The 8th Workshop on Markov Processes and Related Topics

July 16-18, 2012

Lecture Room 1124, New Library Building (后主楼)

Beijing Normal University

July 20-21, 2012

Wuyi Mountains, Fujian Province

Fujian Normal University

Organizers: Mu-Fa Chen(BNU), Huo-Nan Lin (FJNU), Jian Wang (FJNU)

Probability Group, Stochastic Research Center, Beijing Normal University

School of Mathematics and Computer Science, Fujian Normal University

Phone and Fax: 86-10-58809447   E-mail: rcstoch@bnu.edu.cn

Secretary: Wenchuang Zhou (Beijing Normal University)

Website: http://math.bnu.edu.cn/probab/Workshop2012

	July 16	July 17	July 18	July 20	July 21
	08:20-08:30 Welcome talk			08:20-09:00 Opening	
Chairman	M. F. Chen	J. Fill	Z. H. Li	R. M. Song	W. B. Li
08:30-09:00	S. G. Peng	S. J. Sheu	G. Yin		J. Fill
09:00-09:30	S. Feng	X. Y. Wu	J. H. Shao	I. Shigekawa	X. Chen
09:30-10:00	A. Winter	F. Baudoin	Tea break	J. Xiong	X.P. Guo
10:00-10:30	Take picture	Tea break	D. Y. Chen	Tea break	Tea break
10:30-11:00	Y. Q. Zhao	H. Z. Zhao	A. Y. Chen	F. Q. Gao	Z. H. Li
11:00-11:30	J. M. Wang	D. J. Luo		J. H. Bao	J. Wang
Chairman	S. J. Sheu	A. Y. Chen		S. Z. Fang	H. N. Lin
14:30-15:00	T. J. Zhang	Y. Z. Hu		Q. M. Shao	L. M. Wu
15:00-15:30	Y. X. Ren	F. Z. Gong		Z. Dong	R. M. Song
15:30-16:00	Y. J. Wang	X. W. Zhou		Y. T. Ma	Tea break
16:00-16:30	Tea break	Tea break		Tea break	S. Z. Fang
16:30-17:00	F. Y. Wang	J. L. Wu		Z. Q. Chen	W. B. Li
17:00-17:30	C. Ouyang	Y. Liu		G. Uribe Bravo	

July 16

Chairman: Mu-Fa Chen

08:20-08:30 Welcome talk

08:30-09:00 Shige Peng (Shandong University)

09:00-09:30 Shui Feng (McMaster University)

Transition functions of a Fleming-Viot process and a random time change

09:30-10:00 Anita Winter (Universität Duisburg-Essen)

Tree valued spatial Λ-cannings dynamics

10:00-10:30 Take picture & Tea break

10:30-11:00 Yiqiang Q. Zhao (Carleton University)

Tail asymptotics for two-dimensional reflecting Brownian motion — a kernel method

11:00-11:30 Jieming Wang (Beijing Institute of Technology)

Perturbation by non-local operators

Chairman: Shuenn-Jyi Sheu

14:30-15:00 Tusheng Zhang (University of Manchester)

Existence and uniqueness of invariant measures for Spdes with two reflecting walls

15:00-15:30 Yan-Xia Ren (Peking University)

Weak extinction versus global exponential growth of total mass for super-diffusions corresponding to the operator $Lu + \beta u - ku^2$

15:30-16:00 Yongjin Wang (Nankai University)

The hitting problems for a class of reflected O-U processes

16:00-16:30 Tea break

16:30-17:00 Feng-Yu Wang (Beijing Normal University)

Integration by parts formula and shift Harnack inequality for stochastic equations

17:00-17:30 Cheng Ouyang (University of Illinois at Chicago)

Some functional inequalities for SDEs driven by fractional Brownian motions

July 17

Chairman: James Allen Fill

08:30-09:00 Shuenn-Jyi Sheu (National Central University)

The resolvents of drift-accelerated diffusions

09:00-09:30 Xian-Yuan Wu (Capital Normal University)

Large deviation behavior for the longest head run in IID Bernoulli sequence

09:30-10:00 Fabrice Baudoin (Purdue University)

Functional inequalities for subelliptic diffusion operators via curvature bounds

10:00-10:30 Tea break

10:30-11:00 Huaizhong Zhao (Loughborough University)

Random periodic solution of SDEs and SPDEs

11:00-11:30 Dejun Luo (Chinese Academy of Sciences)

Generalized stochastic flow associated to the Itô SDE with partially Sobolev coefficients and applications

Chairman: Anyue Chen

14:30-15:00 Yaozhong Hu (University of Kansas)

Convergence in density of some nonlinear Gaussian functionals

15:00-15:30 Fuzhou Gong (Chinese Academy of Sciences)

Ergodicity and asymptotic stability of Feller semigroups on Polish spaces

15:30-16:00 Xiaowen Zhou (Concordia University)

Some support properties of Λ-Fleming-Viot process with Brownian mutation

16:00-16:30 Tea break

16:30-17:00 Jiang-Lun Wu (Swansea University)

Path independent property of the action functionals for stochastic dynamical systems

17:00-17:30 Yong Liu (Peking University)

On time regularity of generalized Ornstein-Uhlenbeck processes with cylindrical stable noise

July 18

Chairman: Zenghu Li

08:30-09:00 George Yin (Wayne State University)

Switching diffusion processes

09:00-09:30 Jinghai Shao (Beijing Normal University)

Measure-valued continuous curves and processes in total variation norm

09:30-10:00 Tea break

10:00-10:30 Dayue Chen (Peking University)

The voter model in a random environment in Z^d

10:30-11:00 Anyue Chen (University of Liverpool)

Asymptotic behavior of extinction probability of interacting branching collision processes

July 20

08:20-09:00 Opening & Take picture

Chairman: Renming Song

09:00-09:30 Ichiro Shigekawa (Kyoto University)

Exponential convergence of Markov processes

09:30-10:00 Jie Xiong (University of Macau and University of Tennessee)

Large deviation principle for some measure-valued processes

10:00-10:30 Tea break

10:30-11:00 Fuqing Gao (Wuhan University)

Moderate deviations for random matrices

11:00-11:30 Jianhai Bao (Swansea University)

Bismut formulae and applications for functional SPDEs

Chairman: Shizan Fang

14:30-15:00 Qi-Man Shao (Hong Kong University of Science and Technology)

Cramér type moderate deviations for self-normalized processes

15:00-15:30 Zhao Dong (Chinese Academy of Sciences)

15:30-16:00 Yutao Ma (Beijing Normal University)

Uniform logarithmic Sobolev inequalities in dimension for harmonic measures on spheres

16:00-16:30 Tea break

16:30-17:00 Zhenqing Chen (University of Washington)

From generalized Nash inequality to off-diagonal upper bound estimate

17:00-17:30 Gerónimo Uribe Bravo (Instituto de Matematicas, UNAM)

Generalized time-change and continuous-state branching processes with immigration

July 21

Chairman: Wenbo Li

08:30-09:00 James Allen Fill (The Johns Hopkins University)

Comparison inequalities and fastest-mixing Markov chains

09:00-09:30 Xia Chen (University of Tennessee)

Quenched asymptotics for Brownian motion in generalized Gaussian potential

09:30-10:00 Xianping Guo (Zhongshan University)

Linear programming and constrained average optimality for continuous-time Markov decision processes in Polish spaces

10:00-10:30 Tea break

10:30-11:00 Zenghu Li (Beijing Normal University)

Stochastic equations and Lamperti transformations

11:00-11:30 Jian Wang (Fujian Normal University)

Functional inequalities for stable-like Dirichlet forms

Chairman: Huo-Nan Lin

14:30-15:00 Liming Wu (Chinese Academy of Sciences)

Transport inequality on graphs

15:00-15:30 Renming Song (University of Illinois)

Heat kernel estimates for relativistic stable processes

15:30-16:00 Tea break

16:00-16:30 Shizan Fang (Institute of Mathematic of Bourgogne)

Sobolev estimates for optimal transportations

16:30-17:00 Wenbo Li (University of Delaware)

Negative moments for branching processes

Bismut Formulae and Applications for Functional SPDEs

Jianhai BAO *Swansea University, UK*, E-mail: J.BAO.536390@swansea.ac.uk

Abstract: By using Malliavin calculus, explicit derivative formulae are established for a class of semi-linear functional stochastic partial differential equations with additive or multiplicative noise. As applications, gradient estimates and Harnack inequalities are derived for the semigroup of the associated segment process.

This is a joint work with Feng-Yu Wang and Chenggui Yuan.

Functional Inequalities for Subelliptic Diffusion Operators via Curvature Bounds

Fabrice BAUDOIN *Purdue University, USA*, E-mail: fbaudoin@math.purdue.edu

Abstract: In this talk I shall review some recent results that were obtained by the authors in joint works with M. Bonnefont, N. Garofalo and B. Kim. Let L be a symmetric and subelliptic diffusion operator defined on a manifold M. By using the curvature dimension inequality proposed by Baudoin-Garofalo we will discuss the following properties of L that are usually addressed in a Riemannian framework by using Ricci lower bounds:

- Boundedness of the Riesz transform;

- Existence of log-Sobolev inequalities;

- Existence of isoperimetric and Gaussian isoperimetric inequalities.

References

[1] F. Baudoin & M. Bonnefont (2012). Log-Sobolev inequalities for subelliptic operators satisfying a generalized curvature dimension inequality, *Journal of Functional Analysis*.

[2] F. Baudoin & N. Garofalo (Year). Curvature-dimension inequalities and Ricci lower bounds for sub-Riemannian manifolds with transverse symmetries, *arXiv:1101.3590*, submitted paper.

[3] F. Baudoin & N. Garofalo (2012). A note on boundedness of Riesz transform for some subelliptic operators, *International Math. Research Notices*.

Asymptotic Behavior of Extinction Probability of Interacting Branching Collision Processes

Anyue CHEN *University of Liverpool, UK* , E-mail: achen@liverpool.ac.uk
Junping Li *Central South University, China*

Abstract: Although the exact expressions for the extinction probability of Interacting Branching Collision Process (IBCP) have been given recently, see Chen et al [1], these expressions are sometimes very complicated and thus quite informative, particularly regarding the asymptotic behavior. In this talk, the latter problem will be addressed in detail. We shall show that for large n, the extinction probability (a_n) is proportional to $n^\alpha q^n$ where q is the smallest positive root of $C(s) = 0$ on the interval of $[0,1]$ and $C(s)$ is the generating function of the rates of the collision component. The interesting quantity α is exactly given which is extremely informative.

References

[1] A.Y. Chen, J.P. Li, Y.Q. Chen and D.X. Zhou (2012). Extinction Probability of Interacting Collision Branching Processes, *Adv, Appl. Prob.*, **44**, 226-259.

The Voter Model in a Random Environment in Z^d

Dayue CHEN *Peking University, PRC*, E-mail: dayue@pku.edu.cn

Abstract: We consider the voter model with flip rates determined by $(\mu_e, e \in E_d)$, where E_d is the set of all non-oriented nearest-neighbour edges in the Euclidean lattice Z^d. Suppose that $(\mu_e, e \in E_d)$ are i.i.d. random variables satisfying $\mu_e \geq 1$. We prove that when $d = 2$, almost surely for all random environments the voter model has only two extremal invariant measures: δ_0 and δ_1. This is a joint work with Zhichao Shan.

Quenched Asymptotics for Brownian Motion in Generalized Gaussian Potential

Xia CHEN *University of Tennessee, USA*, Email:xchen@math.utk.edu

KEY WORDS: generalized Gaussian field, parabolic Anderson model.

MATHEMATICAL SUBJECT CLASSIFICATION: 60J65, 60K37, 60K40, 60G55, 60F10.

Abstract:

Recall that the notion of generalized function is introduced for the functions that can not be defined pointwise, and is given as a linear functional over the test functions. The same idea applies to random fields. In this talk, we study the long term asymptotics for the quenched moment

$$E_0 \exp\left\{ \int_0^t V(B_s) ds \right\}$$

consisting of a d-dimensional Brownian motion $\{B(s); \; s \geq 0\}$ and a generalized Gaussian field $V(\cdot)$. The major progress made in this paper includes: Solution to an open problem posted by Carmona and Molchanov with an answer different from what was conjectured; the quenched laws for Brownian motions in Newtonian-type potentials, and in the potentials driven by white noise or by fractional white noise.

References

[1] Chen, X. Quenched asymptotics for Brownian motion in generalized Gaussian potential. *Ann. Probab.*, **to appear**.

From Generalized Nash Inequality to Off-diagonal Upper Bound Estimate

Zhenqing CHEN *University of Washington, USA*, E-mail: zchen@math.washington.edu

Abstract: In their 1987's paper, Carlen, Kusuoka and Stroock extended Davis' method to general symmetric Markov processes and obtained an upper bound transition density function estimate. That formula requires the on-diagonal estimate to be of polynomial decay rate. In this talk, I will report recent progress on the off-diagonal heat kernel upper bound estimates for general symmetric Markov processes that allows non-polynomial on-diagonal decay rates, via generalized Nash inequality.

Sobolev Estimates for Optimal Transportations

Shizan FANG *Institute of Mathematic of Bourgogne, France*, E-mail: fang@u-bourgogne.fr

Abstract: We will give a priori estimates in Sobolev spaces of optimal transportations, with dimension free constants. We will use these results to solve Monge-Ampère equations on the Wiener space.

Transition Functions of a Fleming-Viot Process and a Random Time Change

Shui FENG *McMaster University, Canada*, E-mail: shuifeng@mcmaster.ca

Abstract: In this talk, a random time change is discussed. The transition function of a Fleming-Viot process is derived from the transition function of a measure-valued branching diffusion with immigration through the time change. This is a joint work with Fang Xu.

References

[1] S.N. Ethier and R.C. Griffiths (1993). The transition function of a Fleming–Viot process. *Ann. Probab.* **21**, No. 3, 1571–1590

[2] S. Feng and F. Xu (2012). Gamma-Dirichlet structure and two classes of measure-valued processes.

http://arxiv.org/abs/1112.4557

[3] Z.H. Li. *Measure-Valued Branching Markov processes.* Springer, Heidelberg, 2010.

Comparison Inequalities and Fastest-mixing Markov Chains

James Allen FILL *The Johns Hopkins University, USA*, E-mail: jimfill@jhu.edu
Jonas KAHN *Université de Lille, France*, E-mail: jonas.kahn@math.univ-lille1.fr

Abstract: We introduce a new partial order on the class of stochastically monotone Markov kernels having a given stationary distribution π on a given finite partially ordered state space $\mathcal{X}$. When $K \preceq L$ in this partial order we say that K and L satisfy a *comparison inequality*. We establish that if $K_1, \ldots, K_t$ and $L_1, \ldots, L_t$ are reversible and $K_s \preceq L_s$ for $s = 1, \ldots, t$, then $K_1 \cdots K_t \preceq L_1 \cdots L_t$. In particular, in the time-homogeneous case we have $K^t \preceq L^t$ for every t if K and L are reversible and $K \preceq L$, and using this we show that (for suitable common initial distributions) the Markov chain Y with kernel K mixes faster than the chain Z with kernel L, in the strong sense that *at every time* t the discrepancy—measured by total variation distance or separation or L^2-distance—between the law of Y_t and π is smaller than that between the law of Z_t and π.

Using comparison inequalities together with specialized arguments to remove the stochastic monotonicity restriction, we answer a question of Persi Diaconis by showing that, among all symmetric birth-and-death kernels on the path $\mathcal{X} = \{0, \ldots, n\}$, the one (we call it the *uniform chain*) that produces fastest convergence from initial state 0 to the uniform distribution has transition probability $1/2$ in each direction along each edge of the path, with holding probability $1/2$ at each endpoint.

We also use comparison inequalities

(i) to identify, when π is a given log-concave distribution on the path, the fastest-mixing stochastically monotone birth-and-death chain started at 0, and

(ii) to recover and extend a Peres–Winkler result that extra updates do not delay mixing for monotone spin systems.

Among the fastest-mixing chains in (i), we show that the chain for uniform π is slowest in the sense of maximizing separation at every time.

References (selected)

[1] I. Benjamini, N. Berger, C. Hoffman, & E. Mossel (2005). Mixing times of the biased card shuffling and the asymmetric exclusion process, *Trans. Amer. Math. Soc.*, **357**(8), 3013–3029 (electronic).

[2] S. Boyd, P. Diaconis, P. Parrilo, & L. Xiao (2009). Fastest mixing Markov chain on graphs with symmetries, *SIAM J. Optim.*, **20**(2), 792–819.

[3] S. Boyd, P. Diaconis, J. Sun, & L. Xiao (2006). Fastest mixing Markov chain on a path, *Amer. Math. Monthly*, **113**(1), 70–74.

[4] S. Boyd, P. Diaconis, & L. Xiao (2004). Fastest mixing Markov chain on a graph, *SIAM Rev.*, **46**(4), 667–689 (electronic).

[5] P. Diaconis & J. A. Fill (1990). Strong stationary times via a new form of duality, *Ann. Probab.*, **18**(4), 1483–1522.

[6] J. A. Fill & J. Kahn (2012). Comparison inequalities and fastest-mixing Markov chains, *Annals of Applied Probability* (accepted subject to minor revision). Available from `http://www.ams.jhu.edu/~fill/`.

[7] Y. Peres & P. Winkler (2011). Can extra updates delay mixing?, Preprint, `arXiv:1112.0603v1 [math.PR]`.

[8] S. Roch (2005). Bounding fastest mixing, *Electron. Comm. Probab.*, **10**, 282–296 (electronic).

[9] J. Sun, S. Boyd, L. Xiao, & P. Diaconis (2006). The fastest mixing Markov process on a graph and a connection to a maximum variance unfolding problem, *SIAM Rev.*, **48**(4), 681–699 (electronic).

Ergodicity and Asymptotic Stability of Feller Semigroups on Polish Spaces

Fuzhou GONG *Institute of Applied Mathematics, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing 100190, China, Beijing,* E-mail: fzgong@amt.ac.cn

Yuan Liu *Institute of Applied Mathematics, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing 100190, China, Beijing*

Abstract: There exists a long literature of studying the ergodicity and asymptotic stability for various semigroups from dynamic systems and Markov chains. Abundant theories and applications have been established for compact or locally compact state spaces. However, it seems very hard to extend all of them to infinite dimensional or general Polish settings. Actually, the *strong Feller* semigroups were the most popular objects in the field of stochastic processes on Banach spaces. Recent years, people have developed many new approaches to more complicated models. For instance, the *asymptotic strong Feller* property, as a celebrating breakthrough, was presented by Hairer and Mattingly, which can be applied to deal with the uniqueness of ergodicity for 2D Navier-Stokes equations with degenerate stochastic forcing. Some notable contributions to this subject came from Lasota and Szarek along with their sequential works for *equicontinuous* semigroups. Indeed, the equicontinuity is adaptable to many known stochastic partial differential equations at present. However, it seems far from being necessary in the theoretical sense. In this talk, we will give the sharp criterions or equivalent characterizations about the ergodicity and asymptotic stability for *Feller* semigroups on Polish spaces with full generality. To this end we will introduce some new notions, especially the *eventual continuity* of Feller semigroups, which seems very close to be necessary for the ergodic behavior in some sense and also allows the sensitive dependence on initial data in some extent.

References

[1] M. Hairer, J. C. Mattingly. Ergodicity of the 2D Navier-Stokes equations with degenerate stochastic forcing. Ann. of Math. **164** (2006), 99-1032.

[2] S. C. Hille, D. T. H. Worm. Ergodic decompositions associated with regular Markov operators on Polish spaces. Ergod. Theor. Dyn. Syst. **31** (**2**) (2011), 571-597.

[3] A. Lasota, T. Szarek. Lower bound technique in the theory of a stochastic differntial equation. J. Differential Equations **231** (2006), 513-533.

[4] S. P. Meyn, R. L. Tweedie. Markov chains and stochastic stability. Cambridge Univ. Press, London, 2nd edit., 2009.

[5] T. Szarek. Feller Processes on non-locally compact spaces. Ann. Proba. **34** (**5**) (2006), 1849-1863.

[6] T. Szarek, M. Ślęczka, M. Urbański. On stability of velocity vectors for some passive tracer models. Bull. Lond. Math. Soc. **42** (**5**) (2010), 923-936.

Linear Programming and Constrained Average Optimality for Continuous-Time Markov Decision Processes in Polish Spaces

Xianping GUO, *Zhongshan University, China*, Email: mcsgxp@mail.sysu.edu.cn
Yonghui Huang, Zhongshan University, China, E-mail: hyongh5@mail.sysu.edu.cn
Xin-Yuan Song, *Chinese University of Hong Kong, Hong Kong*, Email: xysong@sta.cuhk.edu.hk

   This talk concerns with the constrained average optimality for continuous-time Markov decision processes in Polish spaces, in which policies can depend on *histories*. The optimality criterion to be optimized is expected average costs, multiple constraints are imposed on similar expected average costs. Under suitable conditions on transition rates and cost functions, the existence of a constrained optimal policy and a linear program for solving a constrained optimal policy are shown. Finally, a cash flow model is used to illustrate the applications of the main results.

References

[1] Chen, M.F. (2004). *From Markov Chains to Non-Equilibrium Particle Systems.* Second edition. World Scientific Publishing Co., Inc., River Edge, NJ.

[2] Feinberg, E. A. (2004). Continuous-time jump Markov decision processes: A discrete-event approach. *Math. Oper. Res.* **29**, 492-524.

[3] Guo, X.P. and Hernández-Lerma, O. (2009). *Continuous-Time Markov Decision Processes.* Springer-Verlag, New York.

[4] Guo, X.P. and Rieder, U. (2006). Average optimality for continuous-time Markov decision processes in Polish spaces, *Ann. Appl. Probab.* **16**, 730-756.

[5] Guo, X.P. and Song, X.Y. (2011). Discounted continuous-time constrained Markov decision processes in Polish spaces, *Ann. Appl. Probab.*, **21**, 2016-2049.

[6] Hernández-Lerma, O., and González-Hernández, J. (1998). Infinite linear programming and multichain Markov control processes in uncountable spaces. *SIAM J. Control Optim.* **36**, 313-335.

[7] Hernández-Lerma, O. and Lasserre, J.B. (1999). *Further Topics on Discrete-Time Markov Control Processes.* Springer-Verlag, New York.

[8] Jacod, J. (1975). Multivariate point processes: predictable projection, Radon-Nicodym derivatives, representation of martingales., *Z. Wahrscheinlichkeitstheor. verw. Geb.* **31**, 235-253.

[9] Kakumanu, P. (1972). Nondiscounted continuous-time Markov decision processes with contable state space. *SIAM, J. Control* **10**, 210–220.

[10] Kitaev, M.Y. and Rykov, V.V. (1995). *Controlled Queueing Systems*, CRC Press.

[11] Lund, R.B., Meyn, S.P. and Tweedie, R.L. (1996). Computable exponential convergence rates for stochastically ordered Markov processes. *Ann. Appl. Probab.* **6**, 218-237.

[12] Meyn, S.P. and Tweedie, R.L. (1993). Stability of Markov processes III: Forster-Lyapunov criteria for continous time processes. *Adv in Appl. Probab.* **25**, 518-548.

[13] Prieto-Rumeau, T. and Hernández-Lerma, O. (2008). Ergodic control of continuous-time Markov chains with pathwise constraints. *SIAM J. Control Optim.* **47**, no. 4, 1888-1908.

Convergence in Density of Some Nonlinear Gaussian Functionals

Yaozhong HU *University of Kansas, USA*, E-mail: hu@math.ku.edu
Fei Lu *University of Kansas, USA*
David Nualart *University of Kansas, USA*

Abstract: The central limit theorem states that If $X_1, \cdots, X_n, \cdots$ are iid then

$$F_n := \sqrt{n}\left(\frac{X_1 + \cdots + X_n}{n} - E(X_1)\right) \quad \text{converges in disribution to a normal random variable}.$$

This convergence also holds for some other random sequences F_n such as those given by multiple integrals with respect to Brownian motion ([2], [3]). We study the problem of when the random variable F_n has density $f_n(x), x \in R$ and when the densities $f_n(x)$ converges in L^p to the normal density $\phi(x) = \frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}$. We also applied our general results to least squares estimator for Ornstein-Uhlenbeck processes ([1]). The tool to use is Malliavin calculus. This is an ongoing joint work with Fei LU and David NUALART.

References

[1] Hu, Y. and Nualart, D. (2010) Parameter estimation for fractional Ornstein-Uhlenbeck processes. Statist. Probab. Lett. 80, 1030-1038.

[2] Nualart, D. and Ortiz-Latorre, S. (2008) Central limit theorems for multiple stochastic integrals and Malliavin calculus. Stochastic Process. Appl. 118, 614-628.

[3] Nualart, D. and Peccati, G (2005) Central limit theorems for sequences of multiple stochastic integrals. Ann. Probab. 33, 177-93.

Negative Moments for Branching Processes

Wenbo LI *University of Delaware, USA*, E-mail: wli@math.udel.edu

Abstract: Consider the Galton-Watson branching process $(Z_n)_{n \geq 0}$ with offspring distribution $(p_k)_{k \geq 0}$ starting with $Z_0 = 1$. In the super critical case, i.e. $m = \sum_{k \geq 0} p_k > 1$, Estimates for $E(h(Z_n)Z_n^{-\gamma}$ as $n \to \infty$ are given for slowly varying monotone function h, together with applications to deviation estimates of Z_{n+1}/Z_n.

Stochastic Equations and Lamperti Transformations

Zenghu LI *School of Mathematical Sciences, Beijing Normal University, PRC*,
E-mail: lizh@bnu.edu.cn

Abstract: Two important classes of Markov processes, continuous-state branching processes and positive self-similar processes, can be constructed from Lévy processes by Lamperti transformations. A drawback of those transformations is that they only work for Markov process having zero as a trap. 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 transformations.

On Time Regularity of Generalized Ornstein-Uhlenbeck Processes with Cylindrical Stable Noise

Yong LIU *School of Mathematical Sciences, Peking University, PRC*,
E-mail: liuyong@math.pku.edu.cn

Abstract: A necessary and sufficient condition of càdlàg (right continuous with left limits) modification of Ornstein-Uhlenbeck process with cylindrical stable noise in a Hilbert space is given in this talk. Applying this result, some questions in *Time irregularity of generalized Ornstein-Uhlenbeck processes* (C. R. Acad. Sci. Paris, Ser. I 348(2010), 273-276) and *Structural properties of semilinear SPDEs driven by cylindrical stable process* (Probab. Theory Related Fields, 149(2011), 97-137) are answered.

This is a joint work with Jianliang ZHAI.

Generalized Stochastic Flow Associated to the Itô SDE with Partially Sobolev Coefficients and Applications

Dejun LUO *Institute of Applied Mathematics, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, China*, E-mail: luodj@amss.ac.cn

Abstract: We consider the Itô SDEs with partially Sobolev coefficients. Assuming the exponential integrability of the negative part of the divergence of the drift coefficient and the partial

gradient of the diffusion coefficient with respect to the generalized Cauchy measure, we show the existence, uniqueness and stability of generalized stochastic flows associated to such equations. As an application, we prove the weak differentiability in the sense of measure of the stochastic flow generated by the Itô SDE with Sobolev coefficients.

References

[1] L. Ambrosio (2004). Transport equation and Cauchy problem for BV vector fields, *Invent. Math.*, **158**, 227–260.

[2] G. Crippa and C. de Lellis (2008). Estimates and regularity results for the Di Perna–Lions flows, *J. Reine Angew. Math.*, **616**, 15–46.

[3] R.J. Di Perna and P.L. Lions (1989). Ordinary differential equations, transport theory and Sobolev spaces, *Invent. Math.*, **98**, 511–547.

[4] S. Fang, D. Luo and A. Thalmaier (2010). Stochastic differential equations with coefficients in Sobolev spaces, *J. Funct. Anal.*, **259**, 1129–1168.

[5] X. Zhang (2010). Stochastic flows of SDEs with irregular coefficients and stochastic transport equations, *Bull. Sci. Math.*, **134**, 340–378.

Uniform Logarithmic Sobolev Inequalities in Dimension for Harmonic Measures on Spheres

Yutao MA *School of Mathematical Sciences, Beijing Normal University, PRC,*
E-mail: mayt@bnu.edu.cn

Abstract: In this paper, using the method of Barthe-Zhang: reduce multi- dimensional probabilities to one dimensional probabilities, we obtain unifor- m Poincaréinequalities and logarithmic Sobolev inequalities in dimension for harmonic measures on spheres via Muckenhoupt's characterization for Poincaréinequalities on real line and Barthe-Roberto's characterization for logarithmic Sobolev inequalities on real line.

Some Functional Inequalities for SDEs Driven by Fractional Brownian Motions

Fabrice Baudoin *Purdue University, USA*
Cheng OUYANG *University of Illinois at Chicago, USA*, E-mail: couyang@math.uic.edu
Samy Tindel *Institut Élie Cartan Nancy, Université de Nancy 1, France*

Abstract: Concentration property and Log-Sobolev inequalities for stochastic differential equations (SDE) are usually discussed under a Markovian setting for the underlying semi-group of the system. In this talk, we present some results on this direction for some SDEs driven by fractional Brownian motions. In particular, based on our concentration property, we derive a global Gaussian upper bound for the density function of solution to such SDEs.

References (selected)

[1] F. Baudoin, C. Ouyang, & S. Tindel (2012). Upper bound for the density of solutions of stochastic differential equations driven by fractional Brownian motions, *To appear in Annales de l'Institut Henri Poincaré.*

[2] P. Friz & N. Victoir (2010). Multidimensional Stochastic Processes as Rough Paths, *Multidimensional Stochastic Processes as Rough Paths.*

[3] D. Nualart (2006). The Malliavin Calculus and Related Topics, *Probability and Its Applications. Springer- Verlag, 2nd Edition.*

Weak Extinction Versus Global Exponential Growth of Total Mass for Super-diffusions Corresponding to the Operator $Lu + \beta u - ku^2$

János Engländer   *University of Colorado, Boulder, USA.*
Yan-Xia REN *Peking University, P. R. China*, E-mail: yxren@math.pku.edu.cn
Renming Song *The University of Illinois at Urbana-Champaign, USA.*

Abstract: Consider a superdiffusion X on $\mathbb{R}^d$ corresponding to the semilinear operator $Lu + \beta u - ku^2$, where L is a second order elliptic operator, $\beta(\cdot)$ is in the Kato class, and $k(\cdot) \geq 0$ is nonvanishing and bounded on compact subsets of $\mathbb{R}^d$. Let λ_∞ be the L^∞-growth bound of the semigroup $\{Q_t\}_{t \geq 0}$ corresponding to the Schrödinger operator $L + \beta$. If $\lambda_\infty \neq 0$, then we prove that, in some sense, the exponential growth/decay rate of $\langle 1, X_t \rangle$, the total mass of X_t, is λ_∞. We also describe the limiting behavior of $\exp(-\lambda_\infty t)\langle 1, X_t \rangle$ in these cases. This should be compared to the known result that the generalized principal eigenvalue λ_2 of the operator gives the rate of *local* growth when it is positive, and implies local extinction otherwise. It is easy to show that $\lambda_\infty \geq \lambda_2$, and we discuss cases when $\lambda_\infty > \lambda_2$ and when $\lambda_\infty = \lambda_2$.

When $\lambda_\infty = 0$, and under some conditions on β, we give a sufficient and necessary condition for the superdiffusion X to exhibit weak extinction. We show that the branching intensity k affects weak extinction; this should be compared to the known result that k does not affect weak *local* extinction (which only depends on the sign of λ_2, and which turns out to be equivalent to local extinction) of X.

References

[1] Chen, Z.-Q.(2002). Gaugeability and conditional Gaugeability, Trans. Amer. Math. Soc., **354**: 4639–4679.

[2] Chen, Z.-Q.(2011). Uniform Integrability of exponential martingales and spectral bounds of non-local Feynman-Kac semigroups. Preprint.

[3] Chen, Z.-Q. and Song, R.(2002). General gauge and conditional gauge theorems, Ann. Probab., **30**: 1313–1339.

[4] Engländer, J. and Kyprianou, A. E.(2004). Local extinction versus local exponential growth for spatial branching processes, Ann. Probab., **32**: 78–99.

[5] Engländer, J. and Pinsky, R. G. (1999). On the construction and support properties of measure-valued diffusions on $D \subset \mathbb{R}^d$ with spatially dependent branching, Ann. Probab., **27**: 684–730.

[6] Engländer, J. and Turaev, D.(2002). A scaling limit theorem for a class of superdiffusions, Ann. Probab., **30**: 286–722.

[7] Engländer, J. and Winter, A.(2006). Law of large numbers for a class of superdiffusions, Ann. I. H. Poincaré-PR, **42**: 171–185.

[8] Murata, M.(1984). Positive solutions and large time behaviour of Schrödinger semigroup, Simon's problem, J. Funct. Anal.,**56**: 300–310.

[9] Pinsky, R. G.(1996) Transience, recurrence and local extinction properties of the support for supercritical finite measure-valued diffusions. Ann. Probab., **24**: 237–267.

[10] Simon, B. (1981). Large time behaviuor of the L^p norm of Schrödinger semigroups, J. Funct. Anal., **40**: 66–83.

[11] Zhao, Z.(1992) Subcriticality and gaugeability of the Schrodinger operator, Trans. Amer. Math. Soc., **334**: 75–96.

Measure-Valued Continuous Curves and Processes in Total Variation Norm

Jinghai SHAO *School of Mathematical Sciences, Beijing Normal University, PRC,*
E-mail: shaojh@bnu.edu.cn

Abstract: We present several equivalent characterizations of continuous curves in the total variation norm in the space of purely atomic finite measures. This enable us to provide a sufficient condition for a purely atomic finite measure-valued stochastic process to possess a version with continuous sample paths in the total variation norm. This criterion is in the form of Kolmogorov's continuity theorem. As an application, we study the sample path property of finite measure-valued diffusions with immigrations constructed by Shiga (1990).

Cramér Type Moderate Deviations for Self-normalized Processes

Qi-Man SHAO *Hong Kong University of Science and Technology,*
E-mail: maqmshao@gmail.com

Abstract: A Cramér type moderate deviation characterizes the relative error of a probability approximation and plays more and more important role in probability theory, statistical inference and multiple hypothesis testing problems. In this talk a moderate deviation theorem for general self-normalized processes will be established and applications to Studentized U-statistics and Hotelling's T^2 statistics will be discussed. The talk is based on joint work with Wenxin Zhou and Weidong Liu.

The Resolvents of Drift-accelerated Diffusions

Shuenn-Jyi SHEU *National Central University, Taiwan,*
                E-mail: shuesj@math.sinica.edu.tw
Brice Franke *Universite de Bretagne Occidentale in Brest, France*

Abstract: We consider diffusion processes with growing divergence free drifts. The limit of resolvent family is a selfadjoint pseudo-resolvent. This is shown to be the resolvent for a Hunt processes on some path space. This is a joint work with Brice Franke.

Exponential Convergence of Markov Processes

Ichiro SHIGEKAWA *Kyoto University, Japan*, E-mail: ichiro@math.kyoto-u.ac.jp

Abstract: Let $\{T_t\}$ be a Markovian semigroup in $L^2(M, m)$. We also assume that its dual $\{T_t^*\}$ is Marikovian. Then $\{T_t\}$ defines a Marikovian semigroup in L^p for any $p \in [1, \infty)$. We assume that μ is an invariant probalility measeure and $T_t 1 = T_t^* 1 = 1$. We are interested in the exponential convergence rate of $T_t f$ to $\int_M f \, dm$ as $t \to \infty$. To be precise, set

$$\gamma_{p \to q} = -\limsup \frac{1}{t} \log \|T_t - m\|_{p \to q}$$

where m stands for an operator $f \mapsto m(f) = \int_M f \, dm$ and $\| \ \|_{p \to q}$ denotes an operator norm from L^p to L^q. We are interested in how $\gamma_{p \to q}$ depends on p and q.

We show that under the assumption of hyper-contractivity of the semigroup, $\gamma_{p \to q}$ does not depend on p and q ($p, q > 1$). Moreover, if we assume the symmetry, we can show that L^p spectrum of the generator are independent of $p > 1$. Without the hyper-contractivity, we can constract an example of which the spectrum depends on p. We can also discuss the convergence rate in the setting of the Zygmund space $L \log L$.

This is a joint work with Seiichiro Kusuoka.

References

[1] J-D. Deuschel and D. W. Stroock, "*Large deviations*," Academic Press, San Diego, 1989.

Heat Kernel Estimates for Relativistic Stable Processes

Renming SONG *University of Illinois, USA*, E-mail: rsong@illinois.edu

Abstract: For any $m > 0$, a relativistic α-stable process X^m on $\mathbf{R}^d$ with mass m is a Lévy process such that for any $t \geq 0$ and $\xi \in \mathbf{R}^d$

$$E\left[\exp\left(i\xi \cdot (X_t^m - X_0^m)\right)\right] = \exp\left(-t\left(\left(|\xi|^2 + m^{2/\alpha}\right)^{\alpha/2} - m\right)\right).$$

The infinitesimal generator of X^m is

$$m - (-\Delta + m^{2/\alpha})^{\alpha/2}.$$

When $\alpha = 1$, the infinitesimal generator reduces to

$$m - \sqrt{-\Delta + m^2}.$$

This operator was used in studying the stability of matter in physics. Relativistic stable processes are also closely related to the Bessel potential theory.

Recently, a lot of progress has been made in establishing sharp two-sided estimates on the transition densities of relativistic stable processes (or equivalently, Dirichlet heat kernels of $m - (-\Delta + m^{2/\alpha})^{\alpha/2}$) in smooth domains. In this talk I will give a survey of some of these results. This talk is based on joint work with Zhen-Qing Chen and Panki Kim.

References

[1] Z.-Q. Chen, P. Kim & R. Song (2012). Sharp Heat Kernel Estimates for Relativistic Stable Processes in Open Sets. *Ann. Probab.* **40 (1)**, 213–244.

[2] Z.-Q. Chen, P. Kim & R. Song (2012). Global heat kernel estimates for relativistic stable processes in half-space-like open sets. *Potential Anal.*, **36** (2012) 235–261.

[3] Z.-Q. Chen, P. Kim & R. Song (2012). Global heat kernel estimate for relativistic stable processes in exterior open sets. *J. Funct. Anal.*, **263**, 448–475.

Generalized Time-Change and Continuous-State Branching processes with Immigration

Gerónimo URIBE BRAVO *Instituto de Matematicas, UNAM., Mexico,*
E-mail: geronimo@matem.unam.mx

Abstract: We provide a representation of continuous-state branching processes with immigration by solving a functional equation which can be seen as a generalized time-change. Stability of the solutions is studied and gives, in particular, limit theorems (of a type previously studied by Grimvall, Kawazu and Watanabe, and Li) and a simulation scheme for continuous-state branching processes with immigration.

Integration by Parts Formula and Shift Harnack Inequality for Stochastic Equations

Feng-Yu WANG *School of Mathematical Sciences, Beijing Normal University, PRC,*
    E-mail: wangfy@bnu.edu.cn

Abstract: A new coupling argument is introduced to establish Driver's integration by parts formula and shift Harnack inequality. Unlike known coupling methods where two marginal processes with different starting points are constructed to move together as soon as possible, for the new-type coupling the two marginal processes start from the same point but their difference is aimed to reach a fixed quantity at a given time. Besides the integration by parts formula, the new coupling method is also efficient to imply the shift Harnack inequality. Differently from known Harnack inequalities where the values of a reference function at different points are compared, in the shift Harnack inequality the reference function, rather than the initial point, is shifted. A number of applications of the integration by parts and shift Harnack inequality are presented. The general results are illustrated by some concrete models including the stochastic Hamiltonian system where the associated diffusion process can be highly degenerate, delayed SDEs, and semi-linear SPDEs.

A Class of Stochastic Partial Differential Equations for Superprocesses with Interacting Motion and Branching

Hao WANG *University of Oregon, USA*, E-mail: haowang@uoregon.edu

Abstract: A class of interacting superprocesses on $\mathbb{R}$, called superprocesses with dependent spatial motion (SDSMs), were introduced and studied in Wang(1998) and Dawson et al.(2001). In the present paper, we extend this model to allow particles moving in $\mathbb{R}$ with dependent branching. We show that under a proper re-scaling, a class of discrete SPDEs for the empirical measure-valued processes generated by branching particle systems subject to the same white noise converge in $L^2(\Omega, F, P)$ to the SPDE for a SDSM and the corresponding martingale problem for the SDSMs is well-posed.

Functional Inequalities for Stable-Like Dirichlet Forms

Jian WANG *Fujian Normal University, PRC*, E-mail: jianwang@fjnu.edu.cn

Abstract: Let $V \in C^2(\mathbb{R}^d)$ such that $\mu_V(dx) := e^{-V(x)}\,dx$ is a probability measure, and let $\alpha \in (0, 2)$. Explicit criteria are presented for the α-stable-like Dirichlet form

$$D_{\alpha,V}(f,f) := \int_{\mathbb{R}^d \times \mathbb{R}^d} \frac{|f(x) - f(y)|^2}{|x - y|^{d+\alpha}}\,dy\,\mu_V(dx)$$

to satisfy Poincaré-type (i.e., Poincaré, weak Poincaré and super Poincaré) inequalities. As applications, sharp functional inequalities are derived for the Dirichlet form with V having some typical growths. Finally, the main result of [1] on the Poincaré inequality is strengthened.

References

[1] C. Mouhot, E. Russ, Y. Sire, *Fractional Poincaré inequalities for general measures*, J. Math. Pures Appl. **95** (2011), 72–84.

Perturbation by Non-Local Operators

Jieming WANG *School of Mathematics, Beijing Institute of Technology, PRC,*
E-mail: wangjm@bit.edu.cn

KEY WORDS: symmetric stable process, fractional Laplacian, perturbation, non-local operator, integral kernel, positivity, Lévy system, Feller semigroup, martingale problem

MATHEMATICAL SUBJECT CLASSIFICATION: Primary 60J35, 47G20, 60J75; Secondary 47D07

Abstract: Suppose that $d \geq 1$ and $0 < \beta < \alpha < 2$. We establish the existence and uniqueness of the fundamental solution $q^b(t,x,y)$ to non-local operators $\mathcal{L}^b = \Delta^{\alpha/2} + \mathcal{S}^b$, where

$$\mathcal{S}^b f(x) := \mathcal{A}(d,-\beta) \int_{\mathbb{R}^d} \left(f(x+z) - f(x) - \langle \nabla f(x), z \mathbb{1}_{\{|z| \leq 1\}} \rangle \right) \frac{b(x,z)}{|z|^{d+\beta}} dz$$

and $b(x,z)$ is a bounded measurable function on $\mathbb{R}^d \times \mathbb{R}^d$ with $b(x,z) = b(x,-z)$ for $x, z \in \mathbb{R}^d$. Here $\mathcal{A}(d,-\beta)$ is a normalizing constant. We show that if $b \geq 0$, then $q^b(t,x,y)$ is a strictly positive continuous function and it uniquely determines a conservative Feller process X^b that has strong Feller property. The Feller process X^b is the unique solution to the martingale problem of $(\mathcal{L}^b, \mathcal{S}(\mathbb{R}^d))$, where $\mathcal{S}(\mathbb{R}^d)$ is the space of tempered functions on $\mathbb{R}^d$. Furthermore, sharp two-sided estimates on $q^b(t,x,y)$ is derived.

This is a joint work with Professor Z.-Q. Chen.

References

[1] K. Bogdan and T. Jakubowski, (2007). Estimates of heat kernel of fractional Laplacian perturbed by gradient operators. *Comm. Math. Phys.* **271** , 179-198.

[2] Z.-Q. Chen and T. Kumagai,(2003). Heat kernel estimates for stable-like processes on *d*-sets. *Stoch. Process Appl.,* **108** , 27-62.

[3] Z.-Q. Chen and T. Kumagai, (2008). Heat kernel estimates for jump processes of mixed types on metric measure spaces. *Probab. Theory Relat. Fields,* **140** , 270-317.

[4] T. Komatsu, (1984). On the martingale problem for generators of stable processes with perturbations. *Osaka J. Math.* **21** , 113-132.

The Hitting Problems for a Class of Reflected O-U Processes

Yongjin WANG *Nankai University, PRC*, E-mail: yjwang@nankai.edu.cn

Abstract: We consider and re-visit the hitting problems on a class of reflected O-U processes, due to their growing applications in Queueing Systems, Financial Modelings and more disciplines. With some dedicate efforts, we are able to eventually obtain some explicit and practical results for those Laplace transforms of the hitting probablities.

Tree Valued Spatial Λ-Cannings Dynamics

Andreas Greven *Universität Erlangen-Nürnberg, Germany*
Anton Klimovsky *Eurandom, Netherlands*
Anita WINTER *Universität Duisburg-Essen, Germany*, E-mail: anita.winter@uni-due.de

KEY WORDS: Tree-valued Markov process, Cannings model, generalized Fleming-Viot, spatial Λ-coalescent, metric probability space, Gromov-weak topology

MATHEMATICAL SUBJECT CLASSIFICATION: 60K35, 60J25

Abstract: We study the evolution of genealogies for interacting spatially structured Λ-Cannings models which are also known as generalized Fleming-Viot processes. These are the limit processes of individual-based population models where individuals carry a type, and are replaced by descendants of possibly very sizable offspring. The spatial interaction is due to migration through geographic space.

We show that the dual to these tree-valued spatial Λ-Cannings dynamics are tree-valued spatial Λ-coalescents, and conclude from here the convergence of the fixed time genealogies to the genealogy of an infinitely old population as time tends to infinity. Depending on the strength of migration the latter consists either of a single or of multiple families.

We then study the populations on large tori in Z^d with $d \geq 2$. Depending on the rescaling we find global features which are universal for all Λ-Cannings dynamics and local features which heavily depend on the measure Λ.

Path Independent Property of the Action Functionals for Stochastic Dynamical Systems

Jiang-Lun WU *Swansea University, UK*, E-mail: j.l.wu@swansea.ac.uk

KEY WORDS: Path independent property, Euler-Lagrangian and HJB equations, stochastically integrable systems.

MATHEMATICAL SUBJECT CLASSIFICATION: 60J60, 70H99.

Abstract: Path independent property of Girsanov transformation for stochastic differential equations was considered [1]. In this talk, the path independent property of the action functionals for stochastically deformed dynamical systems will be discussed. The obtained result gives a characterization for stochastic integrability for Hamiltonian systems and also clarifies the non integrability for Navier-Stokes systems. This is a joint work with Ana Bela Cruzeiro and Jean-Claude Zambrini.

References

[1] A. Truman, F.-Y. Wang, J.-L. Wu & W. Yang (2012). A link of stochastic differential equations to nonlinear parabolic equations, *SCIENCE CHINA Mathematics*, to appear.

Large Deviation Behavior for The Longest Head Run in IID Bernoulli Sequence

Xian-Yuan WU *Capital Normal University, PRC*, E-mail: wuxy@mail.cnu.edu.cn
Yong-Hua Mao *Beijing Normal University, PRC*
Feng Wang *Capital Normal University, PRC*

Abstract: This paper discusses large deviation behavior of the longest perfect head run in i.i.d. Bernoulli sequence. Let $Z_1, Z_2, \ldots$ be an i.i.d. sequence with $P(Z_i = 1) = 1 - P(Z_i = 0) = p = 1 - q$ and S_N be the length of the longest consecutive run of 1's within the first N tosses. The famous Erdös-Rényi law tells that $S_N / \ln N \to \xi(p) := [-\ln p]^{-1}$ almost surely as $N \to \infty$. It is proved in this paper that, while $P[S_N / \ln N \geq \xi(p) + x]$ decays like $N^{-x/\xi(p)}$ for each $x > 0$, $P[S_N / \ln N \leq \xi(p) - x]$ decays like $\exp\{-O(N^{x/\xi(p)})\}$ for $0 < x < \xi(p)$.

References

[1] R. Arratia, L. Goldstein and L. Gordon (1989) *Two Moments Suffice for Poisson Approximations: The Chen-Stein Method,* Ann. Proba. **17**(1), 9-25

[2] M. Brown and Y. S. Shao (1987) *Identifying Coefficients in The Spectral Representation for First Passage Time Distribition,* Probab. Eng. Inform. Sci. **1**(1), 69-74

[3] P. Erdös, A. Rényi (1970) *On A New Law of Large Numbers*, J. Analyse Math. **22**(1), 103-111

[4] P. Erdös, P. Révész (1975) *On The Length of The Longest Head-run*, Topics in Imformation Theory, Colloquia Math. Soc. J. Bolyai 16 Keszthely (Hungary), 219-228

[5] W. Feller (1968) *An Introduction to Probability Theory and Its Applications*, 3rd ed. New York: Wiley

[6] J. A. Fill (2009) *On Hitting Times and Fastest Strong Stationary Times for Skip-free and More General Chains,* Journal of Theoretical Probability, **22**(3), 587-600

[7] J. C. Fu, L.-Q. Wang and W. Y. Wendy Lou (2003) *On exact and lardge deviati8on approximation for the distribution of the longest run in a sequence of two-state Markov dependent trials.* J. Appl. Prob. **40**, 346-360

[8] V. L. Goncharov (1944) *On the field of combinatory analysis*, Izv. Akd. Nauk. SSSR Ser. Mat. **8**, 3-48 (in Russian). English translation: Amer. Math. Soc. Transl. **19** (1962), 1-46

[9] L. Gordon, M. F. Schilling and M. S. Waterman (1986) *An Extreme Value Theory for Long Head Runs*, Probab. Th. Rel. Fields **72**, 279-287

[10] J. Komlós, G. Tusnády (1975) *On Sequences of "Pure Heads"*, Ann. Prob. Vol **3**, 608-617

[11] P. Révész (1980) *Strong Theorems on Coin Tossing*, Proc. 1978 int'l. Congress of Mathematicians, Helsinki 1980, 749-754

Large Deviation Principle for Some Measure-Valued Processes

Jie XIONG *University of Macau, China and University of Tennessee, USA,*
   E-mail: jxiong@math.utk.edu
Key words: Large deviation principle, stochastic partial differential equation, Fleming-Viot process, super-Brownian motion.

Mathematical Subject Classification: Primary 60F10; Secondary: 60H15, 60J68.

Abstract: We establish a large deviation principle for the solutions of a class of stochastic partial differential equations with non-Lipschitz continuous coefficients. As an application, the large deviation principle is derived for super-Brownian motion and Fleming-Viot process. This talk is based on a paper joint with Fatheddin.

Switching Diffusion Processes

George YIN, *Wayne State University, USA,* E-mail:gyin@math.wayne.edu

Key words: switching diffusion, recurrence, stability, stabilization.

Mathematical Subject Classification: 60J27, 60J60, 93E15.

Abstract: Numerous problems in control and optimization require the treatment of systems in which continuous dynamics and discrete events coexist. The discrete component is given by a random switching process with a finite state space, and the continuous component is the solution of a stochastic differential equation. Seemingly similar to diffusions, the processes have a number of salient features distinctly different from diffusion processes. In this talk, after reviewing necessary and sufficient conditions for positive recurrence and the existence of unique invariant measure, we study stability and stabilization. Numerical solutions of control and game problems will also be recalled.

Existence and Uniqueness of Invariant Measures for Spdes with Two Reflecting Walls

Tusheng ZHANG *University of Manchester, UK,* E-mail: tusheng.zhang@manchester.ac.uk

Abstract: We consider stochastic partial differential equations with two reflecting walls driven by space-time white noise with non-constant diffusion coefficients under periodic boundary conditions. The existence and uniqueness of invariant measures is established under appropriate conditions. The strong Feller property is also obtained.

Random Periodic Solution of SDEs and SPDEs

Huaizhong ZHAO *Loughborough University, UK,* E-mail: h.zhao@lboro.ac.uk

Key words: Random periodic solutions, stochastic differential equations, stochastic partial differential equations, Wiener Sobolev compact

Mathematical Subject Classification: 60H10, 60H15, 37H99

Abstract: I will talk about the random periodic solutions of stochastic differential equations driven by sdes and spdes and mathematical tools of infinite horizon integral equations and

Wiener- Sobolev compact embedding that we have developed recently. This is based on recent work with C. Feng.

References

[1] H. Z. Zhao & Z. H. Zheng (2009). Random periodic solutions of random dynamical systems, *Journal of Differential Equations*, **246**, 2020-2038.

[2] C.R. Feng, H. Z. Zhao & B. Zhou (2011). Pathwise random periodic solutions of stochastic differential equations equations, *Journal of Differential Equations*, **251**, 119-149.

[3] C.R. Feng & H. Z. Zhao (2012). Random periodic solutions of SPDEs via integral equations and Wiener-Sobolev compact embedding, *Journal of Functional Analysis*, **262**, 4377-4422.

Tail Asymptotics for Two-Dimensional Reflecting Brownian Motion — a Kernel Method

Yiqiang Q. ZHAO *Carleton University, Canada*, E-mail: zhao@math.carleton.ca

Abstract: In this talk, we consider a semi-martingale reflecting Brownian motion model. Using this model, we show how the kernel method can be applied for exact tail asymptotics in the stationary distribution. We demonstrate how to locate the left-most singular point, and how to determine the detailed behavior of the unknown moment generating function at the left-most singular point. This information is the key for characterizing exact tail asymptotics in terms of a Tauberian-like theorem.

Some Support Properties of Λ-Fleming-Viot Process with Brownian Mutation

Xiaowen ZHOU *Concordia University, Canada*, E-mail: xzhou@mathstat.concordia.ca

Abstract: The Λ-Fleming-Viot process is a probability-measure-valued process whose dual process involves Λ-coalescent, the coalescent with multiple collisions. For such a process with Brownian spatial motion, it was shown by Blath that it does not allow a compact support as long as the corresponding Λ-coalescent stays infinite. Applying the lookdown construction we can show that the process has a compact support at any fixed positive time given that the Λ-coalescent does not come down from infinity too slowly. We also find an upper bound on the Hausdorff dimension for the support. These results generalize the early results of Dawson and Hochberg on Fleming-Viot process with Kingman coalescent dual. This talk is based on joint work with Huili Liu.

Participants: (in order of the surname)

Jianhai Bao:
Swansea University, UK.
E-mail: J.BAO.536390@swansea.ac.uk

Fabrice Baudoin:
Purdue University, USA.
E-mail: fbaudoin@math.purdue.edu

Anyue Chen:
University of Liverpool, UK.
E-mail: achen@liverpool.ac.uk

Dayue Chen:
School of Mathematical Sciences, Peking University, Beijing.
E-mail: dayue@pku.edu.cn

Mu-Fa Chen:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: mfchen@bnu.edu.cn

Xia Chen:
University of Tennessee, USA.
Email: xchen@math.utk.edu

Zhenqing Chen:
University of Washington, USA.
E-mail: zchen@math.washington.edu

Zhao Dong:
Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
E-mail: dzhao@mail.amt.ac.cn

Shizan Fang:
Institute of Mathematics of Bourgogne, France.
E-mail: fang@u-bourgogne.fr

Chunrong Feng:
Loughborough University, UK.
E-mail: C.Feng@lboro.ac.uk

Shui Feng:
McMaster University, Canada.
E-mail: shuifeng@mcmaster.ca

James Allen Fill:
The Johns Hopkins University, USA.
E-mail: jimfill@jhu.edu

Fuqing Gao:
Wuhan University, Wuhan.
E-mail: gaofq@public.wh.hb.cn

Fuzhou Gong:
> Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
> E-mail: fzgong@amt.ac.cn

Li Guan:
> Beijing University of Technology, Beijing.
> E-mail: guanli@bjut.edu.cn

Xianping Guo:
> Zhongshan University, Guangzhou.
> Email: mcsgxp@mail.sysu.edu.cn

Hui He:
> School of Mathematical Sciences, Beijing Normal University, Beijing.
> E-mail: hehui@bnu.edu.cn

Wenming Hong:
> School of Mathematical Sciences, Beijing Normal University, Beijing.
> E-mail: wmhong@bnu.edu.cn

Elton P. Hsu:
> Northwestern University, USA.
> E-mail: elton@math.northwestern.edu

Yaozhong Hu
> University of Kansas, USA.
> E-mail: hu@math.ku.edu

Siqi Jian:
> Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.

Shoumei Li:
> Beijing University of Technology, Beijing.
> E-mail: lisma@bjut.edu.cn

Songzi Li:
> Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.

Wenbo Li:
> University of Delaware, USA.
> E-mail: wli@math.udel.edu

Xiangdong Li:
> Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
> E-mail: xdli@amt.ac.cn

Zenghu Li:
> School of Mathematical Sciences, Beijing Normal University, Beijing.
> E-mail: lizh@bnu.edu.cn

Huo-Nan Lin:
> Fujian Normal University, Fuzhou.
> E-mail: linhn@fjnu.edu.cn

Guoping Liu:
> Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.

Yong Liu
School of Mathematical Sciences, Peking University, Beijing.
E-mail: liuyong@math.pku.edu.cn

Dejun Luo:
Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
E-mail: luodj@amss.ac.cn

Yutao Ma:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: mayt@bnu.edu.cn

Zhi-Ming Ma:
Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
E-mail: mazm@amt.ac.cn

Yonghua Mao:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: maoyh@bnu.edu.cn

Cheng Ouyang:
University of Illinois at Chicago, USA.
E-mail: couyang@math.uic.edu

Bin Qian:
Fudan University, Shanghai.
E-mail: binqiancn@yahoo.com.cn

Yan-Xia Ren:
School of Mathematical Sciences, Peking University, Beijing.
E-mail: yxren@math.pku.edu.cn

Jinghai Shao:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: shaojh@bnu.edu.cn

Qi-Man Shao:
Hong Kong University of Science and Technology, Hong Kong.
E-mail: maqmshao@gmail.com

Shuenn-Jyi Sheu:
National Central University, Taipei.
E-mail: shuesj@math.sinica.edu.tw

Ichiro Shigekawa:
Kyoto University, Japan.
E-mail: ichiro@math.kyoto-u.ac.jp

Renming Song:
University of Illinois, USA.
E-mail: rsong@illinois.edu

Gerónimo Uribe Bravo:
Instituto de Matematicas, UNAM., Mexico.
E-mail: geronimo@matem.unam.mx

Feng-Yu Wang:
School of Mathematical Sciences, Beijing Normal University, Beijing.

E-mail: wangfy@bnu.edu.cn

Hao Wang:
 University of Oregon, USA.
 E-mail: haowang@uoregon.edu

Hongxia Wang:
 Beijing University of Technology, Beijing.
 E-mail: xiahongwang@emails.bjut.edu.cn

Jian Wang:
 Fujian Normal University, Fuzhou.
 E-mail: jianwang@fjnu.edu.cn

Jieming Wang:
 School of Mathematics, Beijing Institute of Technology, Beijing.
 E-mail: wangjm@bit.edu.cn

Miao Wang:
 Swansea University, UK.
 E-mail: M.WANG.397462@Swansea.ac.uk

Qingfeng Wang:
 Univerisity of Loughborough, UK.
 E-mail: Q.Wang@lboro.ac.uk

Yingzhe Wang:
 School of Mathematical Sciences, Beijing Normal University, Beijing.
 E-mail: wangyz@bnu.edu.cn

Yongjin Wang:
 Nankai University, Tianjin.
 E-mail: yjwang@nankai.edu.cn

Fajian Wei:
 Univerisity of Loughborough, UK.
 E-mail: f.wei@alumni.lboro.ac.uk

Anita Winter:
 Univerität Duisburg-Essen, Germany.
 E-mail: anita.winter@uni-due.de

Bo Wu:
 Fudan University, Shanghai.
 E-mail: bwu77@163.com

Jiang-Lun Wu:
 Swansea University, UK.
 E-mail: j.l.wu@swansea.ac.uk

Liming Wu:
 Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.
 E-mail: wuliming@amt.ac.cn

Xian-Yuan Wu:
 Capital Normal Unversity, Beijing.
 E-mail: wuxy@mail.cnu.edu.cn

Fubao Xi:
Beijing Institure of Technology, Beijing.
E-mail: xifb@bit.edu.cn

Jie Xiong:
University of Macau, China and University of Tennessee, USA.
E-mail: jxiong@math.utk.edu

George Yin:
Wayne State University, USA.
E-mail: gyin@math.wayne.edu

Wen Yue:
Manchester University, UK.
E-mail: wen.yue@postgrad.manchester.ac.uk

Junfei Zhang:
Beijing University of Technology, Beijing.
E-mail: junfeizhang@emails.bjut.edu.cn

Mei Zhang:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: meizhang@bnu.edu.cn

Tusheng Zhang:
University of Manchester, UK.
E-mail: tusheng.zhang@manchester.ac.uk

Yuhui Zhang:
School of Mathematical Sciences, Beijing Normal University, Beijing.
E-mail: zhangyh@bnu.edu.cn

Huaizhong Zhao:
Loughborough University, UK.
E-mail: h.zhao@lboro.ac.uk

Yiqiang Q. Zhao:
Carleton University, Canada.
E-mail: zhao@math.carleton.ca

Xiaowen Zhou:
Concordia University, Canada.
E-mail: xzhou@mathstat.concordia.ca

Chao Zhu:
University of Wisconsin-Milwaukee, USA.
E-mail: zhu@uwm.edu