Rencontres de Probabilités 2022
Rouen, 24-25 novembre 2022

Programme

Thursday November 24 2022

- 11h - 12:00 mini-course (Part I)**, Thierry Bodineau** (CNRS, IHES)
  Multiscale approach to functional inequalities
- 12:00 - 13:45 lunch
- 13:45 - 14:20 Short talk, **Paul Dario** (Université Claude Bernard Lyon 1)
  Quantitative hydrodynamic limit for some gradient interface models
- 14:20 - 14:55 Short talk, **Zoé Agathe-Nerine** (Université de Paris Cité)
  Long-term stability of interacting Hawkes processes on random graphs
- 14:55 - 15:30 Short talk, **Irene Maes (Université de Leuven)**
  The vanishing of excess heat for nonequilibrium processes reaching zero ambient temperature
- 15:30 - 15:45 coffee break
- 15:45 - 16:45 mini-course (Part II), **Thierry Bodineau** (CNRS, IHES)
  Multiscale approach to functional inequalities

16:45 - 17:20 Short talk, **Chiara Franceschini** (Université de Modena)
Hydrodynamics for a system of in homogeneous hard rods

17:20 - 17:55 Short talk, **Guillaume Barraquand** (CNRS, ENS Paris)
Stationary measures for the Kardar-Parisi-Zhang equation and ASEP

Friday November 25 2022

- 09:00 - 10:00 mini-course (Part III), **Thierry Bodineau** (CNRS, IHES)
  Multiscale approach to functional inequalities
- 10:00 - 10:35 Short talk, **David Dereudre** ((Université de Lille)
  Fully-connected bond percolation on Z^d
- 10:35 - 10:50 coffee break
- 10:50 - 11:25 Short talk, **Gauthier Quilan** (Université de Rouen Normandie)
  Convex hull peeling aléatoire
- 11:25 - 12:00 Short talk, **Thomas Leblé** (CNRS, Université de Paris Cité)
  About translation-invariance in 2d Gibbsian point processes
- 12:00 - 13:30 lunch
- 13:30 - 14:05 Short talk, **Vittoria Silvestri** (Université de Rome La Sapienza)
  Explosive growth for a constrained Hastings–Levitov aggregation model

-14:05 - 14:40 Short talk, **Yannick Couzinié** (Università Roma Tre)
The multicolour East model

-14:40 - 15:15 Short talk, **Peter Nejjar** (Université de Bonn)
Cutoff Profile of ASEP on the segment

-15:15 - 15:50 Short talk, **Oriane Blondel** (CNRS, Université Claude Bernard Lyon 1)
Random walks in dynamic random environment: antisymmetry

Abstracts

Mini-courses

Thierry Bodineau (CNRS, IHES)
Title: *Multiscale approach to functional inequalities*

Abstract: We will review some recent results on functional inequalities for spin systems, focusing on a multiscale generalisation of the Bakry-Emery criterion. This multiscale criterion has been applied to Gibbs measures which are far from being log-concave, in particular the massive continuum sine-Gordon model and the Ising model. This approach relies on the Polchinski equation which is well known in renormalisation theory and has also an interpretation in terms of optimal transport theory.

Talks

Zoé Agathe-Nerine (Université de Paris Cité)
Title: Long-term stability of interacting Hawkes processes on random graphs
Abstract: We consider a population of Hawkes processes modeling the activity of N interacting neurons. The neurons are regularly positioned on the segment [0,1], and the connectivity between neurons is given by a random possibly diluted and inhomogeneous graph where the probability of presence of each edge depends on the spatial position of its vertices through a spatial kernel. The main result concerns the long-time stability of the synaptic current of the population, as $N\to\ infty$, in the subcritical regime in case the synaptic memory kernel is exponential, up to time horizons that are polynomial in N .

Guillaume Barraquand (CNRS, ENS Paris)
Title: Stationary measures for the Kardar-Parisi-Zhang equation and ASEP
Abstract: We will review recent progress on the explicit description of stationary measures for the Kardar-Parisi-Zhang (KPZ) equation. We will emphasize in particular the use of a representation of the matrix product ansatz due to Derrida and Enaud, which provides a very simple description of stationary measures for the open asymmetric simple exclusion process.

Oriane Blondel (CNRS, Université Claude Bernard Lyon 1)
Title: *Random walks in dynamic random environment: antisymmetry*

Abstract: I will discuss a recent result on the antisymmetry of a certain random walk in reversible environments. The discussion will include a review of some settings in which a law of large numbers can be proved.

Yannick Couzinié (Università Roma Tre)
Title: *The multicolour East model*

Abstract: We consider the multicolour East model, a new model in the mathematics literature that is best described as multiple multidimensional East models sharing the neutral state. Looking at the simplest version, the two-colour East model in two dimensions we show ergodicity and analyse sufficient conditions to get asymptotics on the spectral gap in the limit of vanishing transition rates of one of the two colours. We close the talk by looking at generalisations of these results and remaining open questions.

Paul Dario (Université Claude Bernard Lyon 1)
Title: *Quantitative hydrodynamic limit for some gradient interface models*

Abstract: Random surfaces are an important class of models in statistical physics used to model interfaces. They are defined on a microscopic level and it is an important question to understand their behavior over large scales. In this direction a number of important results have been established in the last 20 years (including the hydrodynamic limit of Funaki-Spohn and the scaling limit of Naddaf-Spencer and Giacomin-Olla-Spohn for the so-called $\nabla \phi$ interface model). In this talk, we will present these models, their motivations and main results. We will study a connection with the stochastic homogenization of nonlinear equations and discuss some new results that can be deduced from this approach. This is based on joint works with S. Armstrong, M. Harel and R. Peled.

David Dereudre ((Université de Lille)
Title: *Fully-connected bond percolation on Z^d*

Abstract: We consider the bond percolation model on the lattice Zd with the constraint to be fully connected. Each edge is open with probability p in (0,1), closed with probability 1-p and then the process is conditioned to have a unique open connected component (bounded or unbounded). The model is defined on Zd by passing to the limit for a sequence of finite volume models with general boundary conditions. Several questions and problems are investigated: existence, uniqueness, phase transition, DLR equations. Our main result involves the existence of a threshold 0<p*(d)<1 such that any infinite volume model is necessary the vacuum state in subcritical regime (no open edges) and is non trivial in the supercritical regime (existence of a stationary unbounded connected cluster). Bounds for p^*(d) are given and show that it is drastically smaller than the standard bond percolation threshold in Zd. For instance 0.128<p*(2)<0.202 (rigorous bounds) whereas the 2D bond percolation threshold is equal to 1/2.

Chiara Franceschini (Université de Modena)
Title: *Hydrodynamics for a system of in homogeneous hard rods*

Abstract: A rod is an elongated particle which travels at a certain constant speed in absence of other rods. When two rods collide they exchange their position and continue their motion with the initial speed. The model was introduced by Dobrushin in the 50s for rods of identical length. Here we consider rods of different size and, in the spirit of the work of Boldrighini, Dobrushin and Sukhov of 1982, we show the hydrodynamic equations starting from the microscopic particle systems. It turns out that the Cauchy problem and the effective rod velocity have the same form of those those of the soliton gas.
Work in progress with Pablo Ferrari, Dante Grevino, Herbert Spohn.

Thomas Leblé (CNRS, Université de Paris Cité)
Title: *About translation-invariance in 2d Gibbsian point processes*

Abstract: For two-dimensional systems, a well-known slogan asserts that “continuous symmetries cannot be broken”. One thus expects that: 1) infinite-volume Gibbs states of (reasonable) 2d particle systems are always stationary and 2) their finite-volume measures possess some kind of approximate invariance under translations.
I will review the classical proof of 1) and show that it works well for the Coulomb interaction despite its long-range-ness. Interestingly, 2) is also true but requires more care. Indeed, some kind of “magic” seems to be happening in the infinite-volume limit.

Irene Maes (Université de Leuven)

Title: *The vanishing of excess heat for nonequilibrium processes reaching zero ambient temperature*

Abstract: Co-authors are Faezeh Khodabandehlou (KU Leuven) and Karel Netocny (Czech Academy of Sciences). We present the mathematical ingredients for an extension of the Third Law of Thermodynamics (Nernst heat postulate) to nonequilibrium processes. The central quantity is the excess heat which measures the quasistatic addition to the steady dissipative power when a parameter in the dynamics is changed slowly. We prove for a class of driven Markov jump processes that it vanishes at zero environment temperature. As an application, the nonequilibrium heat capacity goes to zero with temperature as well. Main ingredients in the proof are the matrix-forest theorem for the relaxation behavior of the heat flux, and the matrix-tree theorem giving the low-temperature asymptotics of the stationary probability. From that arborification, the main new condition for the extended Third Law is dynamical and requires the absence of major (low-temperature induced) delays in the relaxation to the steady dissipative structure.

Peter Nejjar (Bonn University)

Title: *Cutoff Profile of ASEP on the segment*

Abstract: We consider the asymmetric simple exclusion proces (ASEP), an interacting particle system that belongs to the so-called Kardar-Parisi-Zhang (KPZ) class of random growth models. Here we study how ASEP on the segment mixes to equilibrium. In particular, we obtain the cutoff window and the cutoff profile of ASEP, giving a precise
description of how ASEP converges to equilibrium.
Based on joint work with Alexey Bufetov.

Gauthier Quilan (Université de Rouen Normandie)

Title: *Convex hull peeling aléatoire*

Abstract: Le convex hull peeling d'un nuage de points est obtenu en prenant l'enveloppe convexe de ces points, puis en supprimant les points extrémaux et en construisant l'enveloppe convexe des points restants. Cette opération est répétée jusqu'à ce qu'il ne reste plus de point. On appelle couche d'ordre n la frontière de l'enveloppe convexe prise à l'étape n de cette procédure. Dans cette présentation, on s'intéresse principalement aux faces k-dimensionnelles des couches successives du convex hull peeling d'un processus de Poisson homogène dont l'intensité tend vers l'infini, qu'on restreint à un corps convexe K. On fera d'abord quelques rappels sur la première couche. Nous verrons notamment que le nombre de faces k-dimensionnelles est très différent selon la régularité du bord de K. On présentera ensuite nos résultats, qui étendent ceux de la première couche à toutes les premières.

Vittoria Silvestri (Université de Rome La Sapienza)

Title: *Explosive growth for a constrained Hastings–Levitov aggregation model*

Abstract: The Hastings--Levitov (HL) growth models describe the formation of random aggregates in the complex plane via conformal maps. In this talk I will discuss a version of the HL models on the upper half plane, in which the growth is restricted to the cluster boundary. We will see that, although one might expect a shape theorem, this constrained model
exhibits explosive behaviour, in that the cluster accumulates infinite diameter as soon as it reaches positive capacity. Based on joint work with Nathanael Berestycki.