The 12th Workshop on Branching Processes and Related Topics

TianYuan Mathematics Research Center, Yunnan, China
2026/11/16 – 2026/11/20

Time	Monday 11/16	Tuesday 11/17	Wednesday 11/18	Thursday 11/19	Friday 11/20
09:30-10:20	白天衣	张蕊	Grégoire Véchambre	肖胜	Guillaume Chevalier
10:20-10:50	Tea Break	Tea Break	Tea Break	Tea Break	Tea Break
10:50-11:40	罗亮晖	张树雄	Louis Chataignier	侯浩杰	危渝绍
12:00-15:00	Lunch	Lunch	Lunch	Lunch	Lunch
15:00-15:50	Discussion	Discussion	Discussion	Discussion	Discussion
15:50-16:20	Tea Break	Tea Break		Tea Break	Tea Break
16:20-17:50	Discussion	Poster Session		Discussion	Discussion
18:00	Dinner	Dinner	Dinner	Dinner	Dinner

Titles and Abstracts

- **Bai, Tianyi 白天衣 (中国科学院数学与系统科学研究院)**

Recent progress on central limit theorem of critical branching random walks

Abstract:

This talk is about recent progress on central limit theorem for the range of a critical branching random walk (CBRW) in $\mathbb{Z}^d$ conditioned to be infinite.

We first present our work arxiv2511.17101, which partially solves the problem under the restriction of dimension and offspring distribution, based on the method of stationary ergodic process and moment estimates. Then we will introduce some AI-aided improvements that extend the result to general cases, and briefly discuss the heuristics behind them.

This talk is based on the joint work with Yueyun Hu.

- **Chataignier, Louis (中国科学院数学与系统科学研究院)**

Path localisation for the derivative martingale of branching Brownian motion

Abstract:

A key tool for studying branching Brownian motion is the family of so-called additive martingales. They describe the typical size of the population in a given direction. Notably, their study yields a law of large numbers for the maximal displacement. To understand the asymptotic behaviour of the latter more finely, another object is particularly relevant, that is, the derivative martingale. In this talk, after introducing the fundamental properties of these martingales, I will present a joint work with Gabriel Flath and Julien Berestycki in which we establish an almost sure path localisation of the particles giving weight to the derivative martingale.

- **Chevalier, Guillaume (中国科学院数学与系统科学研究院)**

TBA

Abstract:

TBA

- **Hou, Haojie 侯浩杰 (南开大学)**

On the maximal displacement of subcritical branching random walks with stretched exponential tail

Abstract:

We study the maximal displacement of a one-dimensional subcritical branching random walk with offspring distribution $\{p_k\}$ and step size X such that $m := \sum_{k=1}^{\infty} k\, p_k \in (0,1)$. Let M_n denote the maximal position of all particles alive at time n and let $M := \sup_{n\in\mathbb{N}} M_n$. First, we show that

$$\lim_{x\to+\infty} \frac{e^{\lambda x^b}}{\ell(x)x^a}\, \mathbb{P}(M > x) = \frac{1-p_0}{1-m}$$

whenever $\mathbb{P}(X > x) = \ell(x)x^a e^{-\lambda x^b}$ for some slowly varying function ℓ, $b \in [0,1)$, and

under further assumptions on a. Next, we prove that

$$\lim_{x\to+\infty}\frac{e^{\lambda x^b+\gamma x}}{\ell(x)x^a}\,\mathbb{P}(M>x) \quad \text{exists and belongs to } (0,\infty)$$

provided that $\sum_{k=1}^{\infty} k\,(\log k)p_k<\infty$ and for some $x_*>0$, $\mathbb{P}(X>x)=\int_x^{\infty}\ell\,(y)y^a e^{-\lambda y^b-\gamma y}\,\mathrm{d}y$ for all $x>x_*$. Here, ℓ is a slowly varying function, $m\mathbb{E}(e^{\gamma X})<1$, $b\in[0,1)$, and a satisfies certain conditions.

- **Luo, Lianghui 罗亮晖 (南方科技大学)**

the extremal process of two-speed branching random walk

Abstract:

We consider a two-speed branching random walk, which consists of two macroscopic stages with different reproduction laws. We prove that the centered maximum converges in law to a Gumbel variable with a random shift and the extremal process converges in law to a randomly shifted decorated Poisson point process, which can be viewed as a discrete analog of the corresponding results for the two-speed branching Brownian motion, previously established by Bovier and Hartung (2014)

- **Wei, Yushao 危渝绍 (湖南第一师范学院)**

Precise Convergence Rates and Non-Uniform Berry-Esseen Bounds for Multi-Type Branching Processes

Abstract:

We study a supercritical multi-type branching process in an i.i.d. random environment. This talk will present recent progress on two aspects: the non-uniform Berry-Esseen bounds for the population size, and the precise convergence rates within the framework of the central limit theorem. The proofs rely on the Perron-Frobenius theory for products of positive random matrices and the harmonic moments of the fundamental martingale to control tail probabilities.

- **Véchambre, Grégoire (中国科学院数学与系统科学研究院)**

Stochastic flows and Poisson representations for the block masses of the Λ-coalescent with dust : moment asymptotics and large deviation estimates

Abstract:

The Λ-coalescent describes the genealogy of populations with multiple mergers, and is connected to branching processes through the genealogy of continuous-state branching processes and of Fleming-Viot flows. We focus on the case with dust, where the long-time behaviour of the block masses is more subtle than without dust. Using a stochastic flow of inverses, we obtain Poisson representations of the ordered block masses as stochastic integrals, which makes stochastic calculus available in this setting. As an application, we derive the exponential decay rates of the moments of the block masses, which exhibit a cutoff phenomenon linked to the dust, and deduce a law of large numbers and large deviation principles for the mass of the largest block.

- **Xiao Sheng 肖胜 (湖南第一师范学院)**

Moments and Convergence Rates for Multitype Branching Processes in Random Environments

Abstract:

In this talk, we discuss moment properties and convergence rates of supercritical multitype branching processes in i.i.d. random environments. We first present the exponential convergence of the fundamental martingale in quenched L^{α}, identifying the critical rate $e^{\gamma/2}$, where γ is the Lyapunov exponent of the mean matrix products. We then show that the naturally normalized population components also converge exponentially, but their rates may differ from that of the fundamental martingale. Finally, we discuss the existence of weighted moments of the martingale limit under both the quenched and annealed laws, focusing on moments of the form $\phi(x) = x^{\alpha}\ell(x)$, where ℓ is slowly varying at infinity. The proofs rely on the double martingale structure of the fundamental martingale. This is joint work with Yingqiu Li and Yushao Wei.

- **Zhang Rui 张蕊 (首都师范大学)**

Extremes of spatially inhomogeneous branching L\'evy processes with regularly varying tails

Abstract:

We consider a class of general supercritical branching L'evy processes whose branching mechanism is governed by an additive functional. We develop an approach to derive the principal eigenvalue of the mean semigroup $\mathbb{M}_t$ and its corresponding eigenfunction. When the spatial motion has regularly varying tails, we prove that, under appropriate normalization, the process $\mathbb{X}_t$ converges weakly to a nontrivial random measure. We further establish large deviation results for $\mathbb{X}_t$.

- **Zhang Shuxiong 张树雄 (安徽师范大学)**

A large-deviation principle for the empirical distribution of a regular branching random walk

Abstract:

Let $\{Z_n\}_{n\geq 0}$ be a supercritical branching random walk with deterministic rooted b-ary tree, $b \geq 2$, and symmetric displacements satisfying $\lim_{x\to+\infty} x^{-\alpha}\log\mathbb{P}(X > x) = -\lambda$ with $\alpha, \lambda > 0$. Set $\overline{Z}_n(\cdot) := Z_n(\cdot)/Z_n(\mathbb{R})$, $n \geq 0$. For a finite union A of intervals, we establish the following full large-deviation principle: for every Borel set $\Gamma \subset [0,1]$,

$$\begin{aligned} -\inf_{q\in\Gamma^{\circ}} Q_A(q) &\leq \liminf_{n\to\infty} n^{-\alpha/2}\log\mathbb{P}\big(\overline{Z}_n\big(\sqrt{n}\,A\big) \in \Gamma\big) \\ &\leq \limsup_{n\to\infty} n^{-\alpha/2}\log\mathbb{P}\big(\overline{Z}_n\big(\sqrt{n}\,A\big) \in \Gamma\big) \\ &\leq -\inf_{q\in\overline{\Gamma}} Q_A(q), \end{aligned}$$

where Q_A is a good rate function on $[0,1]$. Meanwhile, we obtain large deviation probabilities for $\{\overline{Z}_n\big(\sqrt{n}\,A\big)\}_{n\geq 1}$. This strengthens the nonmatching upper and lower bounds obtained by Chen and He [Probab. Theory Related Fields 175 (2019) 255-307] for regular

trees with Weibull displacements. Our method combines a large-deviation principle for rescaled displacement tree fields and exponential equivalence..