Program:	
	Monday, March 04
08:30 - 09:00	Registration/Opening
09:00 - 09:45	Teixeira
10:00 - 10:45	Hilario
10:45 - 11:15	Coffee break
11:15 - 12:00	Bermolen
12:00 - 14:00	Lunch break
14:00 - 14:45	Remenik
15:00 - 15:45	Groisman
15:45 - 16:15	Coffee break
16:15 - 17:00	Moreno
17:15 - 18:00	Rolla
	Tuesday, March 05
09:00 - 09:45	Imbuzeiro
10:00 - 10:45	Cortez
10:45 - 11:15	Coffee break
11:15 - 12:00	Jara
12:00 - 14:00	Lunch break
14:00 - 14:45	Rodriguez
15:00 - 15:45	Armendariz
15:45 - 16:15	Coffee break
16:15 - 17:00	Lacoin
17:15 - 18:00	Ferrari

Abstracts:

Ines Armendariz

Title: Potential method for community detection

Abstract: The stochastic block model (SBM) is a random graph model with planted clusters, that is, groups of vertices that share a common label, and such that the connection probability between a pair of vertices depends on their label. It is a canonical and widely studied model for community detection, where one wants to identify the clusters from the observation of a realization of the graph. In this talk we will review some community detection algorithms and their convergence properties, and discuss a quite natural method based on random walks on the graph. We will show that it converges both weakly and strongly, and that it allows for online identification of the communities.

Joint work in progress with Nicolás Agote, Pablo Ferrari and Florencia Leonardi.

Paola Bermolen

Title: Algorithmic Advances in Graph Representation Learning for Dynamic Graphs Abstract: The extraction of patterns and actionable information from graph data is currently one of the most important topics in machine learning. Different from audio or images, the non-regularity in the data structure makes prediction or classification tasks very difficult. The goal in learning graph representations is to learn a vector per node(embedding) that can be used in the corresponding downstream task. Although graph data are ubiquitous in many applications, the use of these tools is still in its infancy, and traditional techniques persist as the go-to methods for the most part.

Our work focuses on spectral-based representations of graphs, such as Random Dot Product Graphs (RDPGs) and its associated inference method Adjacency Spectral Embedding (ASE). The state of the art in learning such representations has some limitations: i) it becomes prohibitive for medium/large sized graphs, ii) it does not allowworking with missing data, and iii) the invariant nature under rotations of the solution makes it difficult to use it for tracking representations in sequences of graphs.

We bring to bear recent advances in non-convex optimization to address these limitations and demonstrate their impact on RDPG inference. We advocate first-ordergradient descent methods to solve the embedding problem better and to cope organically with previous limitations. The effectiveness of the proposed graph representation learning framework is demonstrated in reproducible experiments with both synthetic and real network data.

Roberto Cortez

Title: Persistence phenomenon in biological neural network models

Abstract: In a biological neural network, the phenomenon of persistence refers to sustained neural firing that continues long after the triggering stimulus goes away. It has been observed in a diverse set of brain regions and organisms, and it is considereda mechanism for short-term storage. In this talk, we introduce a simplified stochastic model for the electric potential of N leaky neurons, whose dynamics is driven by inhomogeneous Poisson processes, accounting for the intrinsic randomness of the firings. The interactions are sparse: upon firing, the neuron instantaneously increases the potential of a fixed number of randomly chosen neurons. We study the large network limit and show that it exhibits a phase transition: the activity of the infinite network either vanishes in finite time, or it persists forever, depending on the parameters of the firing intensity. This allows us to model persistence: we prove that,although the neural activity of a finite network eventually vanishes, it may persist for a very long time.

Pablo Ferrari

Title: Continuous Box Ball System

Abstract: The box ball system is a discrete space-time conservative transport cellular automaton with many conserved quantities called solitons. It was introduced by Takahashi and Satsuma in 1996. We study a space-continuous version, where blocks of consecutive occupied boxes are substituted by occupied segments contained in thereal numbers, separated by empty segments. The walk representation of a continuousball configuration is a zig-zag function, whose dynamics coincides with Pitman transformation, 1975. We describe an intuitive way to identify solitons and to show that solitons are conserved under the dynamics, using the conservation of ``shortest runs''. We also show that the soliton decomposition of some random zig-zag walks give a bidimensional Poisson process, whose evolution is a hierarchical translation of the points. This extends discrete space results by Nguyen, Rolla, Wang, Gabrielli and the speaker, 2021 2022. Work in preparation with Inés Armendáriz, Pablo Blanc and Davide Gabrielli.

Pablo Groisman

Title: The Kuramoto Model in Random Geometric Graphs.

Abstract: The Kuramoto model is a nonlinear system of ODEs that represents the behavior of coupled oscillators. The coupling is determined by a given graph and pushes the system towards synchronization. An important question is whether there isglobal synchronization (the system converges to a state in which all the phases coincide from almost every initial condition) or if the system supports other patterns.

We will consider the Kuramoto model on random geometric graphs in the d dimensional torus and prove a scaling limit. The limiting object is given by the heat equation. On the one hand this shows that the nonlinearities of the system disappear under this scaling and on the other hand, provides evidence that stable equilibria of theKuramoto model on these graphs are, as $n \to \infty$, in correspondence with those of the heat equation, which are explicit and given by twisted states. In view of this, we conjecture the existence of twisted stable equilibria with high probability as $n \to \infty$.

We'll prove this conjecture in dimension d=1.

Marcelo Hilario

Title: Percolation on randomly stretched lattice

Abstract: We revisit a model of percolation on a random lattice first studied by Hoffman [CMP 254, 1-22, 2005]. Starting from the usual square lattice, rows and columns are selected uniformly at random, and all the edges lying along a selected row or column are removed at once. This gives rise to a randomly stretched version of the square lattice. Given a realization, independent bond percolation is performed on top of it. The goal of the present talk is to present a proof for the phase transition for this model. Our proof shares some similarities with the original proof by Hoffman and with the ideas in Kesten et. al. [EJP 27, 1-49 2022] but also brings some new ideas that we expect to be useful in new situations. Based on a joint ongoing work with Marcos Sá, Augusto Teixeira, and Remy Sanchis.

Roberto Imbuzeiro

Title: The top eigenvalue of a random tree

Abstract: Choose a n-vertex labelled tree uniformly at random, with n large. In this talk,we show that, with high probability, the top eigenvalue of the tree equals the squareroot of the maximum degree, up to a small additive error. This is similar to what wasrecently shown for a critical Erdös-Rényi random graph by Hiesmayr and McKensie.

Our proof, however, is quite different, and combines three ingredients. The first one is aseries of probabilistic lemmas on typical trees. The second one consists of combinatorial arguments for counting walks in "nice" trees. The third part of the argument is a way to turn a typical tree into a nice tree that can only make the top eigenvalue larger.

This is joint work with Louigi Addario-Berry (McGill) and Gabor Lugosi (ICREA/UPF).

Milton Jara

Title: Sharp convergence of mean-field models.

Abstract: By means of two examples, the noisy voter model and the SIS model with demographic factor, we explain how to derive quantitative estimates on the rate of convergence of observables of Markov chains. As an application, we show that the lawof the SIS model on the endemic phase can be well approximated by a Curie-Weiss measure.

Joint work with Yangrui Xiang and Enzo Aljovin.

Hubert Lacoin

Title: Strong disorder and very strong disorder are equivalent for directed polymers (joint with Stefan Junk)

Abstract: The Directed Polymer in a Random Environment is a statistical mechanics model, which has been introduced (in dimension 1) as a toy model to study the interfaces of the planar Ising model with random coupling constants. The model was shortly afterwards generalized to higher dimensions. In this latter case, rather than an effective interface model, the directed polymer in a random environment can be thought of as modeling the behavior of a stretched polymer in a solution with impurities. The interest in the model model, triggered by its rich phenomenology has since then generated a plentiful literature in theoretical physics and mathematics. An important topic for the directed polymer is the so-called localization transition. This transition can be defined in terms of the asymptotic behavior of the renormalized partition function of the model. If the finite volume partition function converges to an almost surely positive limit, we say that weak disorder holds. On the other hand, if it converges to zero almost surely, we say that strong disorder holds. It has been proved that weak disorder implies that the distribution of the rescaled polymer converges to standard Brownian motion while some localization results have been proved under thestrong disorder assumptions. Much stronger characterizations of disorder-induced localization have been obtained under the stronger assumption that the partition function converges to zero exponentially fast. This latter regime is known as the very strong disorder regime. It has long been conjectured that strong and very strong disorder are equivalent. In this talk we will sketch a proof of this conjecture.

Gregorio Moreno

Title: Diffusions with a singular drift

Abstract: In this talk, we will consider SDEs with a distribution-valued drift. I will report on recent results on existence and uniqueness, convergence of random walks in vanishing environments, and some examples, including Brox diffusion and random polymers. This is based on joint works with H. Olivero (U. Valparaíso), N. Perkowski (FU-Berlín) and J. Sepúlveda (UC-Chile).

Daniel Remenik

Title: TASEP with inhomogeneous speeds and memory lengths

Abstract: The totally asymmetric simple exclusion process on the integer lattice is one of the basic models in the KPZ universality class. Explicit formulas have been derived forthe distribution of the process, which have been used to derive its long-time scaling limit. In this talk I will discuss some extensions of these formulas to the case when particles jump with different rates, or when their "memory lengths" are different. Basedon these formulas I will present some asymptotic results for examples of interest that connect them to processes related to the KPZ fixed point, and I will discuss some conjectures.

Pablo Rodriguez

Title: On the phase transition of two branching processes with selection

Abstract**:** In this talk we will discuss two special stochastic processes, which may be seen as branching processes with selection. One of them is the accessibility percolation model on spherically symmetric trees; the other is a branching random walk with barriers. We will present the motivation behind its formulation and recent results related to the existence of phase transition in such processes.

Leonardo Rolla

Title: Quasi-stationary distributions for subcritical population models (Joint work with Pablo Groisman and Célio Terra.)

Abstract: We consider population models with reproduction (branching process, contact process, branching random walks). This model has a phase transition in terms of the distribution of the number of children. In the subcritical case, every initial distribution is attracted to the empty configuration and, in the lack of a non-trivial stationary distribution, one studies the quasi-stationary behavior of the system. In this talk we will discuss questions of existence, uniqueness and nonuniqueness of the quasi-stationary distribution, and their relation with spatial aspects of the dynamics.

Augusto Teixeira

Title: CLT for a class of random walks in dynamic random environments

Abstract: This talk will start with a brief overview of some recent developments in the study of random walks in dynamic random environments. Then we will present a new result that provides a CLT for a family of environments that mix fast, but non-uniformly. The proof of the result is based on what we call the Random Markov Property. Roughly speaking, this technique involves the positioning of traps throughout the environment, insuch a way that, when the random walk steps over one of them, it sees an independent future. Finally we will present some open problems of the area that we believe to be exciting and promising.