The 5th Workshop on Branching Processes and Related Topics

June 22–26, 2019

No. 1124 Lecture room on the 11th floor, New Library Building (后主楼)
Beijing Normal University

Organizers: Romain Abraham (Université d'Orléans, France)
Andreas Kyprianou(Univeristy of Bath, UK)
Zenghu Li (Beijing Normal University, PRC)

Supported by National Natural Science Foundation of China
Fund for First-Class Discipline of Beijing Normal University

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Time/Date	June 22	June 23	June 24	June 25	June 26
08:50-09:00	**Opening**				
Chairman	**Z. H. Li**	**A. Kyprianou**	**J. C. Pardo**	**L. Menard**	**E. Horton**
09:00-09:40	B. Mallein	E. Schertzer	A. Winter	R. Abraham	Y. X. Ren
09:40-10:20	P. Andreoletti	A. Watson	G. B. Ojeda	H. He	C. H. Ma
10:20-11:00	Tea break	Take picture	Tea break	Tea break	Tea break
Chairman	**M. Zhang**	**X. W. Zhou**	**A. Winter**	**E. Powell**	**R. Zhang**
11:00-11:40	X. X. Chen	S. Lin	J. C. Pardo	W. M. Hong	E. Horton
11:40-14:30	Lunch Time				
Chairman	**B. Mallein**	**E. Schertzer**		**R. Abraham**	**Y. X. Ren**
14:30-15:10	E. Aidekon	A. Kyprianou	Discussion Time	L. Menard	S. Palau
15:10-15:50	Q. Shi	S. Hautphenne		M. M. Wang	R. Zhang
16:00-16:30	Tea break	Tea break		Tea break	Tea break
Chairman	**H. He**	**S. Lin**		**W. M. Hong**	**E. Horton**
16:30-17:10	M. Zhang	X. W. Zhou		E. Powell	L. M. Wang
17:10-17:50	X. Yang	P. S. Li		M. Pain	Z. H. Li
17:50-19:00	Dinner Time				

June 22

08:50-09:00 **OPENGING**

Chairman: Zenghu Li

09:00-09:40 Bastien Mallein (Université Paris XIII, France)

Convergence of biggins' martingales in branching Lévy processes

09:40-10:20 Pierre Andreoletti (Université d'Orléans, France)

Valleys of branching potentials and the biased random walks on trees

10:20-11:00 Tea break

Chairman: Mei Zhang

11:00-11:40 Xinxin Chen (Université Claude Bernard Lyon 1, France)

Edge local times of randomly biased random walk on trees

Chairman: Bastien Mallein

14:30-15:10 Elie Aidekon (Sorbonne Université, France)

A growth fragmentation embedded in the planar Brownian excursion

15:10-15:50 Xu Yang (North Minzu University, PRC)

On the extinction-extinguishing for a stochastic Lotka-Volterra type population dynamical system

16:00-16:30 Tea break

Chairman: Xinxin Chen

16:30-17:10 Mei Zhang (Beijing Normal University, PRC)

Subcritical branching processes in random environment with immigration stopped at zero

17:10-17:50 Quan Shi (Univeristy of Mannheim, Germany)

The derivative martingale in a branching Lévy process

June 23

Chairman: Andreas Kyprianou

09:00-09:40 Emmanuel Schertzer (Sorbonne Université, France)

A coagulation-transport equation and the nested Kingman coalescent

09:40-10:20 Alexander Watson (University of Manchester, UK)

Long-term behaviour of growth-fragmentation processes

10:20-11:00 Take picture

Chairman: Xiaowen Zhou

11:00-11:40 Shen Lin (Sorbonne Université (Paris VI), France)

Continuum tree limit for the trace of branching random walk on trees

Chairman: Emmanuel Schertzer

14:30-15:10 Andreas Kyprianou (Univeristy of Bath, UK)

Skeletal stochastic differential equations for superprocesses

15:10-15:50 Sophie Hautphenne (University of Melbourne, Australia)

The probabilities of extinction in a branching random walk on a strip

16:00-16:30 Tea break

Chairman: Shen Lin

16:30-17:10 Xiaowen Zhou (University of Concordia, Canada)

The explosion of time-changed spectrally positive Lévy processes

17:10-17:50 Pei-Sen Li (Renmin University of China, PRC)

Ergodicity for Continuous-State nonlinear branching process via coupling

June 24

Chairman: Juan Carlos Pardo

09:00-09:40 Antia Winter (University of Duisburg-Essen, Germany)

The α-Ford chain on cladograms in the diffusion limit

09:40-10:20 Gabriel Berzunza Ojeda (University of Uppsala, Sweden)

The pruning process on Galton-Watson trees

10:20-11:00 Tea break

Chairman: Antia Winter

11:00-11:40 Juan Carlos Pardo (CIMAT, Mexico)

A pathwise approach to branching processes with pairwise interaction

14:30-17:50 Discussion Time

June 25

Chairman: Laurent Menard

09:00-09:40	Romain Abraham (Université d'Orléans, France)
	The ancestral process of a large stationary population
09:40-10:20	Hui He (Beijing Normal University, PRC)
	Lower deviation and moderate deviation probabilities for maximum of a branching random walk
10:20-11:00	Tea break

Chairman: Ellen Powell

11:00-11:40	Wenming Hong (Beijing Normal University, PRC)
	Asymptotic behaviour of heavy-tailed branching processes in random environments

Chairman: Romain Abraham

14:30-15:10	Laurent Ménard (Université Paris-Nanterre, France)
	Random triangulations coupled with an ising model
15:10-15:50	Minmin Wang (University of Sussex, UK)
	Prunings, cut trees and the reconstruction problem
16:00-16:30	Tea break

Chairman: Wenming Hong

16:30-17:10	Ellen Powell (ETH Zürich, Swiss)
	Conformal welding for critical liouville quantum gravity
17:10-17:50	Michel Pain (ENS de Paris, France)
	Derrida-Retaux model : from discrete to continuous time

June 26

Chairman: Emma Horton

09:00-09:40 Yanxia Ren (Peking University, PRC)

Stable Central Limit Theorems for Super Ornstein-Uhlenbeck processes

09:40-10:20 Chunhua Ma (Nankai University, PRC)

Coalescences in Continuous-State Branching Processes

10:20-11:00 Tea break

Chairman: Rui Zhang

11:00-11:40 Emma Horton (Univeristy of Bath, UK)

Stochastic analysis of the neutron transport equation

Chairman: Yanxia Ren

14:30-15:10 Sandra Palau (UNAM, Mexico)

Law of large numbers for superprocesses with non-local branching

15:10-15:50 Rui Zhang (Capital Normal University, PRC)

The non-degenerate limit for supercritical superprocesses

16:00-16:30 Tea break

Chairman: Emma Horton

16:30-17:10 Longmin Wang (Nankai University, PRC)

Branching random walks on hyperbolic groups

17:10-17:50 Zenghu Li (Beijing Normal University, PRC)

Ergodicities and exponential ergodicities of Dawson-Watanabe type processes

THE ANCESTRAL PROCESS OF A LARGE STATIONARY POPULATION

Romain ABRAHAM *University of Orléans, France*, E-mail: romain.abraham@univ-orleans.fr

Abstract: A critical or sub-critical Lévy tree can be seen as the genealogical tree of a large population. Because of the (sub)-criticality, this population becomes instinct a.s. but a similar model with immigration (or equivalently with an immortal individual) can be introduced so that the population size has a stationary distribution.

The ancestral process describes the genealogy of the ancestors of the extant individuals at some fixed time. We give here a complete description of this ancestral process in the case of a quadratic branching mechanism together with a description of the genealogy of n individuals picked uniformly at random.

We also give partial results in the case of a stable branching mechanism.

A GROWTH FRAGMENTATION EMBEDDED IN THE PLANAR BROWNIAN EXCURSION

Elie AIDEKON *Sorbonne Université, France*, E-mail: elie.aidekon@upmc.fr

Abstract: We consider a Brownian excursion from 0 to 1 in the upper half-plane. It (possibly) makes excursions above the horizontal line of height $t > 0$, and for each such excursion, we record the difference between its ending point and its starting point. Hence for each t, we have a collection of real numbers. We show that the process indexed by t is a growth-fragmentation process that we characterize. Joint work with William Da Silva.

VALLEYS OF BRANCHING POTENTIALS AND THE BIASED RANDOM WALKS ON TREES

Pierre ANDREOLETTI *Université d'Orléans, France*, E-mail: pierre.andreoletti@univ-orleans.fr

Abstract: I focus on some properties of branching environments which have important influence on the behavior of the associated randomly biased random walk. In particular I discuss about regular fluctuations of the valleys of the environment implying global behavior for the walk and what we can expect when considering extreme (visited) fluctuations. My approach will be naive starting with intuitive ideas coming from one dimensional random walk in random environment.

EDGE LOCAL TIMES OF RANDOMLY BIASED RANDOM WALK ON TREES

Xinxin CHEN *University Lyon 1, France*, E-mail: xchen@math.univ-lyon1.fr

Abstract: We consider a recurrent random walk on trees for which the environment is given by a branching random walk. In the diffusive or sub-diffusive case, we study the edge local times

up to the n-th return to the root and obtain, under the annealed and quenched probability, the asymptotical behaviours of the largest edge local time and that of the number of edges visited at least n^θ times, as well as the effective conductance of the corresponding electrical network.

THE PROBABILITIES OF EXTINCTION IN A BRANCHING RANDOM WALK ON A STRIP

Peter Braunsteins *The University of Melbourne, Australia*
Sophie HAUTPHENNE *The University of Melbourne, Australia*, E-mail: sophiemh@unimelb.edu.au

Abstract: We consider a class of multitype Galton-Watson branching processes with countably infinite type set $\mathcal{X}$ whose mean progeny matrices have a block lower Hessenberg form. For these processes, we derive partial and global extinction criteria. Our approach involves embedding a finite-type explosive Galton-Watson process in a varying environment in the original infinite-type process, and then establishing asymptotic relationships between the two processes. We study the probability of extinction in sets of types $A \subseteq \mathcal{X}$, q(A). In particular, we develop conditions for q(A) to be different from the global and partial extinction probability vectors. We present an iterative method to compute the vectors q(A), and investigate their location in the set of fixed points of the progeny generating vector. Finally, we extend some of these results to branching random walks on a tree.

LOWER DEVIATION AND MODERATE DEVIATION PROBABILITIES FOR MAXIMUM OF A BRANCHING RANDOM WALK

Hui HE *Beijing Normal University, China*, E-mail: hehui@bnu.edu.cn

Abstract: Given a super-critical branching random walk on real line started from the origin, let M_n be the maximal position of individuals at the n-th generation. Under some mild conditions, it is known from Aïdékon (2013) that as $n \to \infty$, $M_n - x^*n + \frac{3}{2\theta^*}\log n$ converges in law for some suitable constants x^* and θ^*. In this work, we investigate its moderate deviation, in other words, the convergence rates of

$$P\left(M_n \leq x^*n - \frac{3}{2\theta^*}\log n - \ell_n\right),$$

for any positive sequence (ℓ_n) such that $\ell_n = O(n)$ and $\ell_n \uparrow \infty$. As a by-product, we obtain lower deviation of M_n; i.e., the convergence rate of

$$P(M_n \leq xn),$$

for $x < x^*$ in Böttcher case where the offspring number is at least two. We also apply our techniques to study the small ball probability of the limit of the so-called derivative martingale. Our results complete those in Hu (2016) and Gantert and Höfelsauer (2018). This talk is based on a joint work with Xinxin Chen.

ASYMPTOTIC BEHAVIOUR OF HEAVY-TAILED BRANCHING PROCESSES IN RANDOM ENVIRONMENTS

Wenming HONG *Beijing Normal University, China*, E-mail: wmhong@bnu.edu.cn

Abstract: Consider a heavy-tailed branching processes (denoted by Z_n) in random environments, under the condition which infers that $\mathbb{E}\log m(\xi_0) = \infty$. We show that (1) there exists no proper c_n such that $\{Z_n/c_n\}$ has a proper, non-degenerate limit; (2) normalized by a sequence of functions, a proper limit can be obtained, i.e., $y_n\left(\bar{\xi}, Z_n(\bar{\xi})\right)$ converges almost surely to a random variable $Y(\bar{\xi})$, where $Y \in (0,1)$ η-a.s.; (3) finally, we give a necessary and sufficient conditions for the almost sure convergence of $\left\{\frac{U(\bar{\xi}, Z_n(\bar{\xi}))}{c_n(\bar{\xi})}\right\}$, where $U(\bar{\xi})$ is a slowly varying function that may depends on $\bar{\xi}$. This is a joint work with Xiaoyue Zhang.

STOCHASTIC ANALYSIS OF THE NEUTRON TRANSPORT EQUATION

Emma HORTON *University of Bath, UK*, E-mail: elh48@bath.ac.uk

Abstract: The neutron transport equation (NTE) describes the net movement of neutrons through an inhomogeneous fissile medium, such as a nuclear reactor. One way to derive the NTE is via the stochastic analysis of a spatial branching process. This approach has been known since the 1960/70s, however, since then, very little innovation in the literature has e-merged through probabilistic analysis. In recent years, however, the nuclear power and nuclear regulatory industries have a greater need for a deep understanding the spectral properties of the NTE.

In this talk I will formally describe the dynamics of the so-called neutron branching process (NBP), along with an associated Feynman Kac representation. I will then discuss how the latter can be used to prove a Perron-Frö benius-type decomposition of the expectation semigroup using quasi-stationary methods.

Joint work with Alex M. G. Cox, Simon C. Harris, Andreas E. Kyprianou, Denis Villemonais and Minmin Wang.

SKELETAL STOCHASTIC DIFFERENTIAL EQUATIONS FOR SUPERPROCESSES

Andreas KYPRIAANOU *Univeristy of Bath, UK*, E-mail: a.kyprianou@bath.ac.uk

Abstract: It is well understood that a supercritical superprocess is equal in law to a discrete Markov branching process whose genealogy is dressed in a Poissonian way with immigration which initiates subcritial superprocesses. The Markov branching process corresponds to the ge-nealogical description of prolific individuals, that is individuals who produce eternal genealogical lines of decent, and is often referred to as the skeleton or backbone of the original superprocess. The Poissonian dressing along the skeleton may be considered to be the remaining non-prolific genealogical mass in the superprocess. Such skeletal decompositions are equally well understood for continuous-state branching processes (CSBP). In a previous article we developed an SDE

approach to study the skeletal representation of CSBPs, which provided a common framework for the skeletal decompositions of supercritical and (sub)critical CSBPs. It also helped us to understand how the skeleton thins down onto one infinite line of descent when conditioning on survival until larger and larger times, and eventually forever. Here our main motivation is to show the robustness of the SDE approach by expanding it to the spatial setting of superprocesses. This is joint work with Dorottya Fekete and Joaquin Fontbona.

ERGODICITIES AND EXPONENTIAL ERGODICITIES OF DAWSON–WATANABE TYPE PROCESSES

Zenghu LI *Beijing Normal University, China*, E-mail: lizh@bnu.edu.cn

Abstract: Under natural assumptions, we prove the ergodicities and exponential ergodicities in Wasserstein and total variation distances of Dawson–Watanabe superprocesses without or with immigration. The strong Feller property in the total variation distance is derived as a by-product. The key of the approach is a set of estimates for the variations of the transition probabilities. The estimates in Wasserstein distance are derived from an upper bound of the kernels induced by the first moment of the superprocess. Those in total variation distance are based on a comparison of the cumulant semigroup of the superprocess with that of a continuous-state branching process. The results improve and extend those of Stannat (J. Funct. Anal./Ann. Probab., 2003) and Friesen (arXiv, 2019). We also show a connection between the ergodicities of the associated immigration superprocesses and decomposable distributions.

ERGODICITY FOR CONTINUOUS-STATE NONLINEAR BRANCHING PROCESS VIA COUPLING

Pei-sen Li *Renmin University of China, China*, E-mail: peisenli@ruc.edu.cn

Abstract: We consider the unique nonnegative solution to the following SDE.

$$\begin{aligned} X_t = x + \int_0^t \gamma_0(X_s)\mathrm{d}s + \int_0^t \int_0^{\gamma_1(X_{s-})} W(\mathrm{d}s, \mathrm{d}u) \\ + \int_0^t \int_0^\infty \int_0^{\gamma_2(X_{s-})} z\tilde{N}(\mathrm{d}s, \mathrm{d}z, \mathrm{d}u), \end{aligned}$$

where $W(\mathrm{d}t, \mathrm{d}u)$ and $\tilde{N}(\mathrm{d}s, \mathrm{d}z, \mathrm{d}u)$ denote an Gaussian white noise and an independent compensated spectrally positive Poisson random measure, respectively, and γ_0, γ_1 and γ_2 are functions on $\mathbb{R}_+$ with both γ_1 and γ_2 taking nonnegative values. Intuitively, this process can be treated as a branching process with population-size-dependent branching rates and with competition. We establish the exponential convergence with respect to the Wasserstein distance and the total variation for the corresponding semigroup.

CONTINUUM TREE LIMIT FOR THE TRACE OF BRANCHING RANDOM WALK ON TREES

Shen LIN *Sorbonne Université, France*, E-mail: shen.lin@sorbonne-universite.fr

Abstract: On a d-ary tree we consider a "critically biased" branching random walk, whose genealogical structure is given by a critical Galton–Watson tree conditioned to have n vertices. We will show that, as $n \to \infty$, the trace of this branching random walk, appropriately rescaled as a weighted compact metric space, converges to a continuum random tree. Work in progress with Thomas Duquesne (Sorbonne Université) and Niccolò Torri (University Paris-Est Créteil).

COALESCENCES IN CONTINUOUS-STATE BRANCHING PROCESSES

Chunhua MA *Nankai University*, E-mail: mach@nankai.edu.cn

Abstract: Consider a continuous-state branching population constructed as a flow of nested subordinators. Inverting the subordinators and reversing time give rise to a flow of coalescing Markov processes (with negative jumps) which correspond to the ancestral lineages of individuals in the current generation. The process of the ancestral lineage of a fixed individual is the Siegmund dual process of the continuous-state branching process. We study its semigroup, its long-term behavior and its generator. In order to follow the coalescences in the ancestral lineages and to describe the backward genealogy of the population, we define non-exchangeable Markovian coalescent processes obtained by sampling independent Poisson arrival times over the flow. These coalescent processes are called consecutive coalescents, as only consecutive blocks can merge. They are characterized in law by finite measures on $\mathbb{N}$ which can be thought as the offspring distributions of some inhomogeneous immortal Galton-Watson processes forward in time. This is a joint work with Clément Foucart and Bastien Mallein.

CONVERGENCE OF BIGGINS' MARTINGALES IN BRANCHING LéVY PROCESSES

Jean Bertoin *Universität Zürich, Switzerland*
Alexander Iksanov *Taras Shevchenko National University of Kyiv, Ukraine*
Bastien MALLEIN *Université Paris 13, France*, E-mail: `mallein@math.univ-paris13.fr`

KEY WORDS: Branching Lévy processes, Biggins' martingale, spinal decomposition, Lévy-type perpetuities

Abstract: Branching Lévy processes are continuous-time particle systems satisfying the branching property, spatial invariance and an exponential integrability condition. Their laws are characterized by a triplet (σ^2, a, Λ), with $\sigma^2 \geq 0$, $a \in \mathbb{R}$ and Λ a sigma-finite measure on the space of point measures. We give necessary and sufficient conditions on this triplet for the a.s. and L^p convergence of Biggin's additive martingale, using the spinal decomposition as well as estimates on Lévy-type perpetuities.

References

[1] J. Bertoin & B. Mallein (2019). Infinitely ramified point measures and branching Lévy processes, *Annals of Probability*, **47**, 1619-1652.

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[4] B. Mallein & Q. Shi (2019+). Necessary and sufficient conditions for the non-triviality of the derivative martingale in a branching Lévy processes, *in preparation.*

RANDOM TRIANGULATIONS COUPLED WITH AN ISING MODEL

Laurent MÉNARD *Université Paris Nanterre, France*, E-mail: laurent.menard@normalesup.org

Abstract: Angel and Schramm proved in 2003, that uniform planar triangulations converge for the local topology. The limiting law, known as UIPT (for Uniform Infinite Planar Triangulation) has been much studied since and is now a well understood object. In this talk, we will study random triangulations with an Ising configuration sampled according to their energy and not the uniform measure. We will discuss how to extend the local convergence of Angel and Schramm to this model. The limiting object turns out to be much harder to study than the UIPT and is believed to belong to another universality class at criticality. This is a joint work with Marie Albenque and Gilles Schaeffer.

THE PRUNING PROCESS ON GALTON-WATSON TREES

Gabriel Hernan BERZUNZA OJEDA, *Uppsala University, Sweden.*
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Abstract: Aldous and Pitman (1998) introduced a tree-valued Markov chain by pruning off more and more sub-trees along the edges of a Galton-Watson tree. More generally, Abraham, Delmas and He (2012) defined a non-uniform pruning process on the branch points of a Galton-Watson tree. In the same spirit, some authors have considered the continuum tree analogues (i.e. Lévy trees) of pruning dynamics. The aim of this talk is to present a topology which allows to link the discrete and continuum tree-valued dynamics in order to show an invariance principle for the pruning process of Galton-Watson trees. Roughly speaking, we construct the pruning process on the space of so-called bi-measure trees, which are metric measure spaces with an additional pruning measure.

LAW OF LARGE NUMBERS FOR SUPERPROCESSES WITH NON-LOCAL BRANCHING

Sandra PALAU *UNAM, Mexico.* e-mail: sandra@sigma.iimas.unam.mx
Ting YANG *Beijing Institute of Technology, China.* e-mail: yangt@bit.edu.cn

Abstract: Intuitively, the law of large number tell us how fast the mass assigned to a compact set grows as time evolves. Here, we are going to study systems of particles with non-local branching and their limits; the superprocesses. For superprocesses, conditions for extinction and non-extinction and a law of large numbers are provided. Finally, we are going to analyse some examples.

A PATHWISE APPROACH TO BRANCHING PROCESSES WITH PAIRWISE INTERACTION

Juan Carlos PARDO *CIMAT*, E-mail: jcpardo@cimat.mx

Abstract: In this talk, we introduce a family of branching processes with pairwise interaction and study its longterm behaviour. A process of this type is a continuous time Markov chain where *natural births* and *natural deaths* both occur at rates proportional to the current population size but there are also additional births and deaths, due to cooperation and competition, that occur at a rate proportional to the square of the population size. This model can also be thought as the counting process of a particle system where particles may coalesce or fragment with or without collisions. In particular, we are interested on the events of *explosion* and *extinction*; and wether the process posses a stationary distribution or comes down from infinity. This is a joint work with Gabriel Berzunza.

DERRIDA-RETAUX MODEL : FROM DISCRETE TO CONTINUOUS TIME

Michel PAIN *ENS Paris, France*, E-mail: michel.pain@ens.fr

Abstract: Derrida-Retaux model is a simple hierarchical renormalization model [4], originally introduced by Collet et al. [3], that leads to many surprisingly tough questions. Some of them have been solved recently [1,2,6], but many others are still open. In order to answer these questions, with Yueyun Hu and Bastien Mallein [5], we introduced a continuous-time version of the model, which yields an exactly solvable family of solutions. We will discuss the results obtained on this model, focusing on the behavior at criticality, where a growth-fragmentation process appears as universal scaling limit.

References

[1] X. Chen, V. Dagard, B. Derrida, Y. Hu, M. Lifshits, Z. Shi (2019+). The Derrida-Retaux conjecture for recursive models, *in preparation*.

[2] X. Chen, B. Derrida, Y. Hu, M. Lifshits, Z. Shi (2017). A hierarchical renormalization model: some properties and open questions, *arXiv:1705.04787*.

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CONFORMAL WELDING FOR CRITICAL LIOUVILLE QUANTUM GRAVITY

Nina Holden *ETH Zürich, Switzerland*
Ellen Powell *ETH Zürich, Switzerland*, E-mail: egpowell12@gmail.com

Abstract: I will discuss the theory of conformal welding when the welding homeomorphism is defined by a "Liouville quantum gravity" (Gaussian multiplicative chaos for the planar Gaussian free field) measure. I will explain the picture in the so-called subcritical regime, which is due to Scott Sheffield, and present new results of myself and Nina Holden in the critical regime.

STABLE CENTRAL LIMIT THEOREMS FOR SUPER ORNSTEIN-UHLENBECK PROCESSES

Yan-Xia REN *Peking University, China*, E-mail:yxren@math.pku.edu.cn

Abstract: Let ξ be an Ornstein-Uhlenbeck process on $\mathbf{R}^d$ with generator $L = \frac{1}{2}\sigma^2\Delta - bx \cdot \nabla$, where $\sigma, b > 0$. Let ψ be a branching mechanism which is close to a function of the form $\widetilde{\psi}(z) = -\alpha z + \rho z^2 + \eta z^{1+\beta}$ with $\alpha > 0$, $\rho \geq 0$, $\eta > 0$ and $\beta \in (0,1)$, in some sense. We study asymptotic behaviors of (ξ, ψ)-superprocesses $(X_t)_{t\geq 0}$. For any testing function f of polynomial growth, denote by κ_f the order of f in the spectral decomposition of f in terms of the spectrum of the mean semigroup of X. Conditioned on non-extinction, we establish some stable central limit theorems for $\langle f, X_t\rangle$ in three different regimes: the small branching rate regime $\alpha\beta < \kappa_f b(1+\beta)$; the critical branching rate regime $\alpha\beta = \kappa_f b(1+\beta)$; and the large branching rate regime $\alpha\beta > \kappa_f b(1+\beta)$. The talk is based on a joint work with Renming Song, Zhenyao Sun and Jianjie Zhao.

A COAGULATION-TRANSPORT EQUATION AND THE NESTED KINGMAN COALESCENT

Emmanuel SCHERTZER *Sorbonne Université*, E-mail: emmanuel.schertzer@gmail.com

Abstract: Consider the following transport-coagulation equation

$$\forall t > 0, \forall x \geq 0, \quad \partial_t n(t,x) \;=\; \partial_x(x^\gamma n)(t,x) \;+\; \frac{1}{2}\int_0^x n(t,x-y)n(t,y)dy \;-\; n(t,x)\int_0^\infty n(t,y)dy. \tag{1}$$

If we think of $n(t,x)dx$ as the "number" of clusters carrying a mass in an interval of size dx around x at time t, then the previous equation can be interpreted as the following dynamics: clusters coalesce at rate 1, and the mass of each cluster is depleted at a rate proportional to mass$^\gamma$.

Our main motivation for studying the latter PDE is the nested coalescent model in which gene lineages are constrained by a phylogeny, i.e., ancestral lineages can only coalesce if they belong to the same species. In particular, when $\gamma = 2$, we show that the latter PDE can be recovered the nested Kingman coalescent (where gene and species lineages are both described by

a standard Kingman coalescent) at small time scales. In particular, we show that the existence of a self-similar solution for the PDE relates to the speed of coming down from infinity in the nested Kingman coalescent. I will also address some open problems related to the previous results.

This is joint work with A. Lambert.

THE DERIVATIVE MARTINGALE IN A BRANCHING LÉVY PROCESS

Quan SHI *University of Mannheim, Germany*, E-mail: quanshi.math@gmail.com

Abstract: *Branching Lévy processes* are continuous-time particles systems on the real line that satisfy the branching property. They are the continuous-time counterpart to branching random walks, in the same way that Lévy processes are the counterpart to random walks, and can be characterized by a triplet (σ^2, a, Λ). We use the spinal decomposition to derive a necessary and sufficient condition in terms of the triplet for the convergence of the so-called *derivative martingale* toward a non-trivial limit.

This talk is based on joint works with Bastien Mallein and Alexander R. Watson.

BRANCHING RANDOM WALKS ON HYPERBOLIC GROUPS

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Abstract: Let Γ be a nonelementary hyperbolic group equipped with a word metric. Consider a branching random walk (BRW) on Γ with mean offspring $\lambda < \infty$ and let ρ be the spectral radius of the base motion. It is known that, if and only if $\lambda \leq \rho^{-1}$, the BRW is transient in the sense that the population eventually vacates every finite subset of Γ.

In this talk, we study the critical behavior for the volume growth rate $\Phi(\lambda)$ of the trace of BRW. More precisely, we prove that the rate $\Phi(\lambda)$ exhibits a phase transition at $\lambda = \rho^{-1}$ and has critical exponent 1/2 in the sense that $\Phi(\lambda) \sim C \left(\rho^{-1} - \lambda\right)^{1/2}$ as $\lambda \uparrow \rho^{-1}$ for some positive constant C.

This is a joint work with Zhan Shi, Vladas Sidoravicius and Kainan Xiang.

PRUNINGS, CUT TREES AND THE RECONSTRUCTION PROBLEM

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Abstract: The subject of pruning of continuum random trees have stimulated many works in recent years. The so-called cut trees encode the genealogies of the fragmentation processes induced by the pruning. The reconstruction problem investigates the question: how much information of the initial tree has been retained in its cut tree. This problem has been considered for the Brownian tree [2] and for the stable trees [1], where the main arguments there both rely

heavily on the self-similarity of the underlined trees. Examples of continuum random trees which do not necessarily possess the self-similarity property include (non stable) Lévy trees and Inhomogeneous continuum random trees. In this talk, I will discuss some new approach to the reconstruction problem that applies to these two families of trees.

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LONG-TERM BEHAVIOUR OF GROWTH-FRAGMENTATION PROCESSES

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Abstract: Growth-fragmentation processes describe the evolution of systems of cells which grow continuously and fragment suddenly; they are used in models of cell division and protein polymerisation. In the long term, the concentrations of cells with given masses typically increase at some exponential rate and, after compensating for this, they arrive at an asymptotic profile. Up to now, this has mainly been studied for the average behaviour of the system, often by means of a natural partial integro-differential equation and the associated spectral theory. However, the behaviour of the system as a whole, rather than only its average, is more delicate. We obtain a criterion for the convergence of the entire collection of cells to a certain asymptotic profile, and we find some improved explicit conditions for this to occur.

THE α-FORD CHAIN ON CLADOGRAMS IN THE DIFFUSION LIMIT

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Key words: tree-valued Markov chain, tree-valued diffusion, algebraic trees, sample shape convergence, Gromov-weak convergence, Wright-Fisher diffusion, martingale problem, continuum tree

Mathematical Subject Classification: Primary: 60B99; Secondary: 60G99, 60J05, 60J25, 60J60, 60J80

Abstract: In Löhr, Mytnik and Winter (2018) we encoded cladograms as binary, algebraic measure trees and showed that this Markov chain on cladograms with a fixed number of leaves converges in distribution as the number of leaves goes to infinity. For that we developed in Löhr and Winter (2018) a notion of global convergence of cladograms which is a Gromov-weak convergence with respect to the distance arising from the distribution of branch points. In the present talk we extend this construction to the one parameter family of α-Ford trees, $\alpha \in [0, 1]$,

which interpolates between the Kingman coalescent tree ($\alpha = 0$), the Aldous tree ($\alpha = \frac{1}{2}$) and the comb tree $\alpha = 0$.

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ON THE EXTINCTION-EXTINGUISHING FOR A STOCHASTIC LOTKA-VOLTERRA TYPE POPULATION DYNAMICAL SYSTEM

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Abstract: We study a two-dimensional process (X, Y) arising as nonnegative solution to stochastic differential equations both driven by independent Brownian motions and compensated spectrally positive Lévy random measures. Both processes X and Y can be identified as continuous-state nonlinear branching processes where the evolution of Y is negatively affected by X. Assuming that process X extinguishes, i.e. it converges to 0 but never dies out in finite time, and process Y converges to 0, we identify rather sharp conditions under which the process Y exhibits, respectively, the following behaviors: extinction with probability one, or extinguishing with probability one, or both extinction and extinguishing occurring with strictly positive probabilities.

SUBCRITICAL BRANCHING PROCESSES IN RANDOM ENVIRONMENT WITH IMMIGRATION STOPPED AT ZERO

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Abstract: The life periods of subcritical branching processes with immigration in a random environment are studied. The asymptotic tail probability of the extinction time is specified in three cases: weakly subcritical, intermediate subcritical and strongly subcritical. This is a joint work with DouDou Li and Vladimir Vatutin.

THE NON-DEGENERATE LIMIT FOR SUPERCRITICAL SUPERPROCESSES

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Abstract: In this paper, we establish limit theorems for the maximum of the support, denoted by M_t, of supercritical super-Brownian motion $\{X_t, t \geq 0\}$. We prove that there exists $m(t)$ such that $(X_t - m(t), M_t - m(t))$ converges in law. Furthermore, we also give some almost sure convergence for $\frac{M_t - c_0 t}{\log t}$, where c_0 is a constant, conditioned on the nonextinction set. These results are analogue of results for the branching Brownian motion, obtained in Arguin et al.(Probab. Theory Relat. Fields (2013) 157:535-574) and Aidékon et al.(Probab. Theory Relat. Fields, (2013) 157:405-451) and Roberts(Ann. Probab. (2013) 41: 3518-3541).

THE EXPLOSION OF TIME-CHANGED SPECTRALLY POSITIVE LÉVY PROCESSES

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Abstract: We consider a class of continuous-state branching processes with nonadditive branching mechanism that can be obtained from spectrally positive Lévy processes via Lamperti type time changes. By analyzing weighted occupation times of spectrally positive Lévy processes, we identify the speeds of explosions for such time-changed processes.

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