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XXI Escola Brasileira de Probabilidade

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Abstracts

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XXI Escola Brasileira de Probabilidade

IMPA, Rio de Janeiro, July 31 – August 5, 2017

Auditorio 3

Hour	Monday, 31	Tuesday, 1	Wednesday, 2	Thursday, 3	Friday, 4
08:30 - 09:00	**Registration**				
09:00-10:20	**Minicourse I** **Hugo Duminil-Copin** (Bures-sur-Yvette) & **Vincent Tassion** (Zürich)	**Minicourse II** **Véronique Gayrard** (Marseille)	**Minicourse I** **Hugo Duminil-Copin** (Bures-sur-Yvette) & **Vincent Tassion** (Zürich)	**Minicourse II** **Véronique Gayrard** (Marseille)	**Minicourse I** **Hugo Duminil-Copin** (Bures-sur-Yvette) & **Vincent Tassion** (Zürich)
10:20-10:40	**Coffee Break**				
10:40-12:00	**Minicourse II** **Véronique Gayrard** (Marseille)	**Minicourse I** **Hugo Duminil-Copin** (Bures-sur-Yvette) & **Vincent Tassion** (Zürich)	**Minicourse II** **Véronique Gayrard** (Marseille)	**Minicourse I** **Hugo Duminil-Copin** (Bures-sur-Yvette) & **Vincent Tassion** (Zürich)	**Minicourse II** **Véronique Gayrard** (Marseille)
12:00-13:00	**Lunch**				
13:00-13:50	**Markus Heydenreich** (München)	**Pietro Caputo** (Roma)	**Matthieu Lerasle** (Paris-Saclay)	**Ioan Manolescu** (Fribourg)	**Milton Jara** (Rio de Janeiro)
14:00-17:00	**Plenary Talk 31CBM**				
17:00-17:20	**Coffee Break**				
17:20 - 18:10	**Vincent Tassion** (Zürich)	**Charles Bordenave** (Toulouse)	**Stefan Grosskinsky** (Warwick)	**Pablo Ferrari** (Buenos Aires)	
18:10-19:15	**Clément Erignoux** (IMPA) **TBA** **Alexander Glazman** (Université Paris VII – Jussieu)	**Insuk Seo** (Berkeley)	**Inés Armendariz** (Universidad de Buenos Aires) **Sokol Ndreca** (Universidade Federal de Minas Gerais) **Eric Ossami** (USP & University of Groningen)	**Filipe Mussini** (Uppsala University) **Evelina Shamarova** (Universidade Federal da Paraiba) **Clayton Barnes** (University of Washington)	
19:15-20:00		**Opening + Poster**		**Poster**	

Minicourses

Aging in mean field spin glasses Universality of the arcsine law aging regime

Véronique Gayrard [1] [1] Marselle

It is customary in theoretical statistical physics to present glasses as the source of outstanding unsolved problems. At a microscopic level they are strongly disordered, correlated systems that undergo a liquid to solid transition upon appropriate cooling but without any apparent order emerging, and the resulting solid is never observed in equilibrium on laboratory times scales – instead, it undergoes a slow relaxation dynamics with peculiar universal properties that physicists have termed *aging*.
The aging phenomenon opened a wealth of new problems of probability theory in connection with Markov jump processes in highly disordered random environments. Although many of these problems remain unanswered, the case-by-case analysis of several models that began in the early 2000s allowed to isolate a general mechanism that relates aging to the classical arcsine law for stable subordinators through the asymptotic behavior of a partial sum process called *clock process*. This links aging to some of the most classical parts of probability, namely, extreme value theory, the fundamental limit theorems for sums of random variables, and Lévy processes.
In this mini-course, I will explain both this general aging mechanism and the key probability results needed to implement it, starting with a simple model, then on models of increasing difficulties. These are:

- *Trap models on the complete graph*

Proposed by J.P. Bouchaud (1992) as simple phenomenological models for spin glass dynamics, trap models are Markov jump processes that describe thermally activated barrier crossing in random landscapes (random environments) made of i.i.d. heavy tailed "traps". Main examples of microscopic systems that trap models aim to describe are Glauber dynamics on state spaces $\{-1,1\}^n$ reversible with respect to the Gibbs measures associated to random Hamiltonians of mean-field spin glasses, such as

- *The Random Energy Model (REM)* of Derrida (1980), sometimes called the simplest mean field spin glass model, and
- *The family of p-spin SK-models, $p > 2$* (Derrida, 1985).

We will first implement our aging scheme with the simplest possible Glauber dynamics, the so-called *Random Hopping* dynamics whose transition rates do not depend on the random environment. Although physically unrealistic, the relative simplicity of this choice allows important insights to be gained. We will finally deal with the classical but much harder *Metropolis* dynamics, though only in the case of the REM: nothing is know to date about Metropolis dynamics of the the p-spin SK model.

Sharpness results via randomized algorithms

Hugo Duminil-Copin [1], Vincent Tassion[2], Aran Raoufi[3]

[1] Bures-sur-Yvette

[2] Zürich

[3] Bures-sur-Yvette

In these lectures, we will present different techniques developed over the past few years, enabling mathematicians to prove that phase transitions are sharp. We will focus on a few classical models of statistical physics, including Bernoulli percolation, the Ising model and the random-cluster model. In particular, we will prove that the connectivity probabilities of the subcritical random-cluster model decay exponentially fast. The strategy, relying on randomized algorithms, extends to continuum percolation models such as Boolean and Voronoi percolation in arbitrary dimension.

Invited Speakers

Non-backtracking spectrum and sparse random matrices

Charles Bordenave [1], Florent Beanych-George[2], Antti Knowles[3]

[1] Université de Toulouse

[2] Université Paris Descartes

[3] ETH Zürich

In this talk, we will introduce the Hashimoto's non-backtracking matrix. We will illustrate on sparse random matrix ensembles how this non-hermitian matrix can be used as a powerful tool to compute spectral radii and spectral gaps.

Cutoff at the "entropic time" for sparse Markov chains

Pietro Caputo [1], Charles Bordenave[2], Justin Salez[3]

[1] Roma

[2] Toulouse

[3] Paris Diderot

We discuss convergence to equilibrium for a large class of Markov chains in random environment. The chains are sparse in the sense that in every row of the transition matrix P the mass is essentially concentrated on few entries. Moreover, the entries are exchangeable within each row. This includes various models of random walks on sparse random directed graphs. The models are generally non reversible and the equilibrium distribution is itself unknown. We establish that the mixing time is given by the entropy of the equilibrium distribution divided by the average row entropy of P, and that the chains exhibit the so-called cutoff phenomenon at this "entropic time". As an application, one can consider the case where the rows of P are i.i.d. random vectors in the domain of attraction of a Poisson-Dirichlet law. Our main results are based on a detailed analysis of the weight of the trajectory followed by the walker.

Stationary solitons in the Box Ball System in Z

Pablo A. Ferrari [1], Chi Nguyen[2], Leonardo Rolla[3], Minmin Wang[4]

[1 2 3 4] Universidad de Buenos Aires

The Ball Box System (BBS) is a cellular automaton introduced by Takahashi and Tatsuma in 1990 as a discrete analog of the KdV pde, a partial differential equation with many soliton solutions. In the BBS a box is placed at each integer number and can either be empty or contain a ball. A carrier with infinite capacity visit successively the boxes from left to right. The carrier picks balls from occupied boxes and leaves carried balls at empty sites. We discuss existence conditions and invariant states. The automaton has countable many conserved quantities which travel at different speeds (solitons). We show that the product measure at any density less than 1/2 is invariant. Furthermore we describe independence properties of the spatially mixing invariant measures and speed interaction of the solitons.

Derivation of mean-field rate equations for misanthrope processes

Stefan Grosskinsky [1], Mim Jatuviriyapornchai [2]

[1] Warwick

[2] Warwick

We study the single-site dynamics in interacting particle systems (IPS) of misanthrope type with bounded rates on a complete graph. In the limit of diverging system size we establish convergence to a Markovian non-linear birth-death chain, described by a mean-field rate equation known from exchange-driven growth processes. Conservation of mass in the IPS leads to conservation of the first moment for the limit chain, and to interesting ergodic behaviour for models that exhibit condensation. The proof is based on a coupling to branching processes via the graphical construction, and establishing uniqueness of the solution for the limit dynamics.

The backbone scaling limit of high-dimensional incipient infinite cluster

Markus Heydenreich [1], R. van der Hofstad[2], T. Hulshof[3], G. Miermont[4]

[1] LMU München

[2] Eindhoven University of Technology

[3] Eindhoven University of Technology

[4] École normale supérieure de Lyon

By incipient infinite cluster we denote critical percolation conditioned on the cluster of the origin to be infinite. This conditional measure, which is achieved as a suitable limiting scheme, is singular with respect to (ordinary) critical percolation. We define the backbone B as the set of those vertices x, for which $\{x$ connected to the origin$\}$ and $\{x$ connected to $\infty\}$ occur disjointly.

Our main result is that B, properly rescaled, converges to a Brownian motion path in sufficiently high dimension. One interpretation of this result is that spatial dependencies of the backbone vanish in the scaling limit.

The result is achieved through a lace expansion of events of the form

$P(x$ and y are connected and there are m pivotal bonds between x and $y)$.

This extends the original Hara-Slade expansion for percolation and gives rise to some new diagrammatic estimates.

Non-equilibrium fluctuations of interacting particle systems

Milton Jara [1], Otavio Menezes[2]

[1] IMPA

[2] IMPA

We develop a new methodology in order to obtain the scaling limit of the fluctuations of the density of particles around its hydrodynamic limit for diffusive interacting particle systems. The proof does not requires a priori knowledge or even the existence of invariant product measures, and it relies on a sharp estimate of the entropy production of the evolution with respect to carefully chosen reference measures. We apply the methodology to prove convergence of the density fluctuation of reaction-diffusion models to the solution of a stochastic heat equation in dimensions up to three.

Early Learning in Bradley-Terry tournaments

Matthieu Lerasle [1] [1] Paris-Saclay

Zermelo in 1929 introduced Bradley-Terry model to evaluate the value of players using only pairwise comparisons between them. I'll consider this model in "random environment", i.e., when the values of the players are i.i.d. random variables. First, I'll discuss some results on the asymptotic probability that the best player (the one with the largest value) wins (ends up with the largest number of victories) when each pair met once and the number of players grows to infinity. Then, I'll explain why the distribution of the values can be estimated from the observation of the results of the games during only a few "days" of the tournament, using a loss of memory property. Finally, I'll present statistical perspectives for the "early learning problem" of recovering the strength of the players using an empirical Bayes estimator.

First order phase transition for the Random Cluster model with $q > 4$

Ioan Manolescu [1]

[1] Fribourg

This talk aims to prove that the phrase transition of the planar random cluster model (and that of the associated Potts model) is discontinuous when $q > 4$. The result is obtained by computing rigorously the correlation length of the critical random cluster model using a correspondence with the six vertex model. The latter may be expressed using the transfer matrix formalism; the Perron-Frobenius eigenvalues of the diagonal blocks of the transfer matrix may then be computed using the Bethe ansatz.

Metastability without time-reversibility

Insuk Seo [1], Claudio Landim[2], Mauro Mariani[3]

[1] UC Berkeley

[2] IMPA

[3] University of Rome, Sapienza

We consider several stochastic processes which exhibit the metastability. The metastability is a phenomenon in which a process starting from one of local minima arrives at the neighborhood of the global minimum after a sufficiently long time scale. The precise asymptotic analysis of this transition time has been known only for the reversible dynamics, based on the potential theory of reversible processes. In this presentation, we introduce our recent rigorous metastability analysis for several non-reversible dynamics based on the general form of potential theory.

No exceptional word in 3d percolation

Based on a joint work with P. Nolin and A. Teixeira

Vincent Tassion [1] [1] Zurich

We study and present some new results concerning the following problem, raised by Benjamini and Kesten (1995). Consider a site percolation configuration on Z^3 at parameter $1/2$. Each vertex receives independently the value 1, and 0 with equal probability. Which words (i.e. an infinite sequence of 0's and 1's) can be read when following a self-avoiding path in the graph Z^3?

Contributed Talks

Phase transition in the loop $O(n)$ model.

Alexander Glazman[1]
j. w. Hugo Duminil-Copin[2], Ron Peled[1], Yinon Spinka[1]

[1] Tel Aviv University, School of Mathematical Sciences

[2] IHES, Bures-sur-Yvettes

The loop $O(n)$ model is a model for a random collection of non-intersecting loops on the hexagonal lattice, which is believed to be in the same universality class as the spin $O(n)$ model. It has been predicted by Nienhuis that for $0 \leq n \leq 2$ the loop $O(n)$ model exhibits a phase transition at a critical parameter $x_c(n) = 1/\sqrt{2+\sqrt{2-n}}$. For $0 < n \leq 2$, the transition line has been further conjectured to separate a regime with short loops when $x < x_c(n)$ from a regime with macroscopic loops when $x \geq x_c(n)$.

In this talk we will prove that for $n \in [1, 2]$ and $x = x_c(n)$ the loop $O(n)$ model exhibits macroscopic loops. A main tool in the proof is a new positive association (FKG) property shown to hold when $n \geq 1$ and $0 < x \leq \frac{1}{\sqrt{n}}$. This property implies, using techniques recently developed for the random-cluster model, the following dichotomy: either long loops are exponentially unlikely or the origin is surrounded by loops at any scale (box-crossing property). We develop a 'domain gluing' technique which allows us to employ Smirnov's parafermionic observable to rule out the first alternative when $x = x_c(n)$.

Dyson Model: An example of the non-g-measure Gibbs measure

Eric Ossami Endo[1], Rodrigo Bissacot[2], Aernout C. D. van Enter[3], Arnaud Le Ny[4]

[1] Universidade de São Paulo, Brazil

University of Groningen, the Netherlands

[2] Universidade de São Paulo, Brazil

[3] University of Groningen, the Netherlands

[4] LAMA UMR CNRS 8050 – Université Paris-Est (UPEC), Créteil, France

Dyson Model, a long-range Ising model, with ferromagnetic and polynomially decaying interactions of the form $\frac{1}{|x-y|^\alpha}$ with $1 < \alpha < 2$, has been studied for a considerable time. One recent result is the existence of the phase-separation in a low-temperature [2]. We show in [3] that this phase-separation property give us the occurrence of the entropic repulsion, concluding that the Gibbs measures of the Dyson model when α is close to 2 (but different) and the temperature is low enough are not g-measure. This result answers a question raised in [1].

References

[1] R. Fernández, G. Maillard , *Chains with Complete Connections and One-Dimensional Gibbs Measures* , Electron. J. Prob. **9**:145–176, 2004.

[2] M. Cassandro, I. Merola, P. Picco, U. Rozikov . *One-Dimensional Ising Models with Long Range Interactions: Cluster Expansion, Phase-Separating Point* , Comm. Math. Phys. **327**:951-991, 2014.

[3] R. Bissacot, E.O. Endo, A.C.D. van Enter, A. Le Ny. *Entropic Repulsion and lack of the g-measure property for Dyson models.* , arXiv:1705.03156

The Hydrodynamic limit and Propagation of Chaos for Brownian Particles Reflecting from an Inert Barrier

Clayton Barnes

University of Washington, Seattle

Consider a finite collection of Brownian particles of equal mass reflecting from one side of a moving barrier, and pushing this barrier away by giving it a velocity proportional to the accumulated local time of collision. This is a multi-particle analog of a process constructed by Knight (2001). We find the hydrodynamic limit as the number of particles goes to infinity, and prove the propagation of chaos. The stochastic tools developed allow us to prove existence and uniqueness for a class of free boundary problems.

Modeling and Hydrodynamics of Active Matter

Clément Erignoux [1]

[1] IMPA

Extensive work has been put in the modeling of active matter in the last decades, building on the work of Viscek & al (1995). These empirical approaches have unveiled several interesting phenomenon regarding phase transitions and separations. However, most of the theoretical background in collective dynamics modeling relies on mean-field approximations. I will briefly present the phenomenology of active matter and discuss some lattice models where interactions between particles happen at a purely microscopic level, and where one can prove exact hydrodynamics and hope to recover this rich variety of behavior.

Strong solution to the multidimensional stochastic Burgers equation

Evelina Shamarova

Departamento de matemática, UFPB

We prove the existence and uniqueness of a global strong adapted solution to the multidimensional stochastic Burgers equation

$$y(t,x) = h(x) + \int_0^t [\nu \Delta y(s,x) - (y, \nabla) y(s,x) + f(s,x,y)] ds + \int_0^t g(s,x) dB_s$$

in the space $\mathrm{C}([0,T] \times \mathbf{R}^n)$ without gradient-type assumptions on the force or the initial condition. The solution is C^2 in $x \in \mathbf{R}^n$ and α-Hölder continuous in $t \in [0,T]$ for some $\alpha < \frac{1}{2}$. Our approach is based on an interplay between forward-backward SDEs and PDEs. Moreover, we show that as the viscosity goes to zero, the solution of the viscous stochastic Burgers equation converges uniformly to the local strong adapted solution of the inviscid stochastic Burgers equation.

Asymptotic behaviour of the cover time distribution in the Poisson cylinder model

Filipe Mussini [1], Erik Broman[2]

[1] Uppsala Universitet

[2] Göteborgs Universitet

In this work we consider a Poisson cylinder process in $\mathbb{R}^d$ indexed by a time parameter. We are interested in finding the asymptotic behaviour of the probability of a set being covered as a function of the size of the set as it increases. The smallest time where the set is covered is a random variable known as the real cover time. The strategy of the proof is to consider two slightly different cover times, one that dominates the real cover time and another that is dominated by it. Afterwards, we study the asymptotic behaviour of these bounding cover times.

Existence of the zero-range process with superlinear growth rates

Inés Armendáriz [1], Enrique Andjel[2], Milton Jara[3]

[1] Universidad de Buenos Aires, IMAS-Conicet

[2] Université de Provence

[3] IMPA

We use coupling arguments to construct the zero-range dynamics with superlinear, non-decreasing jump rates, and derive some properties of this process.

Asymptotics for the Late Arrivals Problem [1]

Sokol Ndreca [1], Carlo Lancia[2], Gianluca Guadagni[3], Benedetto Scoppola[4]

[1] Departamento de Estatística, UFMG

We study a discrete time queueing system where deterministic arrivals have i.i.d. exponential delays ξ_i. The standard deviation σ of the delay is finite, but much larger than the deterministic unit interarrival time. We describe the model as a bivariate Markov chain, we prove that it is ergodic and then we focus on the unique joint equilibrium distribution. We write a functional equation for the bivariate generating function, finding the solution of such equation on a subset of its set of definition. This solution allows us to prove that the equilibrium distribution of the Markov chain decays superexponentially fast in the quarter plane. Finally, exploiting the latter result, we discuss the numerical computation of the stationary distribution, showing the effectiveness of a simple approximation scheme in a wide region of the parameters. The model, motivated by air and railway traffic, was proposed many decades ago by Kendall with the name of "late arrivals problem", but no solution has been found so far.

[1] Acknowledgment: Sokol Ndreca thanks FAPEMIG for the financial support.

Poster Session

Tuesday, Aug 01: 19 - 20h

Adrian Pablo Hinojosa Luna (Universidade Federal de Minas Gerais)
Exit Time for a Reaction Diffusion model: Case of a One Well Potential

Anatoli Lambartsev (Instituto de Matemática e Estatística)
Coalescence and Minimal Spanning Trees of Asymmetric Bipartite Graph

Caio Moura Quina (Universidade de São Paulo)
The Emergence of a Giant Component

Carolina Bueno Grejo (Instituto de Matemática e Estatística)
A stochastic model for the evolution of species by mutation

Cristian Favio Coletti (Universidade Federal do ABC)
Global survival of tree-like branching random walks

Cristiano Santos Benjamin (Universidade Federal de Minas Gerais)
Asymptotic properties of a random graph with duplications

Daniela Cuesta (Universidad de Buenos Aires)
Evolving Voter Model on Dense Random Graphs

Darcy Camargo (IMECC – UNICAMP)
The Meteor Process Stationary Distribution

David Alexander Chipana Mollinedo (Universidade Tecnológica Federal do Paraná)
Stochastic continuity equation with non-smooth velocity

Diogo Carlos dos Santos (Universidade Federal de Minas Gerais)
Anisotropic Percolation on Slabs

Eli Costa Azevedo (Universidade Estadual de Goiás – Anápolis)
Probabilidade Literal

Emanuel Javier Ferreyra (Universidad de Buenos Aires)
Mean Field Stochastic Games, the potential case

Fabio Júlio da Silva Valentim (Universidade Federal do Espirito Santo)
Homogenization of generalized second-order elliptic difference operators

Fabio Lopes (Univ. de Chile)
A stochastic model for immune response with mutations and evolution

Gabriel Brito Apolinário (Universidade Federal do Rio de Janeiro)
Field theoretical approach to intermittency in la- grangian turbulence

Graciliano Márcio Santos Louredo (Universidade Federal de Juiz de Fora)
Accelerating the estimation process in the con- text of the multivariate skew scale mixtures of normal distributions

Guilherme Aparecido Santos Aguilar (Universidade Federal de Minas Gerais)
Theory and Inference Methods for Zero Truncated Poisson Exponential Gamma Distribution

Jaime Utria Valdes (IMECC)
Frog model with Poisson initial configuration on homogeneous tree

Jamer Insupe Roldan Gonzales (Universidade de Brasilia)
About the sharpness of the phase transition for the Ising model

Poster Session

Thursday, Aug 03: 19 - 20h

Jorge Andres Littin Curinao (Universidad Católica del Norte)
Quasi-additive estimates on the Hamiltonian for the One-dimensional Long Range Ising Model

José Carlos S. de Miranda (Instituto de Matemática e Estatística)
Invariant distribution of a non linear time series with uniform noise

Leandro Chiarini Medeiros (Universidade de Brasilia)
Continuity of the phase transition of the Ising Model in 3 dimensions via random currents

Luana Amaral Gurgel (Universidade Federal de Minas Gerais)
A Particle System with Explosions: Law of Large Numbers for Density of Particles and the Blow- Up Time

Maximiliano Altamirano (University of Buenos Aires)
Quasi-Stationary Distributions for a Random Neuron Model

Marco Vinícius Bahi Aymone (Universidade Federal de Minas Gerais)
Partial sums of biased random multiplicative functions

Mario Estrada Lopez (IMECC)
Asymptotic results for epidemic processes on finite populations

Milton Miranda Neto (Universidade Federal de São Carlos)
Poisson process

Nahuel Soprano Loto (Gran Sasso Science Institute)
Turing instability in a particle system model

Nicolas Frevenza (Universidad de Buenos Aires)
Gibbs measures and permutations

Paula Mendes Soares Fialho (Universidade Federal de Minas Gerais)
On Dependency Graphs and the Lattice Gas

Paulo C. Lima (UFMG)
Low temperature analysis of correlation functions of the Blume-Emery-Griffiths model at the antiquadrupolar-disordered interface

Paulo Henrique Pereira da Costa (Universidade de Brasilia)
Strong Averaging Along Foliated Lévy Diffusions with Heavy Tails on Compact Leaves

Renato Jacob Gava (Universidade Federal de São Carlos)
Limit theorems for the elephant random walk

Ricardo De Carli Novaes (Universidade Federal de São Carlos)
Limit theorems for correlated Bernoulli random variables

Ricardo Felipe Ferreira (Universidade Federal de São Carlos)
On existence of invariant measures for regular and non-regular g-functions

Roberto Vila Gabriel (Universidade de Brasilia)
Limit Theorems in Mallows Distance for Processes with Gibssian Dependence

Rodrigo Lambert (Universidade Federal de Uberlândia)
The divergence between two measures in product spaces

Sávio Ribas (Instituto Federal de Minas Gerais)
Shifted Turán sieve method on tournaments

Túlio Lima Sousa Madureira Silva (Universidade Federal de Minas Gerais)
Análise numérica da transição de fase em um sistema de campo médio

Weberson da Silva Arcanjo (Universidade Federal de Minas Gerais)
The contact process as seen from a random walk