The 17th Workshop on Markov Processes and Related Topics

November 25-27, 2022

Beijing Normal University

Chair: Mu-Fa Chen (BNU)

Organization Committee: Dayue Chen, Wenming Hong, Zenghu Li, Wei Liu, Jian Wang, Fengyu Wang, Xianping Guo, Yinchao Xie, Xicheng Zhang

Sponsors: Key Laboratory of Mathematics and Complex Systems of Ministry of Education, School of Mathematical Sciences, Beijing Normal University
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Website: http://math0.bnu.edu.cn/probab/Workshop2022/

Schedule - Session 1

ZOOM ID : 88959414649 Passcode : 123456

Beijing Time	November 25 (Friday)	November 26 (Saturday)	November 27 (Sunday)
Chairman		**Quansheng Liu**	**Yinchao Xie**
08:00-08:30		Shui Feng	Zhenqing Chen
08:30-09:00		Dangzheng Liu	Guangqiang Lan
09:00-09:30		Dong Yao	Longjie Xie
09:30-10:00		Jiaqi Liu	Xiaoyue Li
Chairman		**Yanxia Ren**	**Jie Xiong**
10:30-11:00		Yuanyuan Liu	Hao Wu
11:00-11:30		Huaming Wang	Quan Shi
11:30-12:00		Peisen Li	Hui He
Chairman	**Zenghu Li**	**Hao Wu**	**Fuqing Gao**
14:00-14:30	14:20-14:30 OPENING	Vladimir Vatutin	Zechun Hu
14:30-15:00	Qiman Shao	Wen Sun	Michael Choi
15:00-15:30	Jian Ding	Xinxin Chen	Longmin Wang
15:30-16:00	Xinxing Chen	Yanqi Qiu	
Chairman	**Liming Wu**	**Zhan Shi**	
16:30-17:00	Fuqing Gao	Elie Aidekon	
17:00-17:30	Huaizhong Zhao	Eulalia Nualart	
17:30-18:00	Xinyi Li	Huaiqian Li	

Schedule - Session 2

ZOOM ID : 83348231624 Passcode : 123456

Beijing Time	November 25 (Friday)	November 26 (Saturday)	November 27 (Sunday)
Chairman		**Dayue Chen**	**Wei Liu (JSNU)**
08:00-08:30		Bo Wu	Carl Mueller
08:30-09:00		Xiangchan Zhu	Fei Pu
09:00-09:30		Xing Huang	FengYu Wang
09:30-10:00		Lingdi Wang	Chaoen Zhang
Chairman		**Xicheng Zhang**	**Jian Wang**
10:30-11:00		Zhao Dong	Xianping Guo
11:00-11:30		Rongchan Zhu	Lijun Bo
11:30-12:00		Xuhui Peng	Wei Liu (WHU)
Chairman	**Xianping Guo**	**Zhao Dong**	**Fengyu Wang**
14:00-14:30		Xiangdong Li	Xicheng Zhang
14:30-15:00	Jian Wang	Jinghai Shao	Jianliang Zhai
15:00-15:30	Dejun Luo	Yulin Song	Xiaobin Sun
15:30-16:00	Zhongwei Liao	Junyu Zhang	
Chairman	**Jian Ding**	**Xiangdong Li**	
16:30-17:00	Wei Liu (JSNU)	Liming Wu	
17:00-17:30	Jianhai Bao	Chenggui Yuan	
17:30-18:00	Lijuan Cheng	Jianglun Wu	

November 25 (Friday)

Session 1

Chairman: Zenghu Li

14:20-14:30 *Opening*

Mu-Fa Chen

14:30-15:00 Qiman Shao (Southern University of Science and Technology, China)

Berry-Esseen rounds for general non-normal approximation with unbounded exchangeable pairs

15:00-15:30 Jian Ding (Peking University)

Recent progress on shotgun assembly problems

15:30-16:00 Xinxing Chen (Shanghai Jiao Tong University)

The Derrida-Retaux conjecture for recursive models

Chairman: Liming Wu

16:30-17:00 Fuqing Gao (Wuhan University)

Fluctuations and moderate deviations for a catalytic Fleming-Viot branching system

17:00-17:30 Huaizhong Zhao (Durham University, UK and Shandong University, China)

Ergodicity of nonstationary stochastic process

17:30-18:00 Xinyi Li (BICMR, Peking University)

Entropic repulsion phenomena for random interlacements

November 25 (Friday)

Session 2

Chairman: Xianping Guo

14:30-15:00 Jian Wang (Fujian Normal University, China)

Stochastic Hamiltonian systems with Levy noises and singular potentials

15:00-15:30 Dejun Luo (Chinese Academy of Sciences)

CLT for some SPDEs with transport noise

15:30-16:00 Zhongwei Liao (Beijing Normal University, Zhuhai, China)

Stability and mean growth of stochastic Solow growth models with jump and regime-switching

Chairman: Jian Ding

16:30-17:00 Wei Liu (Jiangsu Normal University)

Asymptotics of a class of multi-scale stochastic systems

17:00-17:30 Jianhai Bao (Tianjin University)

The random periodic solutions for McKean-Vlasov SDEs

17:30-18:00 Lijuan Cheng (Hangzhou Normal University)

Hessian estimate on Dirichlet and Neumann eigenfunctions of laplacian

November 26 (Saturday)

Session 1

Chairman: Quansheng Liu

08:00-08:30 Shui Feng (McMaster University, Canada)

Hierarchical Dirichlet Process and relative entropy

08:30-09:00 Dangzheng Liu (University of Science and Technology of China)

Deep random matrix theory

09:00-09:30 Dong Yao (Jiangsu Normal University, China)

Principal minors of Gaussian orthogonal ensemble

09:30-10:00 Jiaqi Liu (University of Pennsylvania, USA)

Yaglom type asymptotic results for subcritical branching Brownian motion with absorption

Chairman: Yanxia Ren

10:30-11:00 Yuanyuan Liu (Central South University, China)

On convergence and error bounds for augmented truncation approximations of Markov chains

11:00-11:30 Huaming Wang (Anhui Normal University)

Product of 2-by-2 matrices and cutpoints of random walks

11:30-12:00 Peisen Li (Beijing Institute of Technology)

Exponential ergodicity of branching processes with immigration and competition

Chairman: Hao Wu

14:00-14:30 Vladimir Vatutin (Steklov Mathematical Institute, Moscow, Russia)

Branching processes in non-favorable random environment

14:30-15:00 Wen Sun (University of Science and Technology of China)

Large deviations in coagulation and fragmentation models

15:00-15:30 Xinxin Chen (Beijing Normal University)

Critical branching random walk conditioned to survive at a given set in $\mathbb{Z}^2$

15:30-16:00 Yanqi Qiu (Wuhan University, China)

On the moments of some random variables in Mandelbrot cascades

Chairman: Zhan Shi

16:30-17:00 Elie Aidekon (Fudan University, China)

1-d Brownian loop soup, Fleming–Viot processes and Bass–Burdzy flow

17:00-17:30 Eulalia Nualart (Pompeu Fabra University, Barcelona, Spain)

Non-existence of solutions to stochastic heat and wave equations

17:30-18:00 Huaiqian Li (Tianjin University)

Wasserstein asymtotics for empirical measures of subordinate killed diffusions on compact Riemannian manifolds

November 26 (Saturday)

Session 2

Chairman: Dayue Chen

08:00-08:30 Bo Wu (Fudan University)

Quasi-invariant theorem on the Gaussian path space

08:30-09:00 Xiangchan Zhu (Chinese Academy of Sciences)

Stochastic Navier-Stokes equations via convex integration

09:00-09:30 Xing Huang (Tianjin University, China)

Well-posedness and regularity for distribution dependent SPDEs with singular drifts

09:30-10:00 Lingdi Wang (Henan University)

Ergodicity and stability of hybird systems with threshold type state-dependent switching

Chairman: Xicheng Zhang

10:30-11:00 Zhao Dong (Academy of Mathematics and Systems Science, CAS)

Stability of rarefaction for stochastic viscous conservation law

11:00-11:30 Rongchan Zhu (Beijing Institute of Technology)

Stochastic quantization to perturbation theory of Φ_2^4: asymptoticity and short distance

11:30-12:00 Xuhui Peng (Hunan Normal University, P.R.China)

Large deviations principle via Malliavin calculus for the Navier-Stokes system driven by a degenerate white-in-time noise

Chairman: Zhao Dong

14:00-14:30 Xiangdong Li (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

On the Newton flow on Wasserstein space and related PDEs

14:30-15:00 Jinghai Shao (Tianjin University)

The averaging principle for fully coupled two time-scale stochastic systems

15:00-15:30 Yulin Song (Nanjing University)

Large deviation principles for path-distribution dependent SDEs

15:30-16:00 Junyu Zhang (Sun Yat-sen University)

Zero-sum risk-sensitive continuous-time stochastic games with unbounded payoff and transition rates and Borel spaces

Chairman: Xiangdong Li

16:30-17:00 Liming Wu (Harbin Institute of Technology)

The quasi-stationary distribution (QSD) for Hamilton systems with singular potentials

17:00-17:30 Chenggui Yuan (Swansea University, Swansea, SA1 8EN, UK)

Explicit Numerical Approximations for SDDEs in Finite and Infinite Horizons using the Adaptive EM Method: Strong Convergence and Almost Sure Exponential Stability

17:30-18:00 Jianglun Wu (Swansea University, UK)

Global well-posedness of 3D Burgers equation with a multiplicative noise force

November 27 (Sunday)

Session 1

Chairman: Yinchao Xie

08:00-08:30 Zhenqing Chen (University of Washington, USA)

Stochastic control for subdiffusions

08:30-09:00 Guangqiang Lan (Beijing University of Chemical Technology)

Convergence and exponential stability of modified truncated Milstein method for stochastic differential equations

09:00-09:30 Longjie Xie (Jiangsu Normal University)

Poisson equation on Wasserstein space and diffusion approximations for McKean-Vlasov equation

09:30-10:00 Xiaoyue Li (Northeast Normal University)

The threshold of stochastic tumor-immune model with regime switching

Chairman: Jie Xiong

10:30-11:00 Hao Wu (Tsinghua University)

Crossing probabilities for 2D critical lattice models

11:00-11:30 Quan Shi (AMSS, Chinese Academy of Sciences)

Interval partition evolutions and applications

11:30-12:00 Hui He (Beijing Normal University)

Pruning, cut trees, and the reconstruction problem

Chairman: Fuqing Gao

14:00-14:30 Zechun Hu (College of Mathematics, Sichuan University, China)

Three favorite edges occurs infinitely often for one-dimensional simple random walk

14:30-15:00 Michael Choi (The Chinese University of Hong Kong)

Landscape modification meets spin systems: from torpid to rapid mixing and tunnelling in the low-temperature regime

15:00-15:30 Longmin Wang (Nankai University, China)

Branching random walks on regular trees and hyperbolic spaces

November 27 (Sunday)

Session 2

Chairman: Wei Liu (JSNU)

08:00-08:30 Carl Mueller (University of Rochester, USA)

Self-avoiding models of moving polymers and surfaces

08:30-09:00 Fei Pu (Beijing Normal University)

Hitting with probability one for stochastic heat equations with additive noise

09:00-09:30 FengYu Wang (Tianjin University)

A general framework for solving singular SPDEs

09:30-10:00 Chaoen Zhang (Harbin Institute of Technology)

On entropy-entropy production inequalities

Chairman: Jian Wang

10:30-11:00 Xianping Guo (Sun Yat-sen University)

Non-stationary Markov games with a probability criterion

11:00-11:30 Lijun Bo (University of Science and Technology of China, Xidian University)

Centralized systemic risk control in the interbank system: weak formulation and Gamma-convergence

11:30-12:00 Wei Liu (Wuhan University, China)

Large and moderate deviation principles for McKean-Vlasov SDEs with jumps

Chairman: Fengyu Wang

14:00-14:30 Xicheng Zhang (Wuhan University)

Strong convergence of propagation of chaos for McKean-Vlasov SDEs with singular interactions

14:30-15:00 Jianliang Zhai (University of Science and Technology of China, China)

Irreducibility of SPDEs driven by pure jump noise

15:00-15:30 Xiaobin Sun (Jiangsu Normal University)

Asymptotic behavior of multi-scale McKean-Vlasov stochastic differential equations

1-D BROWNIAN LOOP SOUP, FLEMING–VIOT PROCESSES AND BASS–BURDZY FLOW

Elie Aidekon *Fudan University, China*, E-mail: aidekon@fudan.edu.cn

Abstract: We describe the connection between these three objects which appear in the problem of conditioning the so-called perturbed reflecting Brownian motion on its occupation field. Joint work with Yueyun Hu and Zhan Shi.

THE RANDOM PERIODIC SOLUTIONS FOR MCKEAN-VLASOV SDES

Jianhai Bao *Tianjin University*, E-mail: jianhaibao13@gmail.com

Abstract: In this talk, we explore wellposedness of random periodic solutions of McKean-Vlasov SDEs driven by a two-sided Brownian motion, where the random periodicity behavior is characterized by the equations' long-time behaviour. Given the well-known connection between McKean-Vlasov SDEs and interacting particle systems we show propagation of chaos and that the key properties of the interacting particle system recover those of the McKean Vlasov SDEs in the particle limit.

CENTRALIZED SYSTEMIC RISK CONTROL IN THE INTERBANK SYSTEM: WEAK FORMULATION AND GAMMA-CONVERGENCE

Lijun Bo *University of Science and Technology of China, Xidian University*, E-mail: lijunbo@ustc.edu.cn

Abstract: This talk discusses a systemic risk control problem by the central bank, which dynamically plans monetary supply to stabilize the interbank system with borrowing and lending activities. Facing both heterogeneity among banks and the common noise, the central bank aims to find an optimal strategy to minimize the average distance between log-monetary reserves of all banks and the benchmark of some target steady levels. A weak formulation is adopted, and an optimal randomized control can be obtained in the system with finite banks by applying Ekeland's variational principle. As the number of banks grows large, we prove the convergence of optimal strategies using the Gamma- convergence argument, which yields an optimal weak control in the mean field model. It is shown that this mean field optimal control is associated to the solution of a stochastic Fokker-Planck-Kolmogorov (FPK) equation, for which the uniqueness of the solution is established under some mild conditions.

CRITICAL BRANCHING RANDOM WALK CONDITIONED TO SURVIVE AT A GIVEN SET IN $\mathbb{Z}^2$

Xinxin Chen *Beijing Normal University*, E-mail: xinxin.chen@bnu.edu.cn

Joint work with H. HE (BNU) and S. LIN (Paris 6)

KEY WORDS: Branching random walk, Yaglom theorem

Abstract: We consider a discrete-time branching simple random walk in $\mathbb{Z}^2$ where each particle independently makes simple random walk and produces a random number of children so that the offspring law is of mean 1 and of finite variance. We study the asymptotic behaviours of the critical branching random walk (CBRW) conditioned to hit a given site at large time n and obtain a Yaglom theorem. We also discuss the joint survival probabilities that the CBRW hits two sites which are of distances $\Theta(n^a)$ at large time n, as well as the number of occupied sites.

THE DERRIDA-RETAUX CONJECTURE FOR RECURSIVE MODELS

Xinxing Chen *Shanghai Jiao Tong University*, E-mail: chenxinx@sjtu.edu.cn

Abstract: We are interested in the nearly supercritical regime in a family of max-type recursive models studied by Derrida and Retaux (2014), and prove that under a suitable integrability assumption on the initial distribution, the free energy decays sub-exponentially with exponent $\frac{1}{2}$. This gives a weaker answer to a conjecture of Derrida and Retaux (2014).

STOCHASTIC CONTROL FOR SUBDIFFUSIONS

Zhenqing Chen *University of Washington, USA*, E-mail: zqchen@uw.edu

Abstract: Anomalous subdiffusions can be used to describe particles move slower than Brownian, for example, due to particle sticking and trapping. In this talk, we will discuss optimal control for stochastic differential equations driven by non-Markov sub-diffusions. Such control problem has some distinct features over the ones driven by Brownian motion. For instance, the Hamilton-Jacobi-Bellman (HJB) equation characterizing the optional control consists of equations in the "interior" and on the "boundary". The interior equation corresponds to deterministic control, while the boundary equation corresponds to stochastic control but involving fractional derivative. Based on joint work with Shuaiqi Zhang.

HESSIAN ESTIMATE ON DIRICHLET AND NEUMANN EIGENFUNCTIONS OF LAPLACIAN

Lijuan Cheng *Hangzhou Normal University*, E-mail: chenglj@zjut.edu.cn

Abstract: In this talk, we will introduce two different stochastic approaches to derive explicit constants $c(D)$ for n-dimensional compact manifolds D with boundary such that

$$n\lambda \|\phi\|_\infty \leq \|\phi\| \leq c(D)\lambda \|\phi\|_\infty$$

holds for any Dirichlet eigenfunction ϕ of $-\Delta$ with eigenvalue λ. Corresponding Hessian estimate for Neumann eigenfunctions will be introduced as well.

LANDSCAPE MODIFICATION MEETS SPIN SYSTEMS: FROM TORPID TO RAPID MIXING AND TUNNELLING IN THE LOW-TEMPERATURE REGIME

Michael Choi *The Chinese University of Hong Kong*, E-mail: mchchoi@nus.edu.sg

Abstract: This talk centers around a technique that we call landscape modification. The core idea is that the Hamiltonian function is suitably modified in a way for rapid mixing. We first present model-independent results that give rapid mixing and tunnelling in the low-temperature regime. Building upon these results, we investigate the effect of landscape modification on four models, namely the Curie-Weiss model on the complete graph, the Curie-Weiss model on the random r-regular graph, the Derrida's random energy model and finally the Sherrington-Kirkpatrick spin glass.

RECENT PROGRESS ON SHOTGUN ASSEMBLY PROBLEMS

Jian Ding *Peking University*, E-mail: dingjian@math.pku.edu.cn

Abstract: I will present some recent progress on shotgun assembly problems following the mathematical framework initiated by Mossel and Ross a few years ago. In particular, I will spend much time explain a recent work on the shotgun threshold for sparse Erdos-Renyi graphs, which draws a connection to the isomorphic probability for independent Poisson Galton-Watson trees. This is based on a joint work with Haoyu Liu and a joint work with Yiyang Jiang and Heng Ma.

STABILITY OF RAREFACTION FOR STOCHASTIC VISCOUS CONSERVATION LAW

Zhao Dong *Academy of Mathematics and Systems Science, CAS*, E-mail: dzhao@amt.ac.cn

Abstract: It was proved in [9] that the rarefaction wave for the stochastic Burgers equation with transport noise [14] is time- asymptotically stable. This paper is concerned with more general flux, viscosity and conservative noise. By manipulating the weakly monotone methods, we prove the global well-possedness of strong solutions for general H^1 initial data. Furthermore, we show that the rarefaction wave is still time-asymptotically stable for general stochastic viscous conservation laws with L^p time. This is the joint work with Fei min Huang and Houqi Su.

HIERARCHICAL DIRICHLET PROCESS AND RELATIVE ENTROPY

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

Abstract: Hierarchical Dirichlet process is a discrete random measure serving as an important prior in the Bayesian non-parametrics. It is motivated with the study of groups of clustered

data. This talk focuses on its connection to relative entropy through large deviations. The explicit form reveals the impact of different hierarchies.

FLUTUATIONS AND MODERATE DEVIATIONS FOR A CATALYTIC FLEMING-VIOT BRANCHING SYSTEM

Fuqing Gao *Wuhan University*, E-mail: fqgao@whu.edu.cn

Abstract: We consider fluctuations and moderate deviations of the empirical fields for a catalytic Fleming-Viot branching system. We prove that for independent initial distributions, the fluctuation processes of the empirical fields converge in law to a generalized Ornstein-Uhlenbeck process whose drift term is a linear operator associated with the catalysis. Furthermore, we establish a large deviation principle corresponding to the fluctuation. This talk is based on joint works with Yunshi Gao and Jie Xiong.

NON-STATIONARY MARKOV GAMES WITH A PROBABILITY CRITERION

Xianping Guo *Sun Yat-sen University*, E-mail: mcsgxp@mail.sysu.edu.cn

Abstract: This talk considers nonstationary two-person zero-sum stochastic games under a probability criterion. It focuses on the probability that the accumulated and incurred payoffs do not reach a given goal until the first passage time to some target set. Under a mild condition, we establish a comparison theorem, and derive a sequence of the Shapley equations for the probability criterion. Using the comparison theorem, we prove the existences of the value of the game and a Nash equilibrium. Moreover, we provide a value iteration-type algorithm for computing the value of the game and epsilon-Nash equilibria. Finally, an inventory-production example is presented to illustrate the applications of our results.

PRUNING, CUT TREES, AND THE RECONSTRUCTION PROBLEM

Hui He *Beijing Normal University*, E-mail: hehui@bnu.edu.cn

Abstract: We consider prunings of continuum random trees, as well as the cut trees that encode the genealogies of the fragmentations that come with the pruning. We propose a new approach to the reconstruction problem, which has been treated for the Brownian CRT in Broutin and Wang (EJP, 2017) and for the stable trees in Addario-Berry, Dieuleveut, and Goldschmidt (AIHP, 2019). The talk is based on a joint work with Matthias Winkel (Oxford University) and a joint work with Minmin Wang (University of Sussex) and Nicolas Broutin (Sorbonne University).

THREE FAVORITE EDGES OCCURS INFINITELY OFTEN FOR ONE-DIMENSIONAL SIMPLE RANDOM WALK

Zechun Hu *College of Mathematics, Sichuan University, China*, E-mail: zchu@scu.edu.cn

Abstract: For a one-dimensional simple random walk (S_n), an edge x (between points $x-1$ and x) is called a favorite edge at time n if its local time at n achieves the maximum among all edges. In this paper, we show that with probability 1 three favorite edges occurs infinitely often. Our work is inspired by Tóth and Werner [Combin. Probab. Comput. **6** (1997) 359-369], and Ding and Shen [Ann. Probab. **46** (2018) 2545-2561], disproves a conjecture mentioned in Remark 1 on page 368 of Tóth and Werner [Combin. Probab. Comput. **6**(1997) 359-369]. The talk is based on a joint work with Chen-Xu Hao, Ting Ma and Renming Song.

WELL-POSEDNESS AND REGULARITY FOR DISTRIBUTION DEPENDENT SPDES WITH SINGULAR DRIFTS

Xing Huang *Tianjin University, China*, E-mail: xinghuang@tju.edu.cn

Abstract: In this paper, the distribution dependent stochastic differential equation in a separable Hilbert space with a Dini continuous drift is investigated. The existence and uniqueness of weak and strong solutions are obtained. Moreover, some regularity results as well as gradient estimates and Wang's log-Harnack inequality are derived for the associated semigroup. In addition, Wang's Harnack inequality with power and shift Harnack inequality are also proved when the noise is additive. All of the results extend the ones in the distribution independent situation.

CONVERGENCE AND EXPONENTIAL STABILITY OF MODIFIED TRUNCATED MILSTEIN METHOD FOR STOCHASTIC DIFFERENTIAL EQUATIONS

Guangqiang Lan *Beijing University of Chemical Technology*, E-mail: langq@mail.buct.edu.cn

Abstract: In this talk, we develop a new explicit scheme called modified truncated Milstein method which is motivated by truncated Milstein method proposed by Guo (2018) and modified truncated Euler-Maruyama method introduced by Lan (2018). We obtain the strong convergence of the scheme under local boundedness and Khasminskii-type conditions, which are relatively weaker than the existing results, and we prove that the convergence rate could be arbitrarily close to 1 under given conditions. Moreover, exponential stability of the scheme is also considered while it is impossible for truncated Milstein method introduced in Guo(2018).

WASSERSTEIN ASYMTOTICS FOR EMPIRICAL MEASURES OF SUBORDINATE KILLED DIFFUSIONS ON COMPACT RIEMANNIAN MANIFOLDS

Huaiqian Li *Tianjin University*, E-mail: huaiqianlee@gmail.com

Abstract: Consider the conditional empirical measure associated with the subordinate killed diffusion process on a connected compact Riemannian manifold with boundary. I will talk about the sharp rate of convergence and the precise limit on the quadratic Wasserstein (or Kantorovich) distance between conditional empirical measures and the unique quasi-ergodic distribution of the process. Main ideas of proof will be explained.

EXPONENTIAL ERGODICITY OF BRANCHING PROCESSES WITH IMMIGRATION AND COMPETITION

Peisen Li *Beijing Institute of Technology*, E-mail: peisenli@bit.edu.cn

Abstract: We study the ergodic property of a continuous-state branching process with immigration and competition, which is an extension of the models introduced by Pardoux (2016, Springer) and Berestycki et al. (PTRF, 2018) with an additional immigration structure. The exponential ergodicity in a weighted total variation distance is proved for general branching mechanism including all stable cases. The proof is based on a Markov coupling process and a non-symmetric control function for the distance. These are designed to identify and to make advantage of the dominating factor among the branching, immigration and competition mechanisms in different parts of the state space of the coupling process. The main result is applied to two typical choices of the weighted total variation distance.This is a joint work with Zenghu Li, Jian Wang and Xiaowen Zhou.

ON THE ENTROPY FORMULA FOR GEOMETRIC FLOWS ON WASSERSTEIN SPACE OVER RIEMANNIAN MANIFOLD

Xiangdong Li *Academy of Mathematics and Systems Science, Chinese Academy of Sciences*, E-mail: xdli@amt.ac.cn

Abstract: In this talk, I will give a short survey on my joint work with my collaborators on the entropy formula for the geometric flows on the Wasserstein space over a Riemannian manifold.

THE THRESHOLD OF STOCHASTIC TUMOR-IMMUNE MODEL WITH REGIME SWITCHING

Xiaoyue Li *Northeast Normal University*, E-mail: lixy209@nenu.edu.cn

Abstract: In response to the pressing needs for comprehending the cancer biology, this talk focuses on dynamical behaviors of a class of stochastic tumor-immune models in random environment modulated by Markov chains. A sufficient and nearly necessary threshold-type criterion is investigated, which shows the long-time behavior of the system can be classified by a real-value parameter.

ENTROPIC REPULSION PHENOMENA FOR RANDOM INTERLACEMENTS

Xinyi Li *BICMR, Peking University*, E-mail: xinyili@bicmr.pku.edu.cn

Abstract: The model of random interlacements is the Poissonian cloud of doubly-infinite random-walk-like trajectories in $\mathbb{Z}^d$, $d \geq 3$. Originally introduced by Sznitman in (Ann. Math. 2010) to describe the local law of the trace of transient simple random walk (e.g., on $\mathbb{Z}^d$, $d \geq 3$) under certain setup where the walk is forced to become "recurrent" (e.g., in a torus and of total duration proportional to the volume of the torus), it turns out to be a fairly interesting and tangible model of percolation with long-range correlation with fascinating properties and received a lot of attention among the probabilist community. In this talk, we discuss some entropic repulsion phenomena that emerged from the study of large deviations of random interlacements. This is a joint work with Zijie Zhuang (PKU).

STABILITY AND MEAN GROWTH OF STOCHASTIC SOLOW GROWTH MODELS WITH JUMP AND REGIME-SWITCHING

Zhongwei Liao *Beijing Normal University, Zhuhai, China*, E-mail: zhwliao@hotmail.cn

Abstract: This work focuses on stochastic Solow growth models with uncertainties from technology and environmental variation. The uncertainty of technological progress is driven by Lévy processes, which include continuous perturbation and jump growth, while the uncertainty of environmental variability is characterized by Markov chains. First, in fixed environment, we introduce the criterion of stochastic stability and explicitly compute the mean growth rates of capital, total output and capital-labor ratio. Next, taking environmental variation into account, we describe the recurrence of the regime-switching process, and then give the rate of convergence of the system to its stationary distribution and the asymptotic boundedness of pth moment. Finally, a computable example is proposed ,which is an economic system with negative and positive environments, to illustrate the effectiveness of our results. This work reveals the impact of various random effects on the main economic quantities and provides insight on stability and mean growth rates of stochastic Solow growth models with uncertainties from technology and environment.

DEEP RANDOM MATRIX THEORY

Dangzheng Liu *University of Science and Technology of China*, E-mail: dzliu@ustc.edu.cn

Abstract: In the 1950s, limit theorems for random matrices were initiated by Wigner, and Bellman-Furstenberg-Kesten in two different routes: large dimensional limit for one single random matrix and infinite product of many random matrices. Two types of limit phenomena, Random Matrix Theory statistics and Gaussian Universality, arise respectively. The question of combining both routes lies at the heart of understanding two type of universal limits. In this talk we examine it and investigate possible new phenomena.

YAGLOM TYPE ASYMPTOTIC RESULTS FOR SUBCRITICAL BRANCHING BROWNIAN MOTION WITH ABSORPTION

Jiaqi Liu *University of Pennsylvania, USA*, E-mail: judyliujq@gmail.com

Abstract: In this talk, we will consider a slightly subcritical branching Brownian motion with absorption where particles move as Brownian motion with drift $-\sqrt{2+2\varepsilon}$, undergo dyadic fission at rate 1, and are killed upon hitting the origin. We are interested in the asymptotic behaviors of the process conditioned on survival up to a large time t as the process approaches criticality. Results like this are called Yaglom type results. Specifically, we will talk about the Yaglom asymptotic results for the expected number of particles and the maximal displacement.

ASYMPTOTICS OF A CLASS OF MULTI-SCALE STOCHASTIC SYSTEMS

Wei Liu *Jiangsu Normal University*, E-mail: weiliu@jsnu.edu.cn

Abstract: In this talk we mainly present some asymptotic results for a class of multi-scale stochastic systems, in particular, we will show some strong averaging principle, large deviations principle and central limit type theorems for multiscale SPDEs and DDS(P)DEs.

LARGE AND MODERATE DEVIATION PRINCIPLES FOR MCKEAN-VLASOV SDES WITH JUMPS

Wei Liu *Wuhan University, China*, E-mail: wliu.math@whu.edu.cn

Abstract: In this talk, we consider McKean-Vlasov stochastic differential equations (MVSDEs) driven by Lévy noise. By identifying the right equations satisfied by the solutions of the MVSDEs with shifted driving Lévy noise, we build up a framework to fully apply the weak convergence method to establish large and moderate deviation principles for MVSDEs. In the case of ordinary SDEs, the rate function is calculated by using the solutions of the corresponding skeleton equations simply replacing the noise by the elements of the Cameron-Martin space. It turns out that the correct rate function for MVSDEs is defined through the solutions of skeleton equations replacing the noise by smooth functions and replacing the distributions involved in the equation by the distribution of the solution of the corresponding deterministic equation (without the noise). This is somehow surprising. With this approach, we obtain large and moderate deviation principles for much wider classes of MVSDEs in comparison with the existing literature. This talk is based on a joint work with Yuling Song, Jianliang Zhai and Tusheng Zhang.

ON CONVERGENCE AND ERROR BOUNDS FOR AUGMENTED TRUNCATION APPROXIMATIONS OF MARKOV CHAINS

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Abstract: In the analysis of Markov chains and processes, it is sometimes convenient to replace an unbounded state space with a "truncated" bounded state space. When such a replacement is made, one often wants to know whether the equilibrium behavior of the truncated chain or process is close to that of the untruncated system. When the stability is robust, we further expect to obtain the quantitative bounds on the difference between them. In this talk, we will give conditions under which one can be assured that arbitrarily augmented truncation approximation is convergent. In addition, we are going to present the error bounds for truncation-augmentation schemes of Markov chains on general state space. This talk is based on joint work with Na Lin, Alex Infanger and Peter W. Glynn (Stanford University).

CLT FOR SOME SPDES WITH TRANSPORT NOISE

Dejun Luo *Chinese Academy of Sciences*, E-mail: luodj@amss.ac.cn

Abstract: We consider solutions to stochastic partial differential equations with transport noise, which are known to converge, in a suitable scaling limit, to solution of the corresponding deterministic PDE with an additional viscosity term. Gaussian fluctuations underlying such scaling limit are investigated in two cases of interest: stochastic linear transport equations in all dimensions greater than 2 and 2D Euler equations in vorticity form. In both cases, a central limit theorem with strong convergence and explicit rate is established. This is a joint work with Lucio Galeati.

SELF-AVOIDING MODELS OF MOVING POLYMERS AND SURFACES

Carl Mueller *University of Rochester* , E-mail: carl.e.mueller@rochester.edu

Abstract: Polymer models give rise to some of the most challenging problems in probability and statistical physics. We typically model a polymer using a random walk, where the time parameter n of the walk represents distance along the polymer starting from one end. That is, we imagine that the polymer is built up by adding molecules one by one at random angles. We usually include a self-avoidance term, reflecting the idea that different parts of the polymer cannot be in the same place at the same time. A difficult problem, unsolved in the most important physical cases, is to predict the end-to-end distance or radius of the polymer.

In this talk, I will discuss two extensions of the random polymer model.

[1] Moving polymers can be modeled by stochastic partial differential equations. If the polymer takes values in one-dimensional Euclidean space, we give fairly sharp upper and lower bounds for its radius. We find that there is more stretching than in typical one-dimensional polymer models that do not have time dependence.

[2] Random surfaces can be modeled by elastic manifolds, also called discrete Gaussian free fields. Free fields originate in quantum field theory. If the dimensions of the parameter space and the range are the same, we can derive bounds on the radius of the polymer. These bounds are fairly sharp in two dimensions.

We will explain the models mentioned above and give an outline of our proof techniques.

NON-EXISTENCE OF SOLUTIONS TO STOCHASTIC HEAT AND WAVE EQUATIONS

Eulalia Nualart *Pompeu Fabra University, Barcelona, Spain*, E-mail: eulalia.nualart@upf.edu

Abstract: We consider the stochastic heat equation on $[0, 1]$ with Dirichlet boundary conditions driven by a space-time white noise and a locally Lipschitz drift. We show that the well-known Osgood condition is necessary for the solution to blow-up in finite time, providing the converse of a Theorem by Bonder and Groisman. We also consider the same equation on the whole line and show that the Osgood condition is sufficient for the non-existence of global solutions. Various other extensions are provided; we look at the heat equation with fractional Laplacian, spatial colored noise, and multiplicative noise. Finally, we give the analogous results for the stochastic wave equation in one dimension. This is a joint work with Mohammud Foondun (University of Strathclyde).

LARGE DEVIATIONS PRINCIPLE VIA MALLIAVIN CALCULUS FOR THE NAVIER-STOKES SYSTEM DRIVEN BY A DEGENERATE WHITE-IN-TIME NOISE

Xuhui Peng *Hunan Normal University, P.R.China*, E-mail: xhpeng@hunnu.edu.cn

Abstract: The purpose of this paper is to establish the Donsker–Varadhan type large deviations principle (LDP) for the two-dimensional stochastic Navier–Stokes system. The main novelty is that the noise is assumed to be highly degenerate in the Fourier space. The proof is carried out by using a criterion for the LDP developed in [Jakšić et.al.*Nonlinearity*,31(2):540-596,2018] in a discrete-time setting and extended in [Martirosyan and Nersesyan. *Ann.Inst.Henri Poincaré Probab. Stat.*, 54(4):2002-2041,2018] to the continuous-time. One of the main conditions of that criterion is the uniform Feller property for the Feynman-Kac semigroup,which we verify by using Malliavin calculus. This work is based on joint work with Vahagn Nersesyan and Lihu Xu.

HITTING WITH PROBABILITY ONE FOR STOCHASTIC HEAT EQUATIONS WITH ADDITIVE NOISE

Fei Pu *Beijing Normal University*, E-mail: fei.pu@bnu.edu.cn

Abstract: We study the hitting probabilities of the solution to a system of d stochastic heat equations with additive noise subject to Dirichlet boundary conditions. We show that for any bounded Borel set with positive $d - 6$ -dimensional capacity, the solution visits this set almost surely. This is based on joint work with Robert C. Dalang.

ON THE MOMENTS OF SOME RANDOM VARIABLES IN MANDELBROT CASCADES

Yanqi Qiu *Wuhan University, China*, E-mail: yanqi.qiu@hotmail.com

Abstract: We study the moment of some random variables arising from the Mandelbrot cascades on a quite general tree. By applying Burkholder inequalities and Burkholder-Rosenthal inequalities in this setting, we are able to compute the p-moments of these random variables up to a multiplicative constant depending only on the tree and p. As a consequence, we recover several results of Kahane and also of Aihua Fan on the the multiplicative chaos. This talk is based on a recent joint work with Yong Han and Zipeng Wang.

THE AVERAGING PRINCIPLE FOR FULLY COUPLED TWO TIME-SCALE STOCHASTIC SYSTEMS

Jinghai Shao *Tianjin University*, E-mail: shaojh@tju.edu.cn

Abstract: In this talk we shall introduce some results on the averaging principle for fully coupled two time-scale stochastic systems. We focus on the impact of the ergodicity of the fast component on the limit process and the averaging principle. The key point is to study the continuity of the invariant probability measures relative to parameters. Some illustrative examples are presented.

BERRY-ESSEEN BOUNDS FOR GENERAL NON-NORMAL APPROXIMATION WITH UNBOUNDED EXCHANGEABLE PAIRS

Qiman Shao *Southern University of Science and Technology, China*, E-mail: maqmshao@gmail.com

Abstract: Let W be a random variable of interest. Construct W' so that (W, W') is an exchangeable pair. Let $\Delta = W - W'$. Assume that

$$E(\Delta \mid W) = \lambda(g(W) + r_1),\ E(\Delta^2 \mid W) = 2\lambda(v(W) + r_2).$$

Let Y be a random variable with the probability density function

$$p(y) = \frac{c}{v(y)} \exp\Big(- \int_0^y g(t)/v(t)dt \Big).$$

In this talk, a general Berry-Esseen bound will be given for W approximated by Y. Applications to Pearson's χ^2-test, Polya urn model and isotropic mean-field Heisenberg model at the critical value will be discussed. The talk is based on a join work with Songhao Liu and Hao Shi.

INTERVAL PARTITION EVOLUTIONS AND APPLICATIONS

Quan Shi *AMSS, Chinese Academy of Sciences*, E-mail: quan.shi@amss.ac.cn

Abstract: A composition of a positive integer n is a sequence of positive integers that sum to n. In this talk, I will introduce a family of interval-partition-valued diffusions that arise

as limits of random walks on integer compositions. These infinite-dimensional diffusions have Poisson–Dirichlet (pseudo-)stationary distributions. Our model is closely related to Pitman–Dubins Chinese restaurant processes and random walks on integer partitions studied by Borodin–Olshanski and Petrov. I will also talk about some applications of our model in population genetics and continuum-tree-valued dynamics. This talk is based on joint work with Noah Forman, Douglas Rizzolo, and Matthias Winkel.

LARGE DEVIATION PRINCIPLES FOR PATH-DISTRIBUTION DEPENDENT SDES

Yulin Song *Nanjing University*, E-mail: ylsong@nju.edu.cn

Abstract: In this talk, by the weak convergence method large deviation principles for path-distribution dependent SDEs are established. This is joint work with Xinyi Gu.

LARGE DEVIATIONS IN COAGULATION AND FRAGMENTATION MODELS

Wen Sun *University of Science and Technology of China*, E-mail: wsun@ustc.edu.cn

Abstract: We study the large deviation problems in various coagulation and fragmentation models. As an application, we investigate the gelation phenomenon in the classical Smoluchowski model and condensation phenomenon in the classical Becker-Doring model.

ASYMPTOTIC BEHAVIOR OF MULTI-SCALE MCKEAN-VLASOV STOCHASTIC DIFFERENTIAL EQUATIONS

Xiaobin Sun *Jiangsu Normal University*, E-mail: xbsun@jsnu.edu.cn

Abstract: In this talk, I will present some recent results about the asymptotic behavior of multi-scale McKean-Vlasov stochastic differential equations. More precisely, the averaging principle, central limit type theorem and diffusion approximation for such kind of stochastic system are discussed.

BRANCHING PROCESSES IN NON-FAVORABLE RANDOM ENVIRONMENT

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Key words: branching processes, random environment...

Mathematical Subject Classification: 60J80, 60F05

Abstract: Let $\mathcal{Z} = \{Z_n,\ n = 0, 1, 2, ...\}$ be a critical branching process evolving in a random environment generated by a sequence $\{F_n(s), \quad s \in [0, 1], n = 1, 2, ...\}$ of i.i.d. probability generating functions. Denote $X_i = \log F_i'(1), i = 1, 2, ...$ and introduce a random walk

$$S_0 = 0, \quad S_n = X_1 + ... + X_n,\ n \geq 1.$$

We impose the following restrictions on the characteristics of the process.

Assumption B1. The random variables $X_n, n = 1, 2, ...$ are independent and identically distributed with

$$\mathbf{E}X_1 = 0, \quad \sigma^2 = \mathbf{D}X_1 \in (0, \infty).$$

Besides, the distribution of X_1 is non-lattice.

Assumption B2. There is an $\varepsilon > 0$ such that

$$\mathbf{E}\left(\log^+ \frac{F_1''(1)}{(F_1'(1))^2}\right)^{2+\varepsilon} < \infty.$$

Let Assumptions B1-B2 be valid. If $\varphi(n), n = 1, 2, ...$ is a sequence of positive numbers such that $\varphi(n) \to \infty$ as $n \to \infty$ and $\varphi(n) = o(\sqrt{n})$, then there is a constant $\Theta \in (0, \infty)$ such that

$$\mathbf{P}\left(Z_n > 0; S_n \leq \varphi(n)\right) \sim \frac{\Theta\varphi^2(n)}{n^{3/2}}, \quad n \to \infty.$$

This result compliments Theorem 1.1 in [1] where it was shown that there is a constant $C \in (0, \infty)$ such that $\mathbf{P}\left(Z_n > 0\right) \sim C\sqrt{n}$ as $n \to \infty$.

A GENERAL FRAMEWORK FOR SOLVING SINGULAR SPDES

FengYu Wang *Tianjin University*, E-mail: wangfy@tju.edu.cn

Abstract: We propose a general framework of proper regularization to solve nonlinear SPDEs with singularities included in both drift and noise coefficients. As applications, the (local and global) existence is presented for a broad class of fluid models driven by pseudo-differential noise, which include the stochastic magnetohydrodynamics (hence Navier-Stokes/Euler) equations, stochastic Camassa-Holm type equations, stochastic aggregation-diffusion equation and stochastic surface quasi-geostrophic equation. Thus, some recent results derived in the literature are considerably extended in a unified way.

PRODUCT OF 2-BY-2 MATRICES AND CUTPOINTS OF RANDOM WALKS

Huaming Wang *Anhui Normal University*, E-mail: hmking@ahnu.edu.cn

Abstract: In this talk, I will introduce our resent results on asymptotics of the products of random or nonrandom 2-by-2 matrices. Based on these results, we give a full solution to the cut-point problem of both (1,2) and (2,1) random walks.

STOCHASTIC HAMILTONIAN SYSTEMS WITH LEVY NOISES AND SINGULAR POTENTIALS

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

Abstract: We establish exponential ergodicity for Lévy driven stochastic Hamiltonian systems with singular potentials. The proof relies on an explicit construction of a Lyapunov function, with aid of the strong Feller property and the Lebesgue irreducible property of the systems. Moreover, the approach works well for a class of Lévy driven stochastic Hamiltonian systems with explicit invariant probability measure.

ERGODICITY AND STABILITY OF HYBIRD SYSTEMS WITH THRESHOLD TYPE STATE-DEPENDENT SWITCHING

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Abstract: To deal with stochastic hybrid systems with general statedependent switching, we propose an approximation method by a sequence of stochastic hybrid systems with threshold type switching. The convergence rate in the Wasserstein distance is estimated in terms of the difference between transition rate matrices. Our method is based on an elaborate construction of coupling processes in terms of Skorokhod' s representation theorem for jumping processes. Moreover, we establish explicit criteria on the ergodicity and stability for stochastic hybrid systems with threshold type switching. Some examples are given to illustrate the sharpness of these criteria.

BRANCHING RANDOM WALKS ON REGULAR TREES AND HYPERBOLIC SPACES

Longmin Wang *Nankai University, China*, E-mail: wanglm@nankai.edu.cn

Abstract: The branching random walk on a regular tree or a hyperbolic space exhibits a weak survival phase: For parameter values in a certain interval, the population survives forever, but eventually vacates every compact subset of the space. In this phase, particle trails must converge to the geometric boundary of the space. We will consider the Hausdorff dimension of the limit set consisting of all such points where the population survives and its critical behavior around the phase separation point between weak and strong survival.

QUASI-INVARIANT THEOREM ON THE GAUSSIAN PATH SPACE

Bo Wu *Fudan University*, E-mail: wubo@fudan.edu.cn

Abstract: In this talk, we will first introduce a class of Gaussion processes, and prove the quasi-invariant theorem with respect to the Gaussian Wiener measure, which is the law of

the associated Gaussian process, in particular, it includes cases of Brownian motion and the fractional Brownian motion.

As applications, we will establish the integration by parts formula and Elworthy-Li-Bismut formula on the Gaussian path space, and by which the logarithmic Sobolev inequality will be presented. Moreover, we will also provides some applications in the field of financial mathematics.

CROSSING PROBABILITIES FOR 2D CRITICAL LATTICE MODELS

Hao Wu *Tsinghua University*, E-mail: haowu@mail.tsinghua.edu.cn

Abstract: Conformal invariance of critical lattice models in 2D has been vigorously studied for decades. The first example where the conformal invariance was rigorously verified was the planar uniform spanning tree (together with loop-erased random walk), proved by Lawler, Schramm and Werner. Later, the conformal invariance was also verified for Bernoulli percolation (Smirnov 2001), level lines of Gaussian free field (Schramm-Sheffield 2009), and Ising model and FK-Ising model (Chelkak-Smirnov et al 2012). In this talk, we focus on crossing probabilities of these critical lattice models in polygons with alternating boundary conditions. The talk has two parts. In the first part, we consider critical FK-Ising model and give crossing probabilities of multiple interfaces in polygon with alternating boundary conditions. We will also point out conjectures for general random-cluster models. In the second part, we discuss uniform spanning tree and explain the corresponding results.

GLOBAL WELL-POSEDNESS OF 3D BURGERS EQUATION WITH A MULTIPLICATIVE NOISE FORCE

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

Abstract: This talk is concerned with a 3D Burgers equation perturbed by a linear multiplicative noise. Utilising Doss-Sussman transformation, we link the 3D stochastic Burgers equation to a 3D random Burgers equation. Utilising certain techniques from nonlinear partial differential equations and stochastic analysis, we are able to establish the global well-posedness of 3D Burgers equation with constant diffusion coefficient. Moreover, by developing a solution which is orthogonal to the gradient of diffusion coefficient, we extend the global well-posedness result to a more general case to allow the diffusion coefficient to be a function of space and time variables. Our results and methodology pave a way to extend regularity results of 1D Burgers equations to 3D Burgers equations. Based on joint work with Zhao Dong (Chinese Academy of Sciences) and Guoli Zhou (Chongqing University).

THE QUASI-STATIONARY DISTRIBUTION (QSD) FOR HAMILTON SYSTEMS WITH SINGULAR POTENTIALS

Liming Wu *Harbin Institute of Technology*, E-mail: li-ming.wu@uca.fr

Abstract: In this talk I will present at first some recent progresses on Hamilton systems with singular potentials, whose studies are again at the very beginning of art. The main purpose of

thls talk is about the exponential convergence to its QSD of Hamilton systems with singular potentials of types Coulomb or Lennard-Jones. This talk is based on my joint work with A. Guillin et B. Nectoux which will appear in PTRF.

POISSON EQUATION ON WASSERSTEIN SPACE AND DIFFUSION APPROXIMATIONS FOR MCKEAN-VLASOV EQUATION

Longjie Xie *Jiangsu Normal University*, E-mail: longjiexie@jsnu.edu.cn

Abstract: We consider the fully-coupled McKean-Vlasov equation with multi-time-scale potentials, and all the coefficients depend on the distributions of both the slow component and the fast motion. By studying the smoothness of the solution of the non-linear Poisson equation on Wasserstein space, we derive the asymptotic limit as well as the optimal rate of convergence for the slow process. Extra homogenized drift term containing derivative in the measure argument of the solution of the Poisson equation appears in the limit, which seems to be new and is unique for systems involving the fast distribution.

PRINCIPAL MINORS OF GAUSSIAN ORTHOGONAL ENSEMBLE

Dong Yao *Jiangsu Normal University, China*, E-mail: wonderspiritfall@gmail.com

Abstract: In this paper, we prove that the fluctuation of the maxima of all the largest eigenvalues of $m \times m$ principal minors (with fixed m) of the classical $n \times n$ Gaussian orthogonal ensemble (GOE) is given by the Gumbel distribution as n tends to infinity. We also show that, the eigenvector corresponding to the maximal eigenvalue is asymptotically independent of the eigenvalue and its distribution tends to the uniform distribution on a subset of the sphere.

EXPLICIT NUMERICAL APPROXIMATIONS FOR SDDES IN FINITE AND INFINITE HORIZONS USING THE ADAPTIVE EM METHOD: STRONG CONVERGENCE AND ALMOST SURE EXPONENTIAL STABILITY

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Abstract: In this talk, we investigate explicit numerical approximations for stochastic differential delay equations (SDDEs) under a local Lipschitz condition by employing the adaptive Euler-Maruyama (EM) method. Working in both finite and infinite horizons, we achieve strong convergence results by showing the boundedness of the pth moments of the adaptive EM solution. We also obtain the order of convergence in finite horizon. In addition, we show almost sure exponential stability of the adaptive approximate solution for both SDEs and SDDEs.

ON ENTROPY-ENTROPY PRODUCTION INEQUALITIES

Chaoen Zhang *Harbin Institute of Technology*, E-mail: chaoenzhang@hit.edu.cn

Abstract: The production of entropy is an essential feature of many important kinetic equations and stochastic processes in statistical physics. Functional inequalities comparing entropy with entropy production functional are basic to the study of entropy producing models, as they provide a powerful and robust tool to obtain quantitative rate of convergence to equilibrium. Such inequalities are usually referred to as entropy-entropy production inequalities(EEP inequalities in short). After a brief review of some classical results, I will present an EEP inequality for the McKean-Vlasov equation. Our result extends the one of Carrillo, McCann and Villani to a non-convex setting. And then I will also talk about some results on the EEP inequalities for the Landau equation. This talk is partly based on a joint work with Arnaud Guillin, Wei Liu and Liming Wu.

ZERO-SUM RISK-SENSITIVE CONTINUOUS-TIME STOCHASTIC GAMES WITH UNBOUNDED PAYOFF AND TRANSITION RATES AND BOREL SPACES

Junyu Zhang *Sun Yat-sen University*, E-mail: mcszhjy@mail.sysu.edu.cn

Abstract: We study a finite-horizon two-person zero-sum risk-sensitive stochastic game for continuous-time Markov chains with Borel state and action spaces, in which payoff rates, transition rates and terminal reward functions are allowed to be unbounded from below and from above and the policies can be history-dependent. Under suitable conditions, we establish the existence of a solution to the corresponding Shapley equation (SE) by an approximation technique. Then, by the SE and the extension of the Dynkin's formula, we prove the existence of a saddle point and verify that the value of the stochastic game is the unique solution to the SE. Moreover, we develop a value iteration-type algorithm for approaching to the value of the stochastic game. The convergence of the algorithm is proved by a special contraction operator in our risk-sensitive stochastic game. Finally, we demonstrate our main results by two examples.

STRONG CONVERGENCE OF PROPAGATION OF CHAOS FOR MCKEAN-VLASOV SDES WITH SINGULAR INTERACTIONS

Xicheng Zhang *Wuhan University*, E-mail: XichengZhang@gmail.com

Abstract: In this work we show the strong convergence of propagation of chaos for the particle approximation of McKean-Vlasov SDEs with singular L^p-interactions as well as the moderate interaction particle system in the level of particle trajectories. One of the main obstacles is to establish the strong well-posedness of particle system with singular interaction. In particular, we develop the theory of strong well-posedness of Krylov and Röckner in the case of mixed L^p-drifts, where the heat kernel estimates play a crucial role. Moreover, when the interaction kernel is bounded measurable, we also obtain the optimal rate of strong convergence, which is partially based on Jabin and Wang's entropy method and Zvonkin's transformation.

IRREDUCIBILITY OF SPDES DRIVEN BY PURE JUMP NOISE

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Abstract: The irreducibility is fundamental for the study of ergodicity of stochastic dynamical systems. In the literature, there are very few results on the irreducibility of stochastic partial differential equations (SPDEs) and stochastic differential equations (SDEs) driven by pure jump noise. The existing methods on this topic are basically along the same lines as that for the Gaussian case. They heavily rely on the fact that the driving noises are additive type and more or less in the class of stable processes. The use of such methods to deal with the case of other types of additive pure jump noises appears to be unclear, let alone the case of multiplicative noises.

We develop a new, effective method to obtain the irreducibility of SPDEs and SDEs driven by multiplicative pure jump noise. The conditions placed on the coefficients and the driving noise are very mild, and in some sense they are necessary and sufficient. This leads to not only significantly improving all of the results in the literature, but also to new irreducibility results of a much larger class of equations driven by pure jump noise with much weaker requirements than those treatable by the known methods. As a result, we are able to apply the main results to SPDEs with locally monotone coefficients, SPDEs/SDEs with singular coefficients, nonlinear Schrödinger equations, Euler equations etc. We emphasize that under our setting the driving noises could be compound Poisson processes, even allowed to be infinite dimensional. It is somehow surprising.

ERGODICITY OF NONSTATIONARY STOCHASTIC PROCESSES

Huaizhong Zhao *Durham University, UK and Shandong University, China*, E-mail: huaizhong.zhao@durham.ac.uk

Abstract: We extended recently in various works the classical ergodic theory to nonstationay processes including random periodic processes, random quasi-periodic processes, and sublinear Markovian semigroups. I will discuss their fundamental distinctions in many aspects from the classical case. This talk is based on joint works with Chunrong Feng, Yu Liu, Yujia Liu, Baoyou Qu, Johnny Zhong.

STOCHASTIC QUANTIZATION TO PERTURBATION THEORY OF Φ_2^4: ASYMPTOTICITY AND SHORT DISTANCE

Rongchan Zhu *Beijing Institute of Technology*, E-mail: zhurongchan@126.com

Abstract: In this talk we study the perturbation theory of Φ_2^4 model on the whole plane via stochastic quantization. We use integration by parts formula (i.e. Dyson-Schwinger equations) to generate the perturbative expansion for the k-point correlation functions, and prove bounds on the remainder of the truncated expansion using SPDE estimates; this in particular proves

that the expansion is asymptotic. Furthermore, we derive short distance behaviors of the 2-point function and the connected 4-point function, also via suitable Dyson-Schwinger equations combined with SPDE arguments. This talk is based on joint work with Hao Shen and Xiangchan Zhu.

STOCHASTIC NAVIER-STOKES EQUATIONS VIA CONVEX INTEGRATION

Xiangchan Zhu *Chinese Academy of Sciences*, E-mail: zhuxiangchan@126.com

Abstract: In this talk I will talk about our recent work on the three dimensional stochastic Navier-Stokes equations via convex integration method. First we establish non-uniqueness in law, existence and non-uniqueness of probabilistically strong solutions and non-uniqueness of the associated Markov processes. Second we prove existence of infinitely many stationary solutions as well as ergodic stationary solutions to the stochastic Navier-Stokes and Euler equations. Moreover, we are able to make conclusions regarding the vanishing viscosity limit and the anomalous dissipation.
