武汉大学–斯旺西大学
概率论主题研讨会

First (virtual) Swansea-Wuhan Seminar on Probability

22nd - 23rd September, 2022

ZOOMID: 885 517 8417
Password: whu2022

Schedule

Program for 22 September (Thursday)
8:30 – 11:10 (London)   15:30 – 18:10 (Beijing)

Opening remarks (8:30 – 8:35)

— Chair Wei Liu
— Prof Vitaly Moroz, head of Department of mathematics, Swansea University, UK
— Prof Huijiang Zhao, head of School of mathematics and Statistics, Wuhan University, China

Time	Speaker	Title
8:35 - 9:05	Feng-Yu Wang	Wasserstein Limit for Empirical Measures of Diffusion Processes
9:05 - 9:35	Xicheng Zhang	Strong Convergence of Propagation of Chaos for Mckean-vlasov Sdes with Singular Interactions
9:35 - 9:40		Break Time
9:40 - 10:10	Dmitri Finkelshtein	Structural Properties of the Mean-field Expansion
10:10 - 10:40	Yijun Hu	Risk Measurement of Joint Risk of Portfolios: A Liquidity Shortfall Aspect
10:40 - 11:10	Zeev Sobol	Einstein's Model of "The Movement of Small Particles in a Stationary Liquid" Revisited

Program for 23 September (Friday)
8:30 - 11:00 (London)   15:30 - 18:00 (Beijing)

Time(GMT+8)	Speaker	Title
8:30 - 9:00	Eugene Lytvynov	Quasi-free States on the CAR and CCR Algebras and Point Processes
9:00 - 9:30	Yanqi Qiu	On the Moments of Some Mandelbrot Cascades
9:30 - 9:40		Break Time
9:40 - 10:10	Chenggui Yuan	Estimate of Heat Kernel for Euler-Maruyama Scheme of SDEs Driven by α-Stable Noise and Applications
10:10 - 10:40	Liming Wu	Quasi-Stationary Distribution of Hamilton's Systems with Singular Potential
10:40 - 11:00		Discussion

Organisers
Wei Liu (Wuhan University)
Jiang-Lun Wu (Swansea University)

Sponsors
Tianyuan Mathematical Center in Central China
School of Mathematics and Statistics, Wuhan Univ.
National Natural Science Foundation of China

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Program

I. 22nd September   8:30 am — 11:10 am (London time)/ 3:30 pm — 6:10 pm (Beijing time)

8:30 am — 8:35 am (London time)/ 3:30 pm — 3:35 pm (Beijing time)
Opening remarks
Chair: Wei Liu
Prof Vitaly Moroz, head of Department of Mathematics, Swansea University, UK
Prof Huijiang Zhao, head of School of Mathematics and Statistics, Wuhan University, China

I (a) Chair: Wei Liu

8:35 am — 9:05 am (London time)/ 3:35 pm — 4:05 pm (Beijing time) Feng-Yu Wang
Title: Wasserstein Limit for Empirical Measures of Diffusion Processes

9:05 am — 9:35 am (London time)/ 4:05 pm — 4:35 pm (Beijing time) Xicheng Zhang
Title: Strong convergence of propagation of chaos for McKean-Vlasov SDEs with singular interactions

9:35 am — 9:40 am (London time)/ 4:35 pm — 4:40 pm (Beijing time) break time

I (b) Chair: Jiang-Lun Wu

9:40 am — 10:10 am (London time)/ 4:40 pm — 5:10 pm (Beijing time) Dmitri Finkelshtein
Title: Structural properties of the mean-field expansion

10:10 am — 10:40 am (London time)/ 5:10 pm — 5:40 pm (Beijing time) Yijun Hu
Title: Risk measurement of joint risk of portfolios: a liquidity shortfall aspect

10:40 am — 11:10 am (London time)/ 5:40 pm — 6:10 pm (Beijing time) Zeev Sobol
Title: Einstein's model of "the movement of small particles in a stationary liquid" revisited

II (a) Chair: Xicheng Zhang

8:30 am — 9:00 am (London time)/ 3:30 pm — 4:00 pm (Beijing time) Eugene Lytvynov
Title: Quasi-free states on the CAR and CCR algebras and point processes

9:00 am — 9:30 am (London time)/ 4:00 pm — 4:30 pm (Beijing time) Yanqi Qiu
Title: on the moments of some Mandelbrot cascades
9:30 am — 9:40 am (London time)/ 4:30 pm — 4:40 pm (Beijing time) break time

II (b) Chair: Feng-Yu Wang

9:40 am — 10:10 am (London time)/ 4:40 pm — 5:10 pm (Beijing time) Chenggui Yuan
Title: Estimate of Heat Kernel for Euler-Maruyama Scheme of SDEs Driven by α-Stable Noise and Applications

10:10 am — 10:40 am (London time)/ 5:10 pm — 5:40 pm (Beijing time) Liming Wu
Title: Quasi - stationary distribution of Hamilton's systems with singular potential

10:40 am — 11:00 am (London time)/ 5:40 pm — 6:00 pm (Beijing time) Discussion

Abstracts

1. Feng-Yu Wang

Title: Wasserstein Limit for Empirical Measures of Diffusion Processes

Abstract: The limit in Wasserstein distance is presented by using eigenvalues and eigenfunctions for the empirical measures of diffusion processes on compact Riemannian manifolds or a bounded domain   with reflecting or killing boundary. The convergence rate is estimated also for SDEs and semilinear SPDEs.
References
[1] F.-Y. Wang, Precise limit in Wasserstein distance for conditional empirical measures of Dirichlet diffusion processes, J. Funct. Anal. (2021)
[2] F.-Y. Wang, Convergence in Wasserstein distance for empirical measures of Dirichlet diffusion processes on manifolds, J. Eur. Math. Soc. （2022）
[3] F.-Y. Wang, Wasserstein convergence rate for empirical measures on noncompact manifolds, Stoch. Proc. Appl. (2022)
[4] F.-Y. Wang, Convergence in Wasserstein Distance for Empirical Measures of Semilinear SPDEs, Ann. Appl. Probab. to appear.
[5] F.-Y. Wang, J.-X. Zhu, Limit Theorems in Wasserstein Distance for Empirical Measures of Diffusion Processes on Riemannian Manifolds, H. Poincare Inst. Probab. Stat. to appear.

2. Xicheng Zhang

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

Abstract: 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 for the moderate interaction particle systems on the level of particle trajectories. One of the main obstacles is to establish the strong well-posedness of the SDEs for particle systems with singular interaction. To this end, we extend the results on strong well-posedness of Krylov and R\"ockner to the case of mixed $L^\bbp$-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. (This is a joint work with Zimo Hao and Michael Rockner.)

3. Dmitri Finkelshtein

Title: Structural properties of the mean-field expansion

Abstract: The classical mean-field scheme is widely used both in statistical physics and in the study of stochastic dynamics of complex systems (individual-based models of population ecology, epidemiology, social sciences etc.). It states that when an appropriately chosen small parameter (e.g. the inverse to the number of interacting elements or a space scale parameter) tends to 0, the second and higher-order spatial correlations factorise within the dynamics, provided that the factorisation took place initially (a.k.a. the propagation of chaos property). Therefore, the spatial correlations, being expanded in the power series w.r.t. the small parameter, have an explicit leading term of the expansion, that is the product of solutions to a certain (nonlinear) kinetic equation. In the talk, I will present a new approach which describes all terms of the expansion in the small parameter through solutions to recurrent systems of linear evolution equations. The approach can be applied to a rather general class of dynamics.

4. Yijun HU

Title：Risk measurement of joint risk of portfolios: a liquidity shortfall aspect

Abstract：In this talk, we will present a novel axiomatic framework of measuring the joint risk of a portfolio consisting of several financial positions. From the liquidity shortfall aspect, we construct a distortion-type risk measure to measure the joint risk of portfolios, which we referred to as multivariate distortion joint risk measure, representing the liquidity shortfall caused by the joint risk of portfolios. After its fundamental properties have been studied, we axiomatically characterize it by proposing a novel set of axioms. Furthermore, based on the

representations for multivariate distortion joint risk measures, we also propose a new class of vector-valued multivariate distortion joint risk measures, as well as sensible financial interpretation. Their fundamental properties are also investigated. It turns out that this new class is large enough, as it can not only induce new vector-valued multivariate risk measures, but also recover some popular vector-valued multivariate risk measures known in the literature with alternative financial interpretation. Examples are given to illustrate the proposed multivariate distortion joint risk measures. This talk mainly gives some theoretical results, helping one to have an insight look at the measurement of joint risk of portfolios. This talk is based on a joint work with Suo Gong and Linxiao Wei.

5. Zeev Sobol

Title: Einstein's model of "the movement of small particles in a stationary liquid" revisited

Abstract: The aforementioned celebrated model, though a breakthrough in Stochastic processes and a great step toward construction of the Brownian motion, leads to a paradox: infinite propagation speed and violation of the 2nd law of thermodynamics. We adapted the model by assuming the diffusion matrix dependent of the concentration, rather than constant it was up to Einstein, and proved a finite propagation speed under assumption of a qualified decrease for small concentration.

6. Eugene Lytvynov

Title: Quasi-free states on the CAR and CCR algebras and point processes

Abstract: Quasi-free states, in particular gauge-invariant quasi-free states, form an important class of states on both the algebra of the canonical anticommutation relations (CAR) and the algebra of the canonical commutation relations (CCR). Such states are usually constructed through non-Fock representations of the respective commutation relations. (`Non-Fock' here means that annihilation operators do not map the vacuum vector to zero.) For both the CAR and CCR algebras, the particle density represents the commutative part of the respective algebra. It should, however, be noted that, in the case where the physical space is continuous (rather than discrete), the particle density appears initially as a heuristic notion and requires a rigorous mathematical interpretation. We will discuss how several classes of point processes, including determinantal, permanental and hafnian, can be interpreted as the particle density of a certain quasi-free representation of the CAR or CCR.

7. Yanqi Qiu

Title: on the moments of some Mandelbrot cascades

Abstract: We study the moment of some random variables on the trees related to Mandelbrot cascades. 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.

8. Chenggui Yuan

Title: Estimate of Heat Kernel for Euler-Maruyama Scheme of SDEs Driven by α-Stable Noise and Applications

Abstract: In this talk, we will introduce the discrete parametrix method and apply it to estimate the heat kernel for Euler-Maruyama scheme of SDEs driven by α-stable noise, which implies Krylov's estimate and Khasminskii's estimate. As an application, we will discuss the convergence rate of Euler-Maruyama scheme for a class of multidimensional SDEs with singular drift by using Zvonkin's transformation as well.

9. Liming Wu

Title: Quasi - stationary distribution of Hamilton's systems with singular potential

Abstract: I will present some new advances for Hamilton's systems with singular potential of Coulomb type or of Lennard-Jones type. Especially for its QSD. This talk is based on a joint work with Guillin and Nectoux，to appear in PTRF.