

# Workshop on Measure-Valued Markov Processes and Related Topics

December 28-29, 2025

Beijing Institute of Technology

## Scientific Committee:

Tadahiro OH (The University of Edinburgh)

任艳霞 (北京大学)

宋仁明 (University of Illinois at Urbana-Champaign)

张希承 (北京理工大学)

朱蓉禅 (北京理工大学)

**Organizers:** 侯浩杰、孙振尧、杨婷 (北京理工大学)

- **Hotel:** 铂斯雅致酒店 (入住时间: 14:00 以后; 退房时间: 12:00 以前)  
地址: 北京市房山区阳光北大街 101 号院 1 号
- **Venue:** 北京理工大学良乡校区东校区文萃楼 E, 7 楼报告厅

2025年12月28日（周日）			
时间	报告人	报告题目	主持人
09:00-9:45	赵国焕	Non-local operators with low singularity kernels	
9:45-10:30	杨叙	Extinction behaviours for the mutually interacting continuous-state population dynamics	张希承
10:30-10:45	茶歇与自由讨论		
10:45-11:30	陈娴	A variational formula for discrete-time Markov control processes under risk-sensitive average reward criterion	宋仁明
11:30-14:00	拍照、午餐（东校区食堂二楼自助区）		
14:00-14:45	张蕊	Large deviations and almost sure convergence for the extremes of branching Lévy processes	刘勇
14:45-15:30	刘会利	Speed of coming down from infinity for Lambda-Fleming-Viot initial support	
15:30-16:00	茶歇与自由讨论		
16:00-16:45	Tadahiro Oh	Probabilistic well-posedness of dispersive PDEs beyond variance blowup	许惟钧
17:45-20:00	晚宴（洋森家宴，地址：房山区拱辰街道梅花桩东1号商业楼）		

2025年12月29日（周一）			
时间	报告人	报告题目	主持人
09:00-9:45	朱雅萍	Asymptotic behaviors of the maximal displacement for critical branching random walk in $\mathbb{R}^d$	蒋达权
9:45-10:30	杨帆	From multitype branching Brownian motions to branching Markov additive processes	
10:30-10:45	茶歇与自由讨论		
10:45-11:30	洪杰梁	Regularity of local times of super $\alpha$ -stable motion	任艳霞
11:30-14:00	午餐（东校区食堂二楼自助区）		

## ABSTRACT

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### A variational formula for discrete-time Markov control processes under risk-sensitive average reward criterion

陈娴 厦门大学, E-mail: chenxian@xmu.edu.cn

**Abstract:** We study the risk-sensitive average reward criterion for discrete-time Markov control processes. The state space is a Borel space and the reward function can be unbounded. We prove the existence of a solution to the risk-sensitive average reward optimality equation and the existence of an optimal stationary policy via a new technique of constructing an approximating sequence of coercive reward functions and introducing the split chain. Moreover, we develop a new approach to obtain a variational formula for the risk-sensitive average reward criterion without the compactness condition on the state space in the existing literature.

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### Regularity of local times of super $\alpha$ -stable motion

洪杰梁 南方科技大学, E-mail: hongjl@sustech.edu.cn

**Abstract:** Let  $\alpha \in (0, 2]$ . We study the superprocess  $X$  on  $R^d$  with  $\alpha$ -stable spatial motion and quadratic branching mechanism. When the local time,  $L(t, x)$ , of  $X$  exists in dimensions  $d < 2\alpha$ , we prove a sufficient and necessary condition for the joint continuity of  $L(t, x)$  in  $(t, x)$ , thus completely characterizing the continuity properties of the local time. Besides, when  $d = 1$  and  $\alpha \in (\frac{3}{2}, 2]$ , we further show that the local time  $L(t, x)$  is continuously differentiable in the spatial variable  $x$ , whose derivative is locally Hölder continuous with any index  $\gamma \in (0, \alpha - \frac{3}{2})$ .

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### Speed of coming down from infinity for Lambda-Fleming-Viot initial support

刘会利 河北师范大学, E-mail: liuhuili@hebtu.edu.cn

**Abstract:** The Lambda-Fleming-Viot process is a probability measure-valued process that is dual to a Lambda-coalescent that allows multiple collisions. In this paper, we consider a class of Lambda-Fleming-Viot processes with Brownian spatial motion and with associated Lambda-coalescents that come down from infinity. Notably, these processes have the compact support property: the support of the process becomes finite as soon as  $t \downarrow 0$ , even though the initial measure has unbounded support. We obtain asymptotic results characterizing the rates at which the initial supports become finite. The rates of coming down are expressed in terms of the asymptotic inverse function of the tail distribution of the initial measure and the speed function of coming down from infinity for the corresponding Lambda-coalescent.

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## Probabilistic well-posedness of dispersive PDEs beyond variance blowup

Tadahiro OH *The University of Edinburgh*, E-mail: hiro.oh@ed.ac.uk

**Abstract:** Over the last two decades, there has been significant progress in probabilistic well-posedness theory of nonlinear dispersive PDEs with random initial data. In recent years, several examples of “variance blowup” for equations with quadratic nonlinearities have been observed, where the construction of basic stochastic objects breaks down before reaching the limit of the analytical framework. In the study of stochastic parabolic PDEs, such a variance blowup phenomenon has been observed for the fractional KPZ equation (with a noise rougher than a space-time white noise) and, in a recent work (2025), Hairer introduced a renormalization beyond variance blowup. In this talk, I will talk about a possible extension of probabilistic well-posedness theory of dispersive PDEs beyond variance blowup, taking the Benjamin-Bona-Mahony equation and the quadratic nonlinear wave equation as model examples, and show that these equations with renormalized (rough) Gaussian initial data converge in law to those with stochastic forcings. If time permits, I will discuss what happens in the KdV case.

This talk is based on joint works with Andreia Chapouto (Versailles), Guopeng Li (Beijing Institute of Technology), Jiawei Li (Edinburgh), Shao Liu (Bonn), and Nikolay Tzvetkov (ENS Lyon).

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## From multitype branching Brownian motions to branching Markov additive processes

杨帆 北京邮电大学, E-mail: fan-yang@bupt.edu.cn

**Abstract:** In this talk, we study a class of multitype branching Lévy processes, where particles move according to type-dependent Lévy processes, switch types via an irreducible Markov chain, and branch according to type-dependent laws. This framework generalizes multitype branching Brownian motions. Using techniques of Markov additive processes, we develop a spine decomposition. This approach further enables us to prove convergence results for the additive martingales and derivative martingales, and establish the existence and uniqueness of travelling wave solutions to the corresponding multitype FKPP equations. In particular, applying our results to the on-off branching Brownian motion model resolves several open problems posed by Blath et al. (2025). This talk is based on a joint work with Yutao Liang, Yanxia Ren and Quan Shi.

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## Extinction behaviours for the mutually interacting continuous-state population dynamics

杨叙 北方民族大学, E-mail: xuyang@mail.bnu.edu.cn

**Abstract:** In this talk we consider the systems of two stochastic differential equations (SDEs) with two-way interactions driven by Brownian motions and spectrally positive  $\alpha$ -stable random measures. Such SDEs system can be identified as a Lotka-Volterra type population models. We find some close to sharp conditions for the extinction behaviours. This talk is based on two recent joint works with Jie Xiong and Xiaowen Zhou.

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# Large deviations and almost sure convergence for the extremes of branching Lévy processes

张蕊 首都师范大学, E-mail: zhangrui27@cnu.edu.cn

**Abstract:** Suppose  $\{\mathbb{X}_t, t \geq 0\}$  is a supercritical branching Markov processes whose spatial motions are Lévy processes with regularly varying tails. We investigate the weak convergence of the extremes of  $\{\mathbb{X}_t, t \geq 0\}$ . We further establish the large deviation of  $\{\mathbb{X}_t, t \geq 0\}$  as well as some almost sure convergence results of the maximum of  $\mathbb{X}_t$ .

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# 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, E-mail: gzhaog@amss.ac.cn

**Abstract:** 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.

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# Asymptotic behaviors of the maximal displacement for critical branching random walk in $\mathbb{R}^d$

朱雅萍 上海财经大学, E-mail: zhuyaping@mail.sufe.edu.cn

**Abstract:** In this talk, we consider a discrete-time branching random walk (BRW) in  $\mathbb{R}^d$ , where each particle independently jumps to a new location according to a  $d$ -dimensional random variable  $\mathbf{X}$ , and then produces a random number of children. The offspring distribution is assumed to be critical, with mean one and finite variance. We investigate the asymptotic behavior of the tail distribution of the maximal distance from the origin ever visited by the BRW. In addition, we study the asymptotic behavior of the maximal displacement from the origin at time  $n$ , and establish a Yaglom-type conditional limit theorem. This is a joint work in progress with Haojie Hou.

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