then obtained as roots to this system of equations. The concrete solutions are proposed to the basic and regular schemes such as linear, star-graph branch and loop. Useful conclusions and solutions to realistic schemes are also included to show its efficiency.

Xiangdong Ye, USTC

Title: On multiple ergodic average.

Abstract: Furstenberg proved Szemeredi's theorem using ergodic theory method. He then asked if the multiple ergodic average converges in L^2 sense or even pointwisely. This is considered as one of the most important questions in ergodic theory. In this talk I will review the progress along the question.

Lixin Zhang, Zhejiang University

Title: Response-adaptive designs: from intuitive model to the asymptotically best one

Abstract: Response-adaptive randomization has recently attracted a lot of attention in the literature. The adoption of response-adaptive designs has proved to be beneficial to researchers, by providing more efficient clinical trials, and to patients, by increasing the likelihood of receiving the better treatment. We have established fundamental theorems for various kinds of mathematical models for adaptive-designs. In this talk, we will introduce several kinds of adaptive-designs from the intuition-driven one to the asmptotically sufficient and optimal one. Main important components of response-adaptive designs include efficiency (power), variability and slection bias will be discussed and a new family of designs which give us everything we want in a response-adaptive randomization procedure will be introduced.

Jinping Zhang, North China Electricity Power University

Title: Set-valued stochastic integrals with respect to Poisson processes in a Banach space

Abstract: In a separable Banach space X, at first we study X-valued stochastic integrals with respect to the Poisson random measure $N(dsdz)$ and the compensated Poisson random measure $\tilde{N}(dsdz)$ generated by a stationary Poisson stochastic process p. When the characteristic measure ν of p is finite, both $N(dsdz)$ and $\tilde{N}(dsdz)$ are of finite variation a.s. Then we study the set-valued integrals with respect to the Poisson random measure and the compensated Poisson random measure, which are integrably bounded. The set-valued integral with respect to the compensated Poisson random measure is a right continuous (under Hausdorff metric) set-valued martingale.

Xicheng Zhang, Wuhan University

Title: Density and Derivative Formula for SDEs Driven by α-stable Processes

Abstract: In this talk, I will report some results about SDEs driven by α-stable processes: derivative formula, gradient estimate and the existence and smootheness of law density. The first two are considered in the nondegenerate case, while the existence of law density is considered under Hormander's conditions, and the smoothness is considered in a special degenerate case. The main tool of the proof is the Malliavin calculus.