Frontiers in Analysis and Probability
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Abstracts

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Some log-correlated random fields and their extrema

by David Belius

Abstract: Log-correlated random fields, and their extrema, show up in diverse settings, including the theory of cover times, random matrix theory and number theory. Often this can be explained by way of a multiscale decomposition which exhibits an approximate branching structure. I will recall the main ideas behind the analysis of the most basic model of the log-correlated class, namely Branching Random Walk, where the branching structure is explicit, and explain how to adapt these to models where the branching structure is not immediately obvious.

Gaussian random fields with local pinning

by Erwin Bolthausen

Abstract: We give an overview on some recent and on some more classical results concerning a class of random fields defined on the hypercubic lattice which have slowly decaying correlations. Examples are the lattice versions of the free fields, and the so-called membrane models. A local pinning means that the random field is modified in a way to have a preference to stay close to a deterministic "wall". This typically drastically modifies the character of the random field.

We will focus on two recent results, the first one with T. Chyonobu and T. Funaki on the behavior in the presence of two possible candidates for the global behavior, and the second one with A. Cipriani and N. Kurt on the decay of correlations for the membrane model.

A geometric approach to the Ising model

by Hugo Duminil-Copin

Abstract: In this talk, we will discuss a geometric approach to the Ising model which is based on the so-called random-current representation. We will introduce this representation and review a few results obtained in the past few years.

Interacting one-dimensional quantum particles in a random field

by Frédéric Klopp

Abstract: Consider N one-dimensional quantum particles in the interval $[0, L]$ submitted to a random field. The interaction is assumed to be repulsive. In the thermodynamic limit ($L, N \to +\infty$, $N/L \to \rho > 0$), the aim of the lectures is to describe the ground state and the ground state energy per particle when ρ is small. We will discuss both the bosonic and the fermionic cases.

The continuum parabolic Anderson model on R^3

by Cyril Labbé

Abstract: The continuum parabolic Anderson model describes the motion of a particle in a random potential. In the case where the potential is a white noise in space, the density of the particle satisfies a stochastic PDE which is ill-posed as soon as the dimension of the underlying space is higher than or equal to 2. The theory of regularity structures of Hairer allows one to give a meaning to this SPDE by means of renormalisation techniques. However, in its original framework, the underlying space needed to be a bounded domain. I will present an extension of the analytical part of the theory which allows to construct the solution on the whole space R^3 and starting from a Dirac mass at time 0.

This is a joint work with Martin Hairer.

Mod-phi convergence and distances between probability measures

by Pierre-Loïc Méliot

Abstract: Given a sequence of random variables X_n that admits a limiting law μ, we explain how to use the techniques of mod-phi convergence in order to get precise estimates of the distances between the law μ_n of X_n, and its limit μ.

In the continuous setting, we obtain an alternative to Stein's method, which relies only on Fourier analysis, and which is adequate to deal with sums of dependent random variables.

In the discrete setting, the construction of approximation schemes leads to a better understanding of the mixing of the sources of randomness that occurs in large random arithmetic or geometric structures.

Some results on delocalization and localization of eigenvectors of random matrices

by Sandrine Péché

Abstract: We will discuss what can impact on the delocalization of eigenvectors of random matrices. The talk will make a review of some recent results for Hermitian random matrices.

Spectral geometry of tori with random impurities

by Henrik Ueberschär

Abstract: An important object of study in the theory of disordered quantum systems are Schroedinger operators with a random potential. In 1958, Anderson discovered that for sufficiently strong disorder their eigenfunctions could be exponentially localized at the bottom of the spectrum. I will discuss some new results about the geometry of eigenfunctions on tori with random Dirac masses, the limit of large tori and the breakdown of exponential localization in weakly disordered systems.