University of Zurich[UZH]

Institute of Mathematics

Journées Cartes

June 12 and 13, 2023

abstract booklet

Jean Bertoin (University of Zurich)

Self-similar Markov trees

We represent a Galton-Watson process with types by a discrete genealogical tree with a decoration induced by the types of particles on each segment. When types are integers, such decorated trees can be re-normalized and we provide criteria for the existence of a scaling limit in terms of the reproduction laws of the Galton-Watson process. The limit is described as a self-similar Markov tree. The latter is a random real tree endowed with a decoration that records the evolution of types along branches, and a mass measure that accounts for the asymptotic repartition of particles.

This talk is based on a joint work in progress with Nicolas Curien and Armand Riera.

Alice Contat (Université Paris-Saclay)

Finding Adam in recursive trees

Let $(T(n) : n \geq 1)$ be a process of trees constructed recursively (vertex by vertex, for example the Barabàsi-Albert tree process). Given an observation of $T(n)$ for a given n (large) without labeling, our goal is to find the initial vertex (Adam). More precisely, one wants to output a subset of vertices as small as possible, which contains the initial vertex with probability at least $1 - \varepsilon$. After a quick overview of the existing literature on uniform and preferential attachment recursive trees, I will show you that to find Adam, it is a better idea to look for Eve.

William Da Silva (University of Vienna)

The length of the longest increasing subsequence in the Brownian separable permutons

The Brownian separable permutons are a family of universal limits of random constrained permutations, depending on some parameter p in (0,1). We provide explicit polynomial bounds for the length of the longest increasing subsequence in the Brownian separable permutons, and present simulations suggesting that the lower bound is close to optimal for all p. The strategy relies on a connection to fragmentation processes that I will highlight in the talk.

The talk is based on joint work with Jacopo Borga (Stanford University) and Ewain Gwynne (University of Chicago).

Antoine Jego (EPFL Lausanne)

Crossing exponent of the Brownian loop soup

In this talk, I will present a paper where we study the clusters of loops in a Brownian loop soup in some bounded two-dimensional domain with subcritical intensity $(0, 1/2]$. We obtain an exact expression for the asymptotic probability of the existence of a cluster crossing a given annulus of radii r and rs as $r0$ ($s > 1$ fixed). Relying on this result, we then show that the probability for a macroscopic cluster to hit a given disc of radius r decays like $|\log(r)| - 1 + \theta + o(1)$ as $r \to 0$. Finally, we characterise the polar sets of clusters, i.e. sets that are not hit by the closure of any cluster, in terms of log α-capacity.

This paper reveals a connection between the 1D and 2D Brownian loop soups. This connection in turn implies the existence of a second critical intensity $\theta = 1$ that describes a phase transition in the percolative behaviour of large loops on a logarithmic scale targeting an interior point of the domain.

Based on a joint work with Titus Lupu and Wei Qian.

Mihyun Kang (Graz University of Technology)

Topological aspects of random graphs

In this talk we will briefly overview classical results on Erdos-Renyi random graphs and discuss various topological aspects of random graphs focusing on the following questions: How does the genus of a random graph change as the edge density increases? How does a topological constraint (such as being planar) influence the global and local structure of a random graph (e.g., the largest component and local weak limits)?

Bastien Mallein (Université Sorbonne Paris Nord)

The KPP traveling wave in the half-plane

H. Berestycki and G. Cole (2022) proved that the F-KPP reaction-diffusion equation $\partial_t u = \frac{1}{2}\Delta u + u(1-u)$ in the half-place with Dirichlet boundary conditions admit traveling waves for all speed $c \geq \sqrt{2}$.

Using the duality between this PDE and the branching Brownian motion in the half-plane with absorption at the boundary, we prove that the minimal speed traveling wave is in fact unique (up to shift). Moreover, we give a probabilistic representation of this traveling wave Φ in terms of the Laplace transform of a certain "derivative martingale" of this branching Brownian motion.

We use this probabilistic representation to describe the asymptotic behavior of Φ away from the boundary of the domain, proving that

$$\lim_{y\to\infty} \Phi\left(x + \frac{1}{\sqrt{2}}\log y, y\right) = w(x)$$

where w is the usual one-dimensional traveling wave.

This talk is based on joint work with Julien Berestycki, Cole Graham and Yujin H. Kim.

Alejandro Rosales Ortiz (University of Zurich)

Excursion theory for Markov processes indexed by Lévy trees

We introduce the notion of a Markov process indexed by a Lévy tree. This family of universal objects are intimately related to the theory of super-processes and appear in numerous limit theorems. More recently, Brownian motion indexed by the Brownian tree has played an essential role in the development of Brownian geometry. The goal of this talk is to discuss the recent development of an excursion theory for Markov processes indexed by Lévy trees. In particular, we will explain how one can introduce a notion of local time in this tree-indexed setting. Our results complement the theory developed by Abraham and Le Gall concerning Brownian motion indexed by the Brownian tree. We will assume no prerequisites other than basic properties of Brownian motion and will begin with a concise introduction to excursion theory for time-indexed Markov processes and Lévy trees. The content of this talk is based on two joint works with Armand Riera.

Meltem Unel (Université Paris-Saclay)

Ideal Poisson-Voronoi tessellations on hyperbolic spaces

In this talk, we will study the low-intensity limit of Poisson-Voronoi tessellations on hyperbolic spaces of dimension 2 and higher. Limiting object, the ideal Poisson-Voronoi tessellation, is a natural isometry-invariant, locally finite decomposition of the hyperbolic space into unbounded convex hyperbolic polytopes each with a unique end. After constructing this limiting object, we will look into some of its properties, in particular the geometric features of its cells.

Bart Zonneveld (Radboud Universiteit)

Tree Bijections for Hyperbolic Surfaces

Finding bijections to trees, like the Cori-Vauquelin-Schaeffer bijection or the Bouttier-Di Francesco-Guitter bijection, have proven to be important tools for the encoding of (planar) maps. Motivated by this success we can try to step away from discrete maps and try to apply similar techniques to smooth surfaces.

In this talk I will show you my recent work with Timothy Budd and Thomas Meeusen, where we encode genus-0 hyperbolic surfaces using bijections to dressed trees.