Conference in Honour of the 60th Birthday of Dominique Bakry

December 8-12, 2014, Toulouse

Speakers, titles and abstracts

Gérard Besson (Université de Grenoble)

Title: Some questions on open 3-manifolds

Abstract: We will discuss what could be considered as a new playground for Riemannian geometers: we will describe some open 3-manifolds and mainly ask questions about the kind of Riemannian metrics they can be endowed with.

Philippe Biane (Université Paris-Est)

Title: Fourier transform, orthogonal polynomials and root systems

Abstract: Interpreting the Fourier transform as a scattering leads to a nontrivial inverse scattering problem. In this talk I will describe an approach to this problem through orthogonal polynomials on the unit circle. This leads to some interesting discrete Painlevé equations related to affine root systems.

Pietro Caputo (Università Roma Tre)

Title: Approximate tensorization of entropy at high temperature

Abstract: In a recent work with Prasad Tetali and Georg Menz, we show that, for a suitable class of weakly dependent random variables, the relative entropy functional satisfies an approximate version of the well known tensorization property that holds in the independent case. In the context of spin systems on a graph the weak dependence requirements resemble the well known Dobrushin uniqueness conditions. A natural application of approximate tensorization yields a family of dimensionless logarithmic Sobolev inequalities. I will review some known results from the literature and present some open problems.

Eric Carlen (Rutgers University)

Title: On the hypergroup property

Abstract: t.b.a.

Persi Diaconis (Stanford University)

Title: An exercise (?) in Fourier analysis on the Heisenberg group

Abstract: The Heisenberg group appears in physics,number theory,harmonic analysis, the analysis of algorithms (FFT) and in probability. In joint work with Dan Bump, Angela Hicks, Laurent Miclo and Harold Widom we use Fourier analysis to analyze the rate of convergence (and decay rates) of simple random walk. This is surprisingly challenging, needing new techniques for bounding the eigen values (and vectors) of non stochastic matrices. I will try to bring out the connection to Lévy's area.

Michel Emery (Université de Strasbourg)

Title: Multilinear-algebraic aspects of the classification of Azéma martingales

Abstract: The spatial behaviour of regular multidimensional Azéma martingales is driven by algebraic properties of some 3-linear forms. More precisely, to each such martingale is associated a space of "doubly symmetric" 3-linear forms, which, in turn, constraints the infinitesimal generator of the process. The algebraic foundations of this probabilistic study appear to be new.

Martin Hairer (University of Warwick)

Title: A Wong-Zakai theorem for stochastic PDEs

Abstract: t.b.a.

Nassif Ghoussoub (University of British Columbia)

Title: On the Hardy-Schrödinger operator with a singularity on the boundary

Abstract: I will consider borderline variational problems involving the Hardy-Schrödinger $L_\gamma := -\Delta - \frac{\gamma}{|x|^2}$ operator on a domain $\Omega \subset \mathbb{R}^n$. The classical Hardy inequality states that L_γ is a non-negative operator as long as $\gamma \leqslant \frac{(n-2)^2}{4}$. The situation is much more interesting when the singularity $0 \in \partial\Omega$. For one, the operator could then be non-negative for γ up to $\frac{n^2}{4}$. The problem of whether the Dirichlet boundary problem $L_\gamma u = \frac{u^{\frac{n+2-2s}{n-2}}}{|x|^s}$ on Ω has positive solutions is closely related to whether the best constants in the Caffarelli-Kohn-Nirenberg inequalities are attained. If $\gamma < \frac{(n-2)^2}{4}$, such extremals exist under the condition that the mean curvature of the domain at 0 is negative. The case when $\frac{(n-2)^2}{4} \leqslant \gamma < \frac{n^2}{4}$ turned out to be much more interesting. A detailed analysis of L_γ shows that $\gamma = \frac{n^2-1}{4}$ is another critical threshold for the Hardy-Schrödinger operator, beyond which a "positive mass theorem" – in the spirit of Shoen-Yau – is required.
This is joint work with Frédéric Robert from the Université of Nancy.

Yves Le Jan (Université Paris-Sud)

Title: Loops, fields and networks

Abstract: We investigate the relations between the Poissonnian loop ensemble arising in the construction of random spanning trees, the free field, and random Eulerian networks associated with a Markov chain

Gérard Letac (Université de Toulouse)

Title: Asymptotic behavior of the random Dirichlet probabilities

Abstract: Let α be a probability on the convex set E. For $t > 0$ consider the random Dirichlet probability P_t on E governed by $t\alpha$: that means that $P_t(A_1), \dots, P_t(A_n)$ is Dirichlet with parameters $t\alpha(A_1), \dots, t\alpha(A_n)$ for any partition $(A_1, \dots, A_n)$ of E. The law of $\int_E x P_t(dx)$ is denoted by $\mu(t\alpha)$. We prove that $t \mapsto \mu(t\alpha)$ shrinks in the Strassen order and converges to δ_m if the mean $m = \int_E x\alpha(dx)$ exists. For instance if E is the positive line, this implies that the moments of $\mu(t\alpha)$ are decreasing functions of t. We prove that $\mu(t\alpha)$ can only converge to a Cauchy distribution if m do not exist.
Joint work with Mauro Piccioni.

Terry Lyons (University of Oxford)

Title: Integrating co-cyclic one forms against rough paths

Abstract: The theory of rough paths started by considering how to close the operator that corresponds to integrating a one form along a path. The integration of one forms against p-rough paths was the output. Unlike in the Itô case, the forms were chosen not to depend on time. We explain how this picture can be relaxed to allow 1) a richer class of forms to capture the rough features of the paths (cocyclic) and 2) slowly time varying. This relaxation allows the scalar integrands of a fixed rough path by these forms to form a nice class closed under basic operations and gives a notion of "semi-martingale" associated with an underlying rough path (and is closely related to Gubinelli's controlled rough path notion).

Emanuel Milman (Israel Institute of Technology)

Title: Curvature-Dimension condition for non-conventional dimensions

Abstract: Given an n-dimensional weighted Riemannian manifold satisfying a $CD(\rho, N)$ Curvature-Dimension condition, the range of admissible values for the generalized dimension N has traditionally been confined to $[n, \infty]$. We extend this in two manners. First, we treat the range $N \in (-\infty, 1) \cup [n, \infty]$, identifying in particular new one-dimensional model-spaces for the isoperimetric problem. Of particular interest is when curvature is strictly positive, yielding a new *single* model space (besides the previously known N-sphere and Gaussian measure when $N \in [n, \infty]$): a positively curved two-sided hyperbolic space of dimension $N \in (-\infty, 1)$, enjoying a two-level concentration of the type $\exp(-\min(t, t^2))$. Second, to treat the "forbidden" range $N \in [1, n)$, where all the well-understood isoperimetric, Sobolev and concentration properties completely break-down for the traditional CD condition, we propose a novel *graded* extension of the CD condition. The Graded CD condition reflects a scenario in which the space decouples into two metric-measure "halves" contributing to the total Curvature-Dimension, such that each half satisfies a curvature lower bound requirement. Time permitting, we will present, assuming the Graded CD condition, new isoperimetric inequalities in the previously inaccessible range $N \in [1, n)$, as well as improved ones in the traditional range $N \in [n, \infty)$. This leads to a natural conjecture regarding an optimal concentration property of a certain cone measure associated to a given convex body in $\mathbb{R}^n$, which satisfies the Graded CD condition.

Felix Otto (Max Planck Institute, Leipzig)

Title: A regularity theory for random elliptic operators

Abstract: We present a regularity theory for elliptic systems with random stationary coefficients. Loosely speaking, we identify a radius (a random stationary field) starting from which a $C^{1,\alpha}$-Hölder regularity theory applies, and show that this random variable has exponential moments in probability under mild mixing conditions on the coefficients. In this sense, with overwhelming probability, solutions behave like those of constant-coefficient systems on length scales larger than unity. The mixing condition is expressed in terms of a family of spectral gap conditions that allow for non-integrable correlations. This is joint work with A. Gloria and S. Neukamm; inspired by earlier work of Naddaf & Spencer (for the use of spectral gap conditions in stochastic homogenization), of Avellaneda & Lin (for the use of Campanato's iteration in periodic homogenization), and of Armstrong & Smart (for the extension of the latter ideas to stochastic homogenization).

Gilles Pisier (Texas A&M University and Université ParisVI)

Title: Random matrices, quantum expanders and geometry of operator spaces

Abstract: We plan to give first a brief introduction to the part of Operator Space Theory related to the notion of ”exactness” and its connection to the “strong convergence” of certain random matrices. Then we will describe a recent generalization of “exact” called “subexponential” as well as quantum expanders and their interpretation as ”smooth points” on the operator space analogue of the Euclidean unit sphere.
References: “Random Matrices and Subexponential Operator Spaces” on arxiv and Israel J. Math. (2014), “Quantum Expanders and Geometry of Operator Spaces” on arxiv and JEMS (2014).

Zhongmin Qian (University of Oxford)

Title: Gradient estimates for the positive solutions of the porous medium equation

Abstract: I will report some new gradient estimates of Aronson-Bénilan type for the positive solutions of the porous medium equations and for the fast diffusion equations on a complete manifold that satisfies Bakry-Emery’s curvature dimension condition.

Max von Renesse (Universität Leipzig)

Title: Stochastic mean curvature flow in dimension 2+1

Abstract: t.b.a.

Christophe Sabot (Université de Lyon)

Title: Edge Reinforced Random Walk and related topics

Abstract: The Edge Reinforced Random Walk (ERRW) is a self-interacting discrete time process introduced by Coppersmith and Diaconis in 1986, which is likely to come back to the edges already often visited. In this talk we will review recent results on the ERRW and on closely related self-interacting processes. We will also describe its relations with other topics as Bayesian statistics, supersymmetry and random Schrödinger operators.

Laurent Saloff-Coste (Cornell University)

Title: Long range random walks on nilpotent finitely generated groups

Abstract: Consider a group generated by element $s_1, s_2, \ldots, s_k$. Fix $a_1, a_2, \ldots, a_k \in (0, 2)$. We discuss the behavior of the random walk which proceeds by picking j uniformly at random in $(1, \ldots, k)$, picking n independently with probability $p_k(n) = c_k(1+n)^{-a_j-1}$ and moved from the current location x to xs_j^n. These are perhaps the most natural long range random walks on finitely generated groups.
Joint work with Tianyi Zheng.

Karl-Theodor Sturm (Universität Bonn)

Title: Bakry calculus - Old and new

Abstract: t.b.a.

Feng-Yu Wang (Beijing Normal University)

Title: Hypercontractivity for stochastic Hamiltonian systems

Abstract: The hypercontractivity is proved at the first time for the Markov semigroup associated to a class of finite/infinite dimensional stochastic Hamiltonian systems. Consequently, the Markov semigroup is exponentially convergent to the invariant probability measure in entropy (thus, also in L^2), and is compact for large time. These strengthen the hypocoercivity results derived in the literature. Since the log-Sobolev inequality is invalid for the associated Dirichlet form, we introduce a general result on the hypercontractivity using the Harnack inequality with power. The main results are illustrated by concrete examples.