Rencontres de Probabilités 2023
Rouen, 21-22 septembre 2023

Programme

Thursday September 21 2023

- 11h - 12:00 mini-course (Part I)**, Jan Swart** (Czech Academy of Sciences, Prague)
  Pathwise dualities of interacting particle systems
- 12:00 - 14:00 lunch
- 14:00 - 14:40 Short talk, **Cristina Toninelli** (CNRS, Université Paris Dauphine)
  Fredrickson-Andersen 2-spin facilitated model: sharp threshold
- 14:40 - 15:20 Short talk, **François Huveneers** (King's College, Londres)
  Trapping effects for a random walk in a 1d dynamical environment
- 15:20 - 15:50 coffee break
- 15:50 - 16:50 mini-course (Part II), **Jan Swart** (Czech Academy of Sciences, Prague)
  Pathwise dualities of interacting particle systems
- 16:50 - 17:30 Short talk, **Matteo D'Achille** (Université Paris-Saclay)
  Ideal Poisson-Voronoi tessellations on hyperbolic spaces
- 17:30 - 18:10 Short talk, **Dominik Schmid** (Université de Bonn)
  Approximation the stationary distribution of the open ASEP

Friday September 22 2023

- 09:00 - 10:00 mini-course (Part III), **Jan Swart** (Czech Academy of Sciences, Prague)
  Pathwise dualities of interacting particle systems
- 10:00 - 10:40 Short talk, **Angèle Bouley** (Université de Rouen Normandie)
  Driven gradient symmetric exclusion processes in weak contact with boundary reservoirs
- 10:40 - 11:10 coffee break
- 11:10 - 11:50 Short talk, **Marielle Simon** (Université Lyon 1)
  Hydrodynamic limit for a facilitated exclusion process
- 11:50 - 12:30 Short talk, **Orphée Collin** (CNRS, Université Paris Cité)
  The Random Field Ising Chain
- 12:30 - 14:00 lunch
- 14:00 - 14:40 Short talk, **Sonia Velasco** (Université Paris Cité & Université de Rouen Normandie)
  Quasi-potential for one dimensional SSEP in weak contact with reservoirs
- 14:40 - 15:20 Short talk, **Chiara Franceschini** (Université de Modena)
  Harmonic models and microscopic characterization of the non equilibrium stationary states
- 15:20 - 16:00 Short talk, **Assaf Shapira** (Université Paris Cité)
  TBA

Abstracts

Mini-courses

Jan Swart (Czech Academy of Sciences, Prague)
Title: *Pathwise dualities of interacting particle systems*
Abstract: In my minicourse, I will review the pathwise approach to find dualities of interacting particle systems, demonstrate its usefulness on some old and new examples, and present some open problems and challenges.

Talks

Cristina Toninelli (CNRS, Université Paris Dauphine)
Title: *Fredrickson-Andersen 2-spin facilitated model: sharp threshold*
Abstract:
The Fredrickson-Andersen 2-spin facilitated model (FA-2f) on Zd is a paradigmatic interacting particle system with kinetic constraints (KCM) featuring cooperative and glassy dynamics. For FA-2f vacancies facilitate motion: a particle can be created/killed on a site only if at least 2 of its nearest neighbors are empty.
We will present sharp results for the first time, τ , at which the origin is emptied for the stationary process when the density of empty sites (q) is small: in any dimension $d \geq 2$ it holds $\tau \sim \exp[(d\lambda(d, 2) + o(1)) / (q^{1/(d-1)})]$ w.h.p., with $\lambda(d, 2)$ the threshold constant for the 2-neighbour bootstrap percolation on Z^d. This is the first sharp result for a critical KCM and settles various controversies accumulated in physics literature over the last four decades.
We will explain the dominant relaxation mechanism leading to this result, give a flavour of the proof techniques, and discuss further results that can be obtained via our technique for more general KCM, including full universality results in two dimensions.
[Joint work with I.Hartarsky and F.Martinelli]

François Huveneers (King's College, Londres)

Title: Trapping effects for a random walk in a 1d dynamical environment

Abstract: This talk will address the behavior of a particle evolving in a 1d random environment with diffusive fluctuations. This is a challenging question because the environment interpolates between a static environment (where many results are known) and a fast-mixing one (where homogenization is known to occur). First, I will present numerical results and heuristic arguments for the particle's fluctuations, and then I will consider a simplified environment where this behavior can be rigorously proven. Joint work with F. Simenhaus.

Matteo D'Achille (Université Paris-Saclay)
Title: *Ideal Poisson-Voronoi tessellations on hyperbolic spaces*
Abstract: A Voronoi tessellation is a partition of a metric space into non-overlapping cells containing nuclei, where each cell is the set of points closest to its nucleus. If the nuclei are chosen according to a homogeneous Poisson point process, the result is a Poisson-Voronoi tessellation—-

one of the protagonists of random geometry since its introduction for modeling crystal growth about 70 years ago.

Recently, Poisson-Voronoi tessellations, depending on the intensity of the point process of the nuclei, have been considered or used for various purposes, such as a new proof of the Gauss-Bonnet theorem for compact surfaces without boundary and an upper bound on the Cheeger constant of hyperbolic surfaces with high genus. Thus, a natural question arises: what happens as the intensity of the point process of the nuclei tends to 0?

In this talk, I will first provide an outline of the general recipe for constructing these zero-intensity limit random tessellations, known as Ideal Poisson-Voronoi Tessellations (IPVT). Then, I will focus on d-dimensional hyperbolic space $\mathbb{H}_d$, where a surprisingly simple Poissonian description allows a thorough understanding of the IPVT, including its Möbius invariance, hole probabilities and face intensities of the cell of any fixed point, thanks to Voronoi-Delaunay duality and a connection with recent work by Gusakova-Kabluchko-Thäle.

The presentation will be enriched with numerous figures and will also feature a 3D-printed realization of a cell of the IPVT in the Poincaré ball model of $\mathbb{H}_3$.

Talk mostly based on joint work with Nicolas Curien, Nathanaël Enriquez, Russell Lyons and Meltem Ünel (arXiv 2303.16831).

Dominik Schmid (Université de Bonn)

Title: *Approximation the stationary distribution of the open ASEP*

Abstract: The exclusion process is one of the best-studied examples of an interacting particle system. In this talk, we consider the stationary distribution of asymmetric simple exclusion processes with open boundaries. We project the stationary distribution onto a subinterval, whose size is allowed to grow with the length of the underlying segment. Depending on the boundary parameters for the exclusion process, we provide sufficient conditions such that the projected stationary distribution is close in total variation distance to a product measure. This talk is based on joint work with Evita Nestoridi.

Angèle Bouley (Université de Rouen Normandie)

Title: *Driven gradient symmetric exclusion processes in weak contact with boundary reservoirs*

Abstract: In this talk, we will be studying a driven gradient symmetric exclusion process in weak contact with boundary reservoirs in a one-dimensional case. This particular model has already been studied in an article, but not in the case of weak contact; rather, it was studied in contact with boundary reservoirs. The introduction of weak contact brings about certain changes in the results. We will focus on examining the changes in the convergence of the empirical measure with the hydrodynamic limit, as well as the changes in the dynamical larges deviations. The main difference can be observed in the associated EDP for the hydrodynamic behavior and in the expression of the rate function for the dynamical larges deviations which will lead to new properties.

Marielle Simon (Université Lyon1)

Title: *Hydrodynamic limit for a facilitated exclusion process*

Abstract: In this talk we will be interested in a one-dimensional exclusion process subject to strong kinetic constraints, which belongs to the class of cooperative kinetically constrained lattice gases. More precisely, its stochastic short range interaction exhibits a continuous phase transition to an absorbing state at a critical value of the particle density. In one dimension, and if the microscopic dynamics is symmetric, we will see that its macroscopic behavior, under periodic boundary conditions and diffusive time scaling, is ruled by a non-linear PDE belonging to free boundary

problems (or Stefan problems). One of the ingredients is to show that the system typically reaches an ergodic component in subdiffusive time.
The asymmetric case can also be fully treated: in this case, considered on the infinite line, the empirical density converges to the unique entropy solution to a hyperbolic Stefan problem.
Based on joint works with O. Blondel, C. Erignoux, M. Sasada and L. Zhao.

Orphée Collin (Université Paris Cité)

Title: *The Random Field Ising Chain*

Abstract: The Ising Model is a classical model in statistical physics describing the behavior of ferromagnetic moments on a lattice interacting via a local interaction. When the lattice is one-dimensional and in the case of homogeneous nearest-neighbor interaction, the model is known to be exactly solvable (and simple). However, the disordered version of the one-dimensional Ising Model (called the Random Field Ising Chain), where the chain interacts with an i.i.d environment, is a much more challenging model. In particular, it exhibits a pseudo-phase transition as the strength Gamma of the inner-interaction goes to infinity. A description of the typical configurations when Gamma is large has been given in the physical literature in terms of a renormalisation group fixed point.
We study the RFIC and its continuum analogue (which arises as a weak disorder limit) and provide mathematical evidence that, in accordance with the physicists' description, typical configurations are close to the configuration given by the process of Gamma-extrema of the Brownian Motion, when Gamma is large.

Sonia Velasco (Université Paris Cité & Université de Rouen Normandie)

Title: *Quasi-potential for one dimensional SSEP in weak contact with reservoirs*

Abstract: We derive a formula for the quasi-potential of a one dimensional assymmetric exclusion process in weak contact with reservoirs. The interaction with the boundary is so weak that, in the diffusive scale, the density profile evolves as the one of the exclusion process with reflecting boundary conditions. In order to observe an evolution of the total mass, the process has to be observed in a longer time-scale, in which the density profile becomes immediately constant.
[Joint work with Claudio Landim]

Chiara Franceschini (Université de Modena)

Title: *Harmonic models and microscopic characterization of the non equilibrium stationary states*

Abstract: The goal of characterizing the invariant measure of a non reversible particle system placed out of equilibrium is typically a difficult one. This has been achieved e.g. for the well known exclusion process.

In this talk I will show two examples of boundary driven zero range type models whose invariant measure can be explicitly characterized via a probabilistic mixture of products of inhomogeneous distribution. In particular, the mixing measure is in terms of the order statistics of i.i.d. uniform random variables. The two models, recently introduced, share the same algebraic description and are in a duality relation. One is a symmetric particle system with nearest neighbor jumps and the other is obtained after a suitable scaling limit and it describes heat conduction, similarly to the Kipnis-Marchoro-Presutti model (1982).

This is from joint works with: Gioia Carinci, Rouven Frassek, Davide Gabrielli, Cristian Giardinà, Frank Redig and Dimitrios Tsagkarogiannis

Assaf Shapira (Université Paris Cité)
Title:
Abstract: