List of Abstracts

Wednesday 15th

Everywhere and instantaneous blowup of parabolic SPDEs

Eulalia Nualart[1]

[1] Pompeu Fabra University

We consider the non-linear stochastic heat equation defined on the whole line driven by a space-time white noise. We will first recall some known results on the almost sure blow up for this type of equations. We then give sufficient conditions for the solution to blow up everywhere and instantaneously almost surely. The main ingredient of the proof is the study of the spatial growth of stochastic convolutions using techniques from Malliavin calculus and Poincaré inequalities.

This is a joint work with Davar Khoshnevisan and Mohammud Foondun.

Multidimensional Stein method for normal approximation and quantitative asymptotic independence

Ciprian Tudor[1]

[1] University of Lille

Let $(X_1, X_2, \ldots, X_n)$ be a random vector and denote by $P_{(X_1,X_2,\ldots,X_n)}$ its probability distribution on $\mathbb{R}^n$. We develop a multidimensional Stein-Malliavin calculus which allows to measure the Wasserstein distance between the law $P_{(X_1,X_2,\ldots,X_n)}$ and the probability distribution $P_Z \otimes P_{(X_2,\ldots,X_n)}$, where Z is a Gaussian random variable. We also regard the particular case of random vectors in Wiener chaos and we give an asymptotic version of this result. As an example, we derive the rate of convergence for the Wasserstein distance for a two-dimensional sequence of multiple stochastic integrals, the first converging to a normal law and the second to a Rosenblatt distribution.

Attraction to and repulsion from patches on the hypersphere and hyperplane for isotropic d-dimensional α-stable processes with index in $\alpha \in (0,1]$ and $d \geq 2$

Andreas Kyprianou[1]

[1] University of Warwick

Consider a d-dimensional α-stable processes with index in $\alpha \in (0,1]$ and $d \geq 2$. Suppose that Ω is a region of the unit sphere $S^{d-1} = \{x \in \mathbb{R}^d : |x| = 1\}$. We construct the aforesaid stable Lévy process conditioned to approach Ω continuously, either from inside S^{d-1}, from outside S^{d-1} or in an oscillatory way; all of which have zero probability. Our approach also extends to the setting of hitting bounded domains of (d-1)-dimensional hyperplanes. We appeal to a mixture of methods, appealing to the modern theory of self-similar Markov process as well as the classical potential analytic view.

Small time asymptotics for kernels of diffusions

Pierre Perruchaud[1]

[1] University of Luxembourg

Imagine yourself in a peculiar car that drives in all directions without rotating. Controlling the car through random Gaussian pushes will give a model of Brownian motion, and at t time t, the position of the car will be localized in a neighborhood of size ?t of the initial point. In this car, you can get to any point of your choosing, but cannot change your orientation; the situation is different on a small spherical planet: big loops will cause the car to rotate. Contrary to the position, the angle will actually be of size t. These behaviors, along with curvature information, are encoded in the kernel of the diffusions and their asymptotics. In this talk, we will consider the case of a car with constant velocity, but varying direction. It will turn out to be both very different and very similar to the cases above.

Thursday 16th

Berry’s random wave model and applications

Maurizia Rossi[1]

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Berry’s random wave model is a Gaussian field on the plane that should predict the local behavior of any high-energy wavefunction, at least for "generic" chaotic billiards. It appears as the scaling limit of a number of random wave models, for instance on the sphere and its spin line bundles, on the torus and on negatively curved manifolds. In this talk we investigate analytic and geometric properties of Berry’s field with an emphasis on the distribution of its nodal statistics, also in view of Yau’s conjecture. Then we combine such results with the scaling limit property to investigate the local behavior of random wave models in some of the above mentioned settings. Finally, we mention some open problems in this research field.

Kac-Rice formula for transverse intersections

Michele Stecconi[1]

[1] University of Luxembourg

The Kac-Rice fomula allows to compute the expected cardinality (or volume) of the zero set of a random function. I will present a generalization that, given a random smooth map between two smooth manifolds: from M to N, computes the expected cardinality (or volume) of the preimage of a fixed submanifold W of N. Note that in general it is not possible to write W as the regular zero set of a global function on N. In analogy with the standard case (when W is a point), the formula is an integral over $M \times W$, but presents non-trivial additional terms depending on the tangent space to W.

This theory can be applied to study singularities of random fields, especially in the Gaussian case. For instance, the intersection of two submanifolds can be seen as the preimage of the diagonal for an appropriate map on product spaces.

Nonparametric estimation of the Lévy density: frequentist and Bayesian results

Ester Mariucci[1]

[1] University of Versailles Saint-Quentin-en-Yvelines

We consider the problem of estimating the Lévy density of a pure jump Lévy process, from discrete observations of one trajectory. We discuss results both from a frequentist and a Bayesian perspective.

In a high frequency setting and for Lévy processes possibly of infinite variation, we construct a linear wavelet estimator of the Lévy density based on a compound Poisson approximation. Its performance is studied in terms of L_p loss functions, $p \geq 1$, over Besov balls. To show that the resulting rates are frequentist minimax-optimal for a large class of Lévy processes, we propose new non-asymptotic bounds of the cumulative distribution function of Lévy processes with Lévy density bounded from above by the density of a Lévy process of α-stable-type in a neighbourhood of the origin. In a low frequency setting, we propose a Bayesian estimator for the Lévy density of a compound Poisson process with jumps supported on the set of natural numbers which achieves the minimax posterior contraction rate.

The results presented are in collaboration with Céline Duval, Shota Gugushvili and Frank van der Meulen.

Central limit theorems for heat equation with time-independent noise: the regular and rough cases

Wangjun Yuan[1]

[1] University of Luxembourg

We investigate the asymptotic behaviour of the spatial average of the solution to the parabolic Anderson model with time independent noise in dimension $d \geq 1$, as the domain of the integral becomes large. We consider three cases: (a) the case when the noise has an integrable covariance function; (b) the case when the covariance of the noise is given by the Riesz kernel; (c) the case of the rough noise, i.e. fractional noise with index $H \in (1/4, 1/2)$ in dimension $d = 1$. In each case, we identify the order of magnitude of the variance of the spatial integral, we prove a quantitative central limit theorem for the normalized spatial integral by estimating its total variation distance to a standard normal distribution, and we give the corresponding functional limit result.

This is the joint work with Raluca Balan.

Zeros and critical points of Gaussian fields : a moment-based approach

Louis Gass[1]

[1] University of Luxembourg

The study of the zeros set associated with a (vector valued) Gaussian field is a very classical topic in probability. In this talk, I will present a moment-based approach in order to study local and global properties of this zeros set. The analysis is based on the Kac-Rice formula, which gives an integral expression for the p-th moment of the nodal volume of a random field. I will present a new method of resolution of the Kac-Rice singularity which leads to new results on the finiteness of the p-th moment for the nodal volume. I will also comment on the local geometry of the zeros sets, and in particular the local attraction/repulsion of critical points of random fields.

On the distribution of random quadratic forms

Guillaume Poly[1]

[1] University of Rennes 1

It is well known that a quadratic form evaluated in a random gaussian vector has a distribution given by an explicit weighted sum of chi-squares and the coefficients are explicitely given by the spectrum of the quadratic form. This proceeds from a diagonalisation procedure and the invariance of the gaussian law by isometry.

This technique completely fails beyond the gaussian distribution. In this talk, we will provide some insights about this situation and develop a formalism to provide fine estimates about the distribution of such quadratic forms. In particular, it will be shown that in case of central convergence and under mild conditions on the random vectors on which the quadratic forms are evaluated, the distribution admits a density whose regularity tends to infinity when we get closer to Gaussianity. All our estimates will be independent of the dimension (i.e the size of the random vectors).

This is a joint work with R.Herry and D.Malicet

Quantitative and stable limits of high-frequency statistics of Levy processes: a Stein's method approach.

Chiara Amorino[1]

[1] University of Luxembourg

We establish inequalities for assessing the distance between the distribution of errors of partially observed high-frequency statistics of multidimensional Lévy processes and that of a mixed Gaussian random variable. Furthermore, we provide a general result guaranteeing stable convergence. Our arguments rely on a suitable adaptation of the Stein's method perspective to the context of mixed Gaussian distributions, specifically tailored to the framework of high-frequency statistics.

This is based on a joint work with A. Jaramillo and M. Podolskij.

Thursday 16th

The dimer model on minimal graphs: the elliptic case and beyond

Béatrice de Tilière[1]

[1] University Paris Dauphine

The dimer model represents the adsorption of diatomic molecules on the surface of a crystal. It is modeled through perfect matchings of a planar graph chosen with respect to the Boltzmann measure. When the graph is periodic, Kenyon, Okounkov and Sheffield show that the phase diagram is given by the spectral curve, which has the remarkable property of being Harnack. Another important result is the local expression obtained by Kenyon for one Gibbs measure when the underlying graph is isoradial and the model is critical. In a series of works with Cédric Boutillier (Sorbonne University) and David Cimasoni (University of Geneva), we extend these results in a unified framework. We consider the model on minimal graphs and prove an explicit correspondence with the set of Harnack curves; we also prove local formulas for the two parameter family of Gibbs measures.

Berry-Essen Theorem for Functionals of Certain Infinitely Divisible Processes

Andreas Basse-O'Connor[1]

[1] Aarhus University

In this talk, we derive Berry-Esseen bounds for non-linear functionals of certain infinitely divisible processes. More precisely, we consider the convergence rate in the Central Limit Theorem for functionals of heavy-tailed moving averages, including the linear fractional stable noise, stable fractional ARIMA processes, and stable Ornstein-Uhlenbeck processes. Our rates are obtained for the Wasserstein and Kolmogorov distances and depend strongly on the interplay between the process's memory, controlled by parameter a, and its tail index, controlled by a parameter b. For example, we obtain the classical $n^{-1/2}$ convergence rate when the tails are not too heavy, and the memory is not too strong, more precisely, when $a * b > 3$ or $a * b > 4$ in the Wasserstein and Kolmogorov distance, respectively.

Our quantitative bounds rely on a new second-order Poincare inequality on the Poisson space, which we derive through Stein's method and Malliavin calculus. This inequality improves and generalizes a result by Last, Peccati, and Schulte. The talk is based on joint work with M. Podolskij (University of Luxembourg) and C. Thäle (Ruhr University Bochum).

Tail asymptotics for exponential functionals of subordinators and extinction times of self-similar fragmentations

Bénédicte Haas[1]

[1] Sorbonne Paris North University

Exponential functionals of subordinators have been thoroughly investigated, since they play a key role in several facets of modern probabilities since they correspond to the extinction times of non-increasing self-similar Markov processes. As such, they are involved in the description of various processes ranging from the analysis of algorithms to coagulation or fragmentation processes. In this talk we will provide the exact large-time equivalents of the density and upper tail distribution of the exponential functional of a subordinator in terms of its Laplace exponents. This improves previous results on the logarithmic asymptotic behaviour of this tail.

We will then see how this result can be used to determine the large-time behavior of the tail distribution of the extinction time of a self-similar fragmentation process with a negative index of self-similarity. The extinction time of a typical fragment in such a process is an exponential functional of a subordinator. But the tail of the extinction time of the whole fragmentation process decreases much more slowly in general. We will quantify this difference by determining the asymptotic ratio of the two tails.

Nonparametric estimation of trawl processes: Theory and Applications

Almut Veraart [1]

[1] Imperial College London

This talk introduces a flexible class of stochastic processes, called trawl processes, which are defined as Lévy bases evaluated over deterministic trawl sets and are widely applicable in many sciences. We will present a novel nonparametric estimator of the trawl function characterising the trawl set and the serial correlation of the process and establish the corresponding asymptotic theory. A simulation study shows the good finite sample performance of the proposed estimator, and, in an empirical illustration, the new methodology is applied to modelling and forecasting high-frequency financial spread data from a limit order book.

This talk is based on joint work with Orimar Sauri (Aalborg University)