报告日程

1月9号：活动中心331

时间	报告	主持人
08:20-08:30　开幕式		
08:30-09:10	报告人：王凤雨 题　目：Nonlinear functional inequalities for ergodicity rate of generalized porous media equations	许全华
09:10-09:50	报告人：张土生 题　目：Exponential ergodicity of stochastic evolution equations with reflection	
09:50-10:10	休息	
10:10-10:50	报告人：郭先平 题　目：Nonstationary zero-sum Markov games with the probability criterion	刘伟
10:50-11:30	报告人：宋仁明 题　目：Heat kernel estimates for Markov processes with jump kernels blowing-up at the boundary	

1月9号：活动中心331

时间	报告	主持人
14:30-15:00	报告人：许惟钧 题　目：Cancellations in interface motion problem of the 1D stochastic Allen-Cahn equation	吴波
15:00-15:30	报告人：赵国焕 题　目：Non-local operators with low singularity kernels	周国立
15:30-16:00	报告人：尚世界 题　目：Stochastic reaction-diffusion equations with super-linear drift	余迁
16:00-16:30	休息	
16:30-17:00	报告人：王振富 题　目：Relative entropy methods for mean-field limits: quantitative chaos beyond exchangeability	杜恺
17:00-17:30	报告人：顾陈琳 题　目：Coupling between Brownian motion and random walks on the infinite percolation cluster	潘雅娟
17:30-18:00	报告人：李石虎 题　目：Mean field stochastic partial differential equations with nonlinear kernels	张作政

1月10号: 正心楼11

时间	报告	主持人
08:30-09:00	**报告人:** 解龙杰 **题　目:** Uniform in time diffusion approximation and applications	聂天洋
09:00-09:30	**报告人:** 李建阁 **题　目:** Random core partitions: limiting distributions and concentration inequalities	江一鸣
09:30-10:00	**报告人:** 张卓松 **题　目:** Berry-Esseen bounds for functionals of independent random variables	张振中
10:00-10:30	休息	
10:30-11:00	**报告人:** 马宇韬 **题　目:** Deviation probabilities and convergence rate for extreme eigenvalues of large chiral random matrices	刘源远
11:00-11:30	**报告人:** 尹晟 **题　目:** Strong and weak convergences of noncommutative rational functions in random matrices	张奇
11:30-12:00	**报告人:** 许媛媛 **题　目:** Optimal decay of eigenvector overlap for non-Hermitian random matrices	李瑞囡

1月11号: 正心楼11

时间	报告	主持人
08:30-09:00	报告人：杨叙 题　目：Extinction, explosion and contraction for time-inhomogeneous SDEs with jumps	何辉
09:00-09:30	报告人：肖惠 题　目：Conditioned local limit theorems for products of random matrices	成灵妍
09:30-10:00	报告人：孙振尧 题　目：On the subcritical self-catalytic branching Brownian motions	沈钿
10:00-10:30	休息	
10:30-11:00	报告人：陈娴 题　目：Quantile Markov decision processes in continuous space	程丽娟
11:00-11:30	报告人：温家强 题　目：Mean-field BSDEs with quadratic growth：theory and applications	廖华夫
11:30-12:00	报告人：吴明燕 题　目：SDE driven by multiplicative cylindrical α-stable noise with distributional drift	程梦雨
14:00-17:30	讨论	

报告题目与摘要

Nonstationary zero-sum Markov games with the probability criterion

郭先平 中山大学

摘要: This paper studies a two-person non-stationary stochastic game under a probability criterion, which focuses on the probability that the accumulated rewards of player 1 (i.e., the costs of player 2) exceed a prescribed threshold before the first passage into a target set. We first present two illustrative examples. The first one shows that the probability criterion breaks the implication from a nonzero-sum Nash equilibrium to a zero-sum saddle point. The second demonstrates that the non-stationary game can not be transformed into an equivalent and stationary one via the standard state augmentation. Because of the non-stationariness, we introduce the notion of the n-th value of game from time n onwards. Under a mild condition, we prove that the sequence of the n-th values is the unique solution of the system of Shapley equations for the probability criterion. From the system of Shapley equations, we establish the existence of the value and a saddle-point for the game, give an iteration algorithm for computing the approximation value and ϵ-saddle-points of the game, and provide convergence guarantees together with explicit error bounds. Finally, an energy management numerical example is presented to illustrate the theoretical results and the effectiveness of the proposed algorithm.

Heat kernel estimates for Markov processes with jump kernels blowing-up at the boundary

宋仁明 *University of Illinois Urbana-Champaign*

摘要: In this talk, I will present some recent results about purely discontinuous symmetric Markov processes on closed subsets of $\mathbb{R}^d$, $d \geq 1$, with jump kernels of the form $J(x,y) = |x-y|^{-d-\alpha}\mathcal{B}(x,y)$, $\alpha \in (0,2)$, where the function $\mathcal{B}(x,y)$ may blow up at the boundary of the state space.

Examples of Markov processes that fall into our general framework include traces of isotropic α-stable processes in $C^{1,\mathrm{Dini}}$ sets, processes in Lipschitz sets arising in connection with the

nonlocal Neumann problem, and a large class of resurrected self-similar processes in the closed upper half-space.

Our main results are sharp two-sided heat kernel estimates for these Markov processes. A fundamental difficulty in accomplishing this task is that, in contrast to the existing literature on heat kernels for jump processes, the tails of the associated jump measures in our setting are not uniformly bounded.

Thus, standard techniques in the existing literature used to study heat kernels are not applicable.To overcome this obstacle, we employ recently developed weighted functional inequalities specifically designed for jump kernels blowing up at the boundary. This talk is based on a joint paper with Soobin Cho, Panki Kim and Zoran Vondracek.

Nonlinear functional inequalities for ergodicity rate of generalized porous media equations

王凤雨 天津大学

摘要: We introduce several nonlinear functional inequality to characterize different type convergence rates of generalized porous media equations, and present criteria to verify these inequalities. Some concrete examples are presented to verify the main results. The talk is based on an ongoing joint work with Xing Huang and Michael Rockner.

Exponential ergodicity of Stochastic Evolution Equations with reflection

张土生 中国科学技术大学

摘要: In this paper, we establish an exponential ergodicity for stochastic evolution equations with reflection in an infinite dimensional ball. As an application, we obtain the exponential ergodicity of stochastic Navier-Stokes equations with reflection. A coupling method plays an important role.

Quantile Markov decision processes in continuous space

陈娴 厦门大学

摘要: The quantile, also known as Value-at-Risk (VaR), is one of the most natural and widely adopted measures of risk. We establish a quantile decomposition theorem using conditional quantiles and derive both the quantile dynamic programming and nested quantile dynamic programming formulations over Borel state. As an application, we apply our quantile dynamic programming framework to an optimal execution problem. This is a joint work with Erick Delage and Weikai Wang.

Coupling between Brownian motion and random walks on the infinite percolation cluster

顾陈琳 清华大学

摘要: For the supercritical Z^d-Bernoulli percolation ($d \geqslant 2$), we give a coupling between the random walk on the infinite cluster and its limit Brownian motion, such that the typical distance between the paths during $[0, T]$ is of order $T^{1/3+o(1)}$. This partially answers an open question posed by Biskup [Probab. Surv., 8:294-373, 2011]. The construction of the coupling utilizes the optimal transport tool, and the analysis relies on local CLT and percolation density concentration. As an application, our result implies the law of the iterated logarithm proved by Duminil-Copin [arXiv:0809.4380], and further identifies the limit constant. This talk is based on a joint work with Zhonggen Su and Ruizhe Xu.

Random core partitions: limiting distributions and concentration inequalities

李建阁 哈尔滨工业大学

摘要: Random partitions are a well-studied subject, with deep connections to random matrix theory, mathematical physics, and other fields. In contrast, our understanding of random core

partitions remains limited. In this talk, we establish the asymptotic normality of key statistics for uniformly random core partitions with bounded perimeters in both Kolmogorov and Wasserstein W_1 distances. Our proof integrates a variety of combinatorial and probabilistic tools, including Stein's method via the Hoeffding decomposition, the combinatorial central limit theorem, the Efron-Stein inequalities on product spaces and slices, and asymptotics of Polya frequency sequences. Moreover, our approach may extend to proving asymptotic normality for functionals of random variables with specific global dependence structures that admit a suitable mixture decomposition. (Joint work with Y. Sha and H. Xiong).

Uniform ergodicity for a stochastic Lotka–Volterra type population system

李培森 北京理工大学

摘要: We introduce a class of continuous-state branching processes immigration, predation and competition, which can be viewed as a combination of the classical Lotka-Volterra model and continuous-state branching processes with competition introduced by Berestycki, Fittipaldi, and Fontbona (Probab. Theory Relat. Fields, 2018). This model can be constructed as the unique strong solution to a class of two-dimensional stochastic differential equations with jumps. We establish sharp conditions for the uniform ergodicity in the total variation of this model. Our proof relies on a novel, localized Markov coupling approach, which is of its own interest in the ergodicity theory of Markov processes with interactions.

Mean field stochastic partial differential equations with nonlinear kernels

李石虎 江苏师范大学

摘要: This talk focuses on the mean field stochastic partial differential equations. We first show the existence and uniqueness of solutions for mean field stochastic partial differential equations in the variational framework, then establish the convergence of the empirical laws of interacting systems to the law of solutions of mean field equations. As applications, we study a class of interacting particle systems with polynomial kernels, which are widely encountered in fields such as the data science and the machine learning.

Deviation probabilities and convergence rate for extreme eigenvalues of large chiral random matrices

马宇韬 北京师范大学

摘要: Consider the large chiral random matrices X_n with parameter v and n. We give deviation probabilities and convergence rates for both spectral radius and rightmost eigenvalues of X_n.

Stochastic reaction-diffusion equations with super-linear drift

尚世界 中国科学技术大学

摘要: In this talk, we consider the stochastic reaction-diffusion equations with logarithmic super-linear drift, driven by Brownian motion or space-time white noise. We will present recent progress on the global existence and uniqueness of solutions to these equations on both bounded and unbounded domains.

On the subcritical self-catalytic branching Brownian motions

孙振尧 北京理工大学

摘要: The self-catalytic branching Brownian motions (SBBM) are extensions of the classical one-dimensional branching Brownian motions by incorporating pairwise branchings catalyzed by the intersection local times of the particle pairs. These processes naturally arise as the moment duals of certain reaction-diffusion equations perturbed by multiplicative space-time white noise. For the subcritical case of the catalytic branching mechanism, we construct the SBBM allowing an infinite number of initial particles. Additionally, we establish the coming down from infinity (CDI) property for these systems and characterize their CDI rates. This is based on a joint work with Haojie Hou.

Relative entropy methods for mean-field limits: quantitative chaos beyond exchangeability

王振富 北京大学

摘要: I will present a relative-entropy framework for deriving quantitative mean-field limits and propagation of chaos for interacting particle systems by controlling the entropy between the N-particle joint law and a suitably chosen tensorized (or partially tensorized) reference flow. The approach yields convergence for rough and even singular interactions, building on entropy-based chaos estimates. I will then highlight recent developments for non-exchangeable systems.

Mean-field BSDEs with quadratic growth：theory and applications

温家强 南方科技大学

摘要: In this talk, I will present some of our recent works on general mean-field backward stochastic differential equations (BSDEs) with quadratic growth, including theoretical results on existence, uniqueness, comparison theorems, and applicational results on particle systems, stochastic optimal control problems, utility maximization problems, and PDEs.

SDE driven by multiplicative cylindrical α-stable noise with distributional drift

吴明燕 厦门大学

摘要: In this talk, we will introduce the following stochastic differential equation driven by a non-degenerate symmetric α-stable process in $\mathbb{R}^d$ with $\alpha \in (1,2)$:

$$\mathrm{d}X_t = b(t, X_t)\mathrm{d}t + \sigma(t, X_{t-})\mathrm{d}L_t^{(\alpha)}, \quad X_0 = x \in \mathbb{R}^d,$$

where b belongs to $L^\infty(\mathbb{R}_+; \mathbf{C}^{-\beta}(\mathbb{R}^d))$ with some $\beta \in (0, \alpha - 1)$, and $\mathbf{C}^\beta$ denotes a Besov space. The coefficient $\sigma : \mathbb{R}_+ \times \mathbb{R}^d \to \mathbb{R}^d \otimes \mathbb{R}^d$ is a measurable matrix-valued function. The noise $L_t^{(\alpha)} = (L_t^{(\alpha),1}, ..., L_t^{(\alpha),d})$ consists of independent 1-dimensional symmetric α-stable processes,

and is referred to as a cylindrical α-stable process. We will present the well-posedness result of weak solutions to the SDE, and provide quantitative stability estimates with respect to the drift coefficients. This is a joint work with Zimo Hao.

Conditioned local limit theorems for products of random matrices

肖惠 中国科学院数学与系统科学研究院

摘要: In this talk, we begin by presenting new results on Gaussian heat kernel approximations for the persistence probability in the classical setting of sums of independent and identically distributed real-valued random variables. We then show some recent progress on conditioned local limit theorems for products of random matrices. In this setting, the proof requires the construction of a target harmonic measure, which is a key element in formulating the local limit theorem for conditioned random walks on linear groups. The main difficulty arises from analyzing the reversed random walk, whose increments depend on the entire future trajectory in the context of random walks on linear groups. To address this difficulty, we introduce a reversed sequence that can be described as a dual random walk perturbed by future observations, and develop an approach based on the finite-size approximation of these perturbations.

Uniform in time diffusion approximation and applications

解龙杰 江苏师范大学

摘要: We establish a uniform in time diffusion approximation for the joint distribution of the fully coupled multi-scale stochastic system with irregular coefficients. As a direct application, we obtain the explicit characterization of the limit of invariant measure of the original multi-scale system. As a second application, we derive an formula for the entropy production in the small mass limit of the degenerate Langevin dynamic, and the entropy anomaly is rigorously proved. As a third application, we prove a uniform in time homogenization for solutions of second order PDEs.

Cancellations in interface motion problem of the 1D stochastic Allen-Cahn equation

许惟钧 西湖大学

摘要: We consider two types of stochastic perturbations to the one dimensional Allen-Cahn equation, one with spacetime white noise, and the other with more singular noise. In both models, the interface location, when suitably rescaled, converges to a diffusion process on the real line. Cancellations play important roles in both models, but they happen in very different manners.

Based on joint works with Wenhao Zhao and Shuhan Zhou.

Optimal decay of eigenvector overlap for non-Hermitian random matrices

许媛媛 中国科学院数学与系统科学研究院

摘要: We consider the standard overlap of any bi-orthogonal family of left and right eigenvectors of a large random matrix with centred i.i.d. entries and we prove that it decays as an inverse second power of the distance between the corresponding eigenvalues. This extends similar results for the complex Gaussian ensemble from Bourgade and Dubach, as well as Benaych-Georges and Zeitouni, to any i.i.d. matrix ensemble in both symmetry classes. Based on a joint work with Giorgio Cipolloni and Laszlo Erdos.

Extinction, explosion and contraction for time-inhomogeneous SDEs with jumps

杨叙 北方民族大学

摘要: For a class of time-inhomogeneous SDEs with jumps, we establish criteria for the existence and uniqueness of the nonnegative solutions, and examine the extinction,the explosion together with the contractivity of the solutions, which generalize and improve upon earlier results in the literature. As an application, we study the aforementioned properties for a class of mean field SDEs. This talk is based on a joint work with Shukai Chen and Xiaowen Zhou.

Strong and weak convergences of noncommutative rational functions in random matrices

尹晟 哈尔滨工业大学

摘要: It is well-known that many random matrices have asymptotical limits which can be described by free probability. Those results usually use noncommutative polynomial as the test functions. In this talk, we will present a natural extension of the test functions to a larger class. Namely, we will consider the convergence of noncommutative rational functions evaluated at certain random matrices towards the corresponding evaluations at limit random variables.

In the case that random matrices have a strong convergent limit, the extension to rational functions can be done by the linearization combing with a control on norm. Furthermore, the convergence of norm can be shown to be preserved. In the case that random matrices may not strongly converge but converge in distribution, we will show that they still weakly converge for rational functions. Our approach builds on the control of cumulative functions by the rank of random variables.

Berry-Esseen bounds for functionals of independent random variables

张卓松 南方科技大学

摘要: We develop a new Berry–Esseen bound for functionals of independent random variables by introducing a simple form of Chatterjee's perturbative approach. The main result is applied to the weighted triangle counts in inhomogeneous random graphs, random field Curie–Weiss model, set approximation with random tessellations and random sphere of influence graph models. The rate of convergence is the best possible. This is a joint work with Qi-Man Shao.

Non-local operators with low singularity kernels

赵国焕 中国科学院数学与系统科学研究院

摘要: We consider a class of non-local operators whose jump kernels arise from Lévy processes with only low-order singularities near the origin, lacking standard scaling properties. The aim of this work is twofold. First, we introduce generalized Orlicz–Besov spaces that are specifically tailored to the analysis of elliptic equations associated with such operators, and we establish regularity results for the corresponding solutions within this framework. Second, we investigate the martingale problem related to these operators. By employing the analytic results, we prove the well-posedness of the martingale problem under mild conditions. Finally, we derive a new Krylov-type estimate for the martingale solutions by means of a Morrey-type inequality in the setting of generalized Orlicz–Besov spaces. This talk is based on joint work with Eryan Hu.
