



天元數學國際交流中心

Tianyuan Mathematics Research Center

Workshop on
**Nonlocality in Stochastic Evolutionary
Systems**

Conference Program

Organizers

Diego Alonso-Orán (Universidad de La
Laguna)

Hao Tang (Tianjin University)

Feng-Yu Wang (Tianjin University)

August 30 - September 5, 2026

Kunming, China

Introduction to Tianyuan Mathematics Research Center (TYMRC)

The Tianyuan Mathematics Research Center (established in July 2023) is jointly supported by the Chinese Academy of Sciences, the National Natural Science Foundation of China, the Chinese Mathematical Society, the Academy of Mathematics and Systems Science of the Chinese Academy of Sciences, and relevant departments of Kunming City. It aims to build a platform for academic exchange in mathematics and interdisciplinary applications, enhance China's overall mathematical research level, and become a world-class center for mathematical exchange and collaborative research.

It is located in the national-level public welfare forest in the Chaishitan Reservoir area of Yiliang, Kunming, Yunnan Province, surrounded by mountains on three sides and facing water on one side. The center has a total land area of about 27,000 square meters, with three two-story main buildings, namely the Research Building, the Expert Building and the Logistics Building, which can accommodate nearly 200 people for academic activities, and are equipped with a library and reading room, a restaurant and a certain number of offices and guest rooms.

The center has a total construction area of approximately 6,000 square meters. It features a main lecture hall (capacity: 100 people, equipped with an HD LED screen), one medium-sized seminar room, four small meeting rooms, 21 seminar/workshop rooms, one library and reading room, and one café. The Expert Building is equipped with 56 guest rooms, as well as supporting facilities such as a self-service laundry room and a public lounge.

Official website: <http://tianyuan.amss.ac.cn/>

Program Schedule:

Check-in: August 30, 2026;

Departure: September 5, 2026

Venue: Tianyuan Mathematics Research Center (Chishitan Reservoir, Yiliang County, Kunming, Yunnan Province)

Practical Information:

1. This seminar is financially supported by the TYMRC.
Accommodation and meals for participants will be covered by the Center. All other expenses (including round-trip transportation) shall be borne by the participants themselves.
2. The Center will arrange shuttle services to/from the following locations: Kunming High-Speed Railway Station, Kunming Changshui International Airport, and downtown Kunming. Participants are kindly requested to log in to the project management system (<http://tianyuanpm.amss.ac.cn/>) in a timely manner to register their travel information.
3. As the Center is located at a considerable distance from the nearest hospital, participants are advised to bring an adequate supply of essential personal medications.
4. Breakfast: 7:30-9:00
Lunch: 11:30-13:00
Dinner: 17:30-19:00

Schedule

Monday, Augst 31			
08:50-09:00	Opening Ceremony		
Time	Speaker	Title of talk	Chair
09:00-09:50	Tusheng Zhang	Transportation-cost inequalities for invariant measures of stochastic reaction-diffusion equations	Feng-Yu Wang
09:50-10:10	Break/Discussion		
10:10-11:00	Wei Liu (Jiangsu)	Variational Framework for SPDE: Old and New	Feng-Yu Wang
11:00-11:50	Wei Liu (Wuhan)	Transportation Inequalities for Mean-Field Interacting Particle Systems and McKean–Vlasov SDEs	Feng-Yu Wang
	Lunch		
14:00-14:50	Dejun Luo	Point vortex approximation for white noise solutions of stochastic 2D fluid equations	Hao Tang
14:50-15:10	Break/Discussion		
15:10-16:00	Soobin Cho	Heat kernel estimates for local and nonlocal Schrödinger operators with supercritical killing	Hao Tang
16:00-16:50	Rafael Granero-Belinchón	Mathematical results regarding the dynamics of cold plasma	Hao Tang
17:30	Dinner		

Tuesday, September 1			
Time	Speaker	Title of talk	Chair
09:00-09:50	Xiangdong Li	On the convergence of matrix diffusion processes to free diffusions	Tusheng Zhang
09:50-10:10	Break/Discussion		
10:10-11:00	Jianhai Bao	Asymptotic contraction bounds for two different semigroups and applications	Tusheng Zhang
11:00-11:50	Shuaikun Wang	Probability measure-valued solution to the Boltzmann equation	Tusheng Zhang
	Lunch		
14:00	Free discussion		

Wednesday, September 2

Time	Speaker	Title of talk	Chair
09:00-09:50	Weijun Xu	Periodic homogenisation for singular stochastic PDEs	Alonso-Orán
09:50-10:10	Break/Discussion		
10:10-11:00	Claudia García	Leapfrogging motion for the 3D Euler equations	Alonso-Orán
11:00-11:50	Jianliang Zhai	Large deviation principles for stochastic nonlinear Schrodinger equations driven by Lévy noise	Alonso-Orán
	Lunch		
14:00-14:50	Bo Wu	The Monotonicity of L_p inequalities	Xing Huang
14:50-15:10	Break/Discussion		
15:10-16:00	Changsong Deng	Quantitative bounds for high dimensional entropic CLT	Xing Huang
16:00-16:50	Huaiqian Li	Wasserstein convergence rates for empirical measures of subordinated fBm on the flat torus	Xing Huang
17:30	Dinner		

Thursday, September 3			
Time	Speaker	Title of talk	Chair
09:00-09:50	Jian Wang	Harnack inequalities for SDEs driven by symmetric α -stable processes	Xicheng Zhang
09:50-10:10	Break/Discussion		
10:10-11:00	David Poyato	Mean field limit of non exchangeable interacting diffusions on co-evolutionary networks	Xicheng Zhang
11:00-11:50	Xing Huang	Exponential Ergodicity for McKean-Vlasov SDEs with Singular Interactions	Xicheng Zhang
	Lunch		
14:00	Free discussion		

Friday, September 4

Time	Speaker	Title of talk	Chair
09:00-09:50	Vahagn Nersesyan	Controllability of PDEs with highly degenerate forces	Granero-Belinchón
09:50-10:10	Break/Discussion		
10:10-11:00	Longmin Wang	Branching random walks with exponentially decreasing steps	Granero-Belinchón
11:00-11:50	Peter Pang	Variational wave type equations with gradient noise	Granero-Belinchón
	Lunch		
14:00-14:50	Liyang Li	Ergodicity and mixing of the stochastic Burgers equation on the real line	Peter Pang
14:50-15:10	Break/Discussion		
15:10-16:00	Eryan Hu	Heat kernel estimates for anisotropic processes in unbounded open sets	Peter Pang
16:00-16:50	Lingyan Cheng	Tamed Euler Approximation of invariant measures for weakly interacting particle systems and McKean--Vlasov equations	Peter Pang
17:30	Dinner		

Presentation Information

1. **Speaker:** Jianhai Bao (Tianjin University)

Title: *Asymptotic contraction bounds for two different semigroups and applications*

Abstract: In this work, we first establish a general criterion for constructing quantitative estimates between different semigroups under some quasi-Wasserstein distance, consisting a Lyapunov type condition, d -contractivity, d -small sets associated with certain level set U . As an application, we derive non asymptotic convergence estimates between the distribution of the solution to a functional SDE with multiplicative noise and that of its general stochastic algorithm.

2. **Speaker :** Lingyan Cheng (Nanjing University of Science and Technology)

Title : *Tamed Euler Approximation of invariant measures for weakly interacting particle systems and McKean--Vlasov equations*

Abstract: In this talk, we investigate tamed Euler approximations of invariant measures for McKean--Vlasov dynamics with superlinear drift, non-degenerate additive noise, and weak interaction. Adopting an approximate componentwise reflection coupling together with a tailored distance metric, we establish long-time W_1 error bounds that decouple relaxation, discretization, and particle approximation errors under the condition of dissipativity at infinity. For sufficiently small step sizes θ , both the Langevin and N -particle tamed Euler chains admit unique invariant probability measures. The one-particle marginal of the N -particle numerical invariant measure converges to the McKean--Vlasov invariant measure in the W_1 metric with an error rate of $O(\theta^\alpha + \theta^{\beta/2} + \theta^{1/2} + N^{-1/2})$, where θ denotes the time step, N denotes the number of particles, $\alpha \in (0, 1/2]$ is the taming exponent, and $\beta \in (0, 1]$ stands for the local Hölder exponent of the drift. In particular, the convergence rate simplifies to $O(\theta^{1/2} + N^{-1/2})$ when $\alpha = 1/2$ and $\beta = 1$. All constants involved in the derived estimates

are independent of θ and N , and can be explicitly formulated or recursively computed from the model parameters and initial moments. This talk is based on the joint work with Ruinan Li, Wei Liu, and Shiyu Liu.

3. **Speaker:** Soobin Cho (University of Illinois Urbana-Champaign)

Title: *Heat kernel estimates for local and nonlocal Schrödinger operators with supercritical killing*

Abstract: In this talk, we discuss heat kernel estimates for local and nonlocal Schrödinger operators with supercritical killing potentials. A prototypical example is $-(-\Delta)^s - \kappa |x|^{-2(s+\gamma)}$, $s \in (0,1]$, $\kappa, \gamma > 0$. We present both probabilistic and analytic approaches to the study of these operators. We highlight the fundamental differences in the results for the local and nonlocal settings and examine how they differ from those in the critical case ($\gamma = 0$). The talk is based on joint work with Renming Song (UIUC) and Panki Kim (SNU).

4. **Speaker:** Changsong Deng (Wuhan University)

Title: *Quantitative bounds for high dimensional entropic CLT*

Abstract: By using Wang's dimension-free Harnack inequality, we obtain a new quantitative bound for the entropic central limit theorem under the assumption that the Poincare inequality holds. We compare our results with recent developments to demonstrate the merits of our approach.

5. **Speaker:** Claudia García (University of Granada)

Title: *Leapfrogging motion for the 3D Euler equations*

Abstract: In this talk, we focus on the existence of time-periodic leapfrogging vortex rings for the three-dimensional incompressible Euler equations, thereby providing a rigorous realization of a phenomenon first conjectured by Helmholtz (1858). In the leapfrogging motion, two coaxial vortex rings periodically exchange positions, a striking behavior repeatedly observed in experiments and

numerical simulations, yet lacking complete mathematical justification. Our construction relies on a desingularization.

6. Speaker: Rafael Granero-Belinchón (University of Cantabria)

Title: *Mathematical results regarding the dynamics of cold plasma*

Abstract: In this talk we will introduce a number of new results studying the dynamics of cold plasmas. In particular, we will review new asymptotic models and their mathematical properties. Finally, we will introduce the stochastic version of one of these models together with its well-posedness theory.

7. Speaker: Eryan Hu (Tianjin University)

Title: *Heat kernel estimates for anisotropic processes in unbounded open sets*

Abstract : We consider the fundamental solution for integro-differential operators that generate a d -dimensional Markov process so that the corresponding Dirichlet form is comparable to that of d independent copies of one-dimensional jump processes, i.e., the jumping measure is singular with respect to the d -dimensional Lebesgue measure. We establish sharp two-sided heat kernel estimates and Green function estimates for these processes in two types of unbounded $C^{1,1}$ open sets: half-space-like open sets and exterior $C^{1,1}$ open sets.

8. Speaker: Xing Huang (Tianjin University)

Title : *Exponential Ergodicity for McKean-Vlasov SDEs with Singular Interactions*

Abstract: The exponential ergodicity in 1-Wasserstein and k^* -distances is derived for a class of McKean-Vlasov SDEs with small singular interactions measured by $|| \cdot ||_{k^*}$. Moreover, the exponential ergodicity in 2-Wasserstein distance and relative entropy is derived when the interaction term is given by

$$b^{(0)}(x, \mu) := \int_{R^d} h(x - y) \mu(dy)$$

for some measurable function $h: R^d \rightarrow R^d$ satisfying certain small condition.

9. Speaker: Huaiqian Li (Tianjin University)

Title: *Wasserstein convergence rates for empirical measures of subordinated fBm on the flat torus*

Abstract: We study how fast the empirical distribution of a subordinated fractional Brownian motion on a flat torus approaches the uniform distribution, as measured by the Wasserstein distance. The process is defined by time-changing a fractional Brownian motion with an independent subordinator, which induces long-range dependence and heavy tails. We derive sharp upper and lower bounds, with rates that depend explicitly on the dimension, the Hurst parameter, and the subordinator's tail behavior.

10. Speaker : Liying Li (Southern University of Science and Technology)

Title: *Ergodicity and mixing of the stochastic Burgers equation on the real line*

Abstract: We consider the viscous Burgers equation on the real line with additive white-in-time random force and study its ergodic properties. In the case of space-homogeneous noise, under mild assumptions we establish the existence of a unique ergodic solution for every fixed average velocity. The analysis utilizes the directed polymer models derived from the Feynman-Kac representation of the Burgers solution, where the question of unique ergodicity can be reformulated in terms of the existence and uniqueness of the infinite-volume polymer Gibbs measures. Furthermore, the inviscid limit holds for these ergodic solutions, and correspondingly, the polymer measures in the zero-temperature limit converges to delta measures concentrated on infinite minimizers. Further questions on the finer properties of this global solution are open problems related to the

KPZ universality conjectures for non-integrable models. In the case of L^2 noise with small damping, we present a polynomial mixing result using Foiaş-Prodi type estimates, which holds for general conservation laws as well.

11. Speaker: Xiangdong Li (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

Title: *On the convergence of matrix diffusion processes to free diffusions*

Abstract: In this talk, I'll present some recent results on the convergence of Hermitian or Unitary matrix valued diffusion processes to free diffusions. Joint work with Songzi Li and Zizhan Chen.

12. Speaker: Wei Liu (Jiangsu Normal University)

Title: *Variational Framework for SPDE: Old and New*

Abstract: In this talk we mainly present some recent progress on the variational framework for SPDE, especially on the regularization effect by noise and DDSPDE.

13. Speaker: Wei Liu (Wuhan University)

Title : *Transportation Inequalities for Mean-Field Interacting Particle Systems and McKean–Vlasov SDEs*

Abstract: In this talk, we will show transportation inequalities for mean-field interacting particle systems and McKean–Vlasov SDEs under non-globally dissipative conditions. They provide powerful tools for characterizing exponential ergodicity, concentration phenomena, and error analysis for stochastic particle algorithms.

14. Speaker : Dejun Luo (Academy of Mathematics and Systems Science, Chinese Academy of Sciences)

Title : *Point vortex approximation for white noise solutions of stochastic 2D fluid equations*

Abstract : We consider the point vortex system associated to stochastic 2D Euler equations with transport noise. It is known that, for suitably chosen vortex intensities and initial positions, the empirical measures converge weakly to white noise solution of stochastic 2D Euler equations. Our purpose is to extend these result to 2D fluid equations driven by Levy transport noises which are understood in the Marcus sense.

15. Speaker: Vahagn Nersesyan (NYU Shanghai)

Title: *Controllability of PDEs with highly degenerate forces*

Abstract : Controllability is an important tool in the study of stochastic PDEs, allowing us to understand how the effect of a degenerate noise propagates through the system. In this talk, we will review recent results on the controllability of fluid PDEs driven by highly degenerate forcing. We will discuss in particular the case where the control force is low-dimensional and acts only in a small region of the domain. This talk is partially based on joint work with Manuel Rissel.

16. Speaker: Peter Pang (University of Nottingham Ningbo)

Title: *Variational wave type equations with gradient noise*

Abstract: Gradient noise perturbed fluid equations has been a topic of much interest. I shall discuss existence of weak solutions to the (nonlocal) Camassa--Holm and Hunter--Saxton equations with gradient noise. If time permits I shall also discuss structure-preserving semi-discrete numerical schemes for gradient noise.

17. Speaker: David Poyato (University of Granada)

Title: *Mean field limit of non exchangeable interacting diffusions on co-evolutionary networks*

Abstract: Many real-world multi-agent systems evolve not only through changes in the agents' states, but also through changes in their underlying coupling weights, as in neural learning. I will present

a rigorous mean-field limit for non-exchangeable diffusions on such co-evolutionary networks. Their coupled evolution leads to memory effects and non-Markovian limiting dynamics. I will also explain why K-graphons, or probability-graphons, provide the appropriate framework to describe the evolving network.

18. Speaker: Jian Wang (Fujian Normal University)

Title: *Harnack inequalities for SDEs driven by symmetric α -stable processes*

Abstract: Let $L^\alpha := (L_t^\alpha)_{t \geq 0}$ be a one dimensional symmetric α -stable process with $0 < \alpha < 2$, and consider the stochastic differential equation

$$X_t^x = x + \int_0^t b(X_{s-}^x) ds + L_t^\alpha.$$

For a continuous drift $b(x)$ satisfying a one sided Lipschitz condition, we establish log-Harnack and power-Harnack inequalities by a direct coupling on the Poisson jump configuration. The coupling selects one jump by a Palm change of measure and shifts this jump so that two solutions meet at the selected time. In particular, the power-Harnack inequality holds for every $0 < \alpha < 2$, and the argument gives polynomial growth of the Harnack factor for large normalized distances.

19. Speaker: Longmin Wang (Nankai University)

Title: *Branching random walks with exponentially decreasing steps*

Abstract: We consider a branching random walk on the real line in which the step size decreases by a fixed factor from one generation to the next. This process has a natural connection with branching Brownian motion on the hyperbolic plane and gives rise to a stochastically self-similar measure. In this talk, we discuss the boundedness of the process and the Hausdorff dimension of the associated measure. This is based on ongoing joint work with Xinxin Chen and Shen Lin.

20. Speaker: Shuaikun Wang (Shandong University)

Title : *Probability measure-valued solution to the Boltzmann equation*

Abstract: In this talk, we discuss the probability measure-valued solution to the Boltzmann equation with the non-cutoff collision cross-section. We show the well-posedness of the solution and prove the Villani conjecture for it.

21. Speaker: Bo Wu (Fudan University)

Title: *The Monotonicity of I_p Inequalities*

Abstract: The Monotonicity of I_p Inequalities was an open question posed by Wang's book (Functional inequalities, Markov Semigroups and Spectral Theory), In this talk, we will prove I_p Inequalities are monotonically increasing.

22. Speaker: Weijun Xu (Westlake University)

Title: *Periodic homogenisation for singular stochastic PDEs*

Abstract : We introduce renormalisation procedures in recent developments in singular stochastic PDEs, as well as homogenisation problem for equations with oscillatory coefficients. Both renormalisation and homogenisation are singular limiting procedures, but with very different features. It is then natural to ask how these two limiting procedures interact with each other when present in the same problem. We will also share some of our recent works and understandings in this direction. Joint works with Yilin Chen and Ben Fehrman.

23. Speaker: Jianlaing Zhai (University of Science and Technology of China)

Title : *Large deviation principles for stochastic nonlinear Schrodinger equations driven by Lévy noise*

Abstract: We establish a Freidlin-Wentzell type large deviation principle for stochastic nonlinear Schrodinger equation, with either focusing or defocusing nonlinearity, driven by nonlinear multiplicative Levy noise in the Marcus canonical form. This task is challenging in the current setting due to the presence of the power-type nonlinear term, the lack of regularization effect of the Schrodinger operator and the absence of compactness of embeddings.

24. Speaker: Tusheng Zhang (University of Science and Technology of China)

Title: *Transportation-cost inequalities for invariant measures of stochastic reaction-diffusion equations*

Abstract: In this paper, we establish transportation-cost inequalities for invariant measures of stochastic reaction-diffusion equations driven by multiplicative space-time white noise. In particular, the transportation-cost inequalities are established with respect to the L^1 metric, the L^2 metric and the uniform metric, under different dissipativity strengths of the drift.