

61 Probability Encounters, In honour of Sergey Bobkov



Report of Contributions

Contribution ID: 1

Type: **not specified**

Friedrich Götze : The central limit theorem for the Rényi divergence

Tuesday, May 30, 2023 4:10 PM (45 minutes)

We review previous joint results with S. Bobkov and G. Chistyakov for the central limit theorem in the Rényi divergence distances of order larger than one and discuss recent progress for the case of infinite order as well as related questions concerning classes of strongly sub-Gaussian distributions.

Presenter: GÖTZE

Contribution ID: 2

Type: **not specified**

Marta Strzelecka: Norms of structured random matrices

Monday, May 29, 2023 2:45 PM (45 minutes)

We consider the structured Gaussian matrix $G_A=(a_{ij}g_{ij})$, where g_{ij} 's are independent standard Gaussian variables. The exact behavior of the spectral norm of the structured Gaussian matrix is known due to the result of Latala, van Handel, and Youssef from 2018. We are interested in two-sided bounds for the expected value of the norm of G_A treated as an operator from l_p^n to l_q^m . We conjecture the sharp estimates expressed only in the terms of the coefficients a_{ij} 's. The conjectured lower bound holds up to the constant depending only on p and q , and the upper bound is true up to the multiplicative constant depending linearly on a certain (small) power of $\ln(mn)$. This is joint work with Radoslaw Adamczak, Joscha Prochno, and Michal Strzelecki.

Presenter: STRELECKA, Marta

Contribution ID: 3

Type: **not specified**

Yaozhong Qiu: On a Bakry-Émery calculus for multiplication operators

Monday, May 29, 2023 4:10 PM (45 minutes)

We review some progress in the study of generalised Bakry-Émery calculi, and then discuss some recent developments concerning the particular case of the Bakry-Émery calculus associated to multiplication operators. We provide a connection with Hardy inequalities, a sufficient criterion thereof, and some typical examples.

Presenter: QIU, Yaozhong

Contribution ID: 4

Type: **not specified**

Ramon van Handel: Vector concentration inequalities

Wednesday, May 31, 2023 9:45 AM (45 minutes)

The concentration of measure phenomenon asserts that in a remarkably broad range of situations, nonlinear functions of many random variables are well concentrated around their means. A question that arises naturally in probability theory, functional analysis, metric geometry, and geometric group theory is whether there exist analogous phenomena for vector-valued functions, i.e., taking values in normed spaces. While this question is seemingly innocuous on its face, it is not even clear in first instance how it can be meaningfully formulated or approached.

What is arguably the “correct” way to think about this problem was discovered by Pisier in the 1980’s in the setting of Gaussian measures. The extension of Pisier’s ideas beyond the Gaussian setting was a long-standing problem. A few years ago, our work with Ivanisvili and Volberg provided one further example: a vector concentration inequality on the discrete cube. (There are also related works of Lafforgue and Mendel-Naor for very carefully designed models of expander graphs.) All these situations are rather special, and fall far short of the richness and broad applicability of the classical concentration of measure theory. In this talk I aim to describe the current status of a long-term effort to discover more general principles behind the vector concentration phenomenon. Along the way we encounter some new probabilistic questions, unexpected phenomena, and (unfortunately) plenty of unexplained mysteries.

Presenter: VAN HANDEL, Ramon

Contribution ID: 5

Type: **not specified**

Michael Goldman: On recent progress on the optimal matching problem

Tuesday, May 30, 2023 11:10 AM (45 minutes)

In this talk I will present some recent progress in the understanding of the optimal matching problem. Since it is one of the simplest (random) combinatorial problem and because of its numerous connections to theoretical physics, computer sciences and of course probability theory, this problem has attracted a lot of attention from various communities. One of the most striking properties of this problem is the unexpected logarithmic divergence of the average matching cost in dimension 2. This was first understood by Ajtai Komlos and Tusnady in the 80's. Recently, based on the optimal transport formulation of the problem, Caracciolo and al. proposed a PDE ansatz which lead to a renewed interest in the problem. I will give an overview of what is currently known and what is still open in this field.

Presenter: GOLDMAN, Michael

Contribution ID: 6

Type: **not specified**

James Melbourne: Relative Log-concavity in the discrete setting

Tuesday, May 30, 2023 11:55 AM (45 minutes)

A sequence of numbers is considered log-concave with respect to another when the ratio of the two is log-concave. Such relationships arise naturally in diverse fields of study. Examples include the following. The intrinsic volume sequence associated to a convex body, which is log-concave with respect to the probabilities of a Poisson distribution. The confirmation of the strong Mason conjecture shows that the number of independent sets of a matroid of fixed cardinality is log-concave with respect to a Binomial distribution, as are sequences of coefficients of real rooted polynomials, and as is easily observed, every log-concave sequence is relatively log-concave with respect to a geometric sequence. In the case that a complicated probability sequence of interest is relatively log-concave to a simpler “reference sequence” we will demonstrate two techniques and applications thereof, to transfer inequalities (for moments, entropy, tails, etc) known for the reference sequence to the class of sequences relatively log-concave with respect to it. One approach is based on functional analytic considerations, the other using the theory of majorization.

Presenter: MELBOURNE, James

Contribution ID: 7

Type: **not specified**

Galyna Livshyts: The stability and the equality cases in the Gaussian B-inequality

Tuesday, May 30, 2023 2:00 PM (45 minutes)

We establish the equality cases in the celebrated Gaussian B-inequality of Cordero-Erasquin, Fradelizi and Maurey: we show that the equality only holds when the corresponding symmetric convex body is either the whole space or has an empty interior. Furthermore, we derive a stability version with a sharp rate (in some sense). Moreover, we establish equality cases in the strong B-inequality (which are more complicated to describe). Our methods combine L2 method and trace estimates. Joint work with Orli Herscovici, Liran Rotem and Alexander Volberg.

Presenter: LIVSHYTS, Galyna

Contribution ID: 8

Type: **not specified**

Alexandros Eskenazis: Resilience of cube slicing in ℓ_p

Tuesday, May 30, 2023 2:45 PM (45 minutes)

We shall discuss the state of the art on the problem of identifying the volume maximizing and minimizing hyperplane sections of p-balls. Specifically, we will present a recent work with P. Nayar (Warsaw) and T. Tkocz (CMU) identifying the volume maximizing section for p greater than a universal constant.

Presenter: ESKENAZIS, Alexandros

Contribution ID: 9

Type: **not specified**

Emanuel Milman: Multi-Bubble Isoperimetric Problems - Old and New

Monday, May 29, 2023 2:00 PM (45 minutes)

The classical isoperimetric inequality in Euclidean space \mathbb{R}^n states that among all sets of prescribed volume, the Euclidean ball minimizes surface area. One may similarly consider isoperimetric problems for more general metric-measure spaces, such as on the n -sphere S^n and on n -dimensional Gaussian space G^n (i.e. \mathbb{R}^n endowed with the standard Gaussian measure). Furthermore, one may consider the “multi-bubble” isoperimetric problem, in which one prescribes the volume of $p \geq 2$ bubbles (possibly disconnected) and minimizes their total surface area – as any mutual interface will only be counted once, the bubbles are now incentivized to clump together. The classical case, referred to as the single-bubble isoperimetric problem, corresponds to $p=1$; the case $p=2$ is called the double-bubble problem, and so on.

In 2000, Hutchings, Morgan, Ritoré and Ros resolved the double-bubble conjecture in Euclidean space \mathbb{R}^3 (and this was subsequently resolved in \mathbb{R}^n as well) – the boundary of a minimizing double-bubble is given by three spherical caps meeting at 120° -degree angles. A more general conjecture of J. Sullivan from the 1990’s asserts that when $p \leq n+1$, the optimal multi-bubble in \mathbb{R}^n (as well as in S^n) is obtained by taking the Voronoi cells of $p+1$ equidistant points in S^n and applying appropriate stereographic projections to \mathbb{R}^n (and backwards).

In 2018, together with Joe Neeman, we resolved the analogous multi-bubble conjecture for $p \leq n$ bubbles in Gaussian space G^n – the unique partition which minimizes the total Gaussian surface area is given by the Voronoi cells of (appropriately translated) $p+1$ equidistant points. In the present talk, we describe our recent progress with Neeman on the multi-bubble problem on \mathbb{R}^n and S^n . In particular, we show that minimizing bubbles in \mathbb{R}^n and S^n are always spherical when $p \leq n$, and we resolve the latter conjectures when in addition $p \leq 5$ (e.g. the triple-bubble conjectures when $n \geq 3$ and the quadruple-bubble conjectures when $n \geq 4$).

Presenter: MILMAN, Emanuel

Contribution ID: 10

Type: **not specified**

Arnaud Marsiglietti (probability seminar) : Entropic Limit Theorems

Tuesday, May 30, 2023 9:45 AM (45 minutes)

In this talk, we will discuss an asymptotic behavior of entropies for sums of independent random variables that are convolved with a small continuous noise. We will also discuss an asymptotic behavior for Rényi entropies along convolutions in the central limit theorem. In particular, the problem of monotonicity is addressed under suitable moment hypotheses.

Presenter: MARSIGLIETTI, Arnaud

Contribution ID: 11

Type: **not specified**

Maud Szusterman: Bezout inequality with mixed volumes : is the simplex the only minimizer?

Wednesday, May 31, 2023 11:10 AM (45 minutes)

I. Soprunov and A. Zvavitch have shown some mixed volume inequalities for the simplex, which translate algebraic inequalities known as Bezout inequalities. Together with C. Saroglou, they have proven in 2018 that this family of inequalities characterizes the simplex among all polytopes, and conjecturally the characterization would hold among all convex bodies in \mathbb{R}^n . These three authors have shown the conjecture holds true in dimension 3, we provide an alternative proof, and indicate partial results in dimension 4.

Presenter: SZUSTERMAN, Maud

Contribution ID: 12

Type: **not specified**

Krzysztof Oleszkiewicz: On the asymptotic behavior of the best constants in the Khinchine and Khinchine-Kahane inequalities

Wednesday, May 31, 2023 11:55 AM (45 minutes)

A century after the Khinchine inequalities were proven, most of the optimal constants in them are still unknown, but there is a slow, gradual progress in understanding their asymptotic behaviour. I will report on some recent result in this direction.

Presenter: OLESZKIEWICZ, Krzysztof

Contribution ID: 13

Type: **not specified**

Rafal Latala: Chevet's type inequality for subexponential Weibull processes and norms of iid random matrices

Wednesday, May 31, 2023 2:00 PM (45 minutes)

We present a Chevet-type inequality for subexponential Weibull processes and show how it may be applied to derive two-sided bounds for operator ℓ_p to ℓ_q norms of random rectangular matrices with iid Weibull entries. We also discuss lower and upper bounds for operator norms of other iid matrices. The talk is based on a joint work with Marta Strzelecka.

Presenter: LATALA, Rafal

Contribution ID: 14

Type: **not specified**

Aldéric Joulin: On the intertwining approach for proving Poincaré type functional inequalities

Wednesday, May 31, 2023 2:45 PM (45 minutes)

In this talk, we will introduce the notion of intertwining between (weighted) gradient and operators and see how those identities might be used to derive Poincaré type functional inequalities in various situations (non uniformly convex potentials, perturbed product measures, log-concave measures on domains, etc.). This talk is based on a series of works in collaboration with Michel Bonnefont.

Presenter: JOULIN, Aldéric

Contribution ID: 15

Type: **not specified**

Liran Rotem: A Brunn-Minkowski inequality for the KL-divergence

Wednesday, May 31, 2023 4:10 PM (45 minutes)

It is well known that there are curious analogies between convex geometry and information theory. In particular, inequalities about entropy of random variables correspond to Brunn–Minkowski type inequalities about volumes of convex bodies.

In this talk we will discuss displacement concavity of entropy-like functionals, i.e. concavity with respect to geodesics in Wasserstein space. We will mention known results which are analogous to (and even imply) the standard Brunn–Minkowski inequality and Borell’s theorem on log-concave measures. We will then explain how such inequalities can improve when the involved measures are centrally symmetric, and present a new inequality which corresponds to the newly discovered dimensional Gaussian Brunn–Minkowski inequality.

Based on joint work with Gautam Aishwarya

Presenter: ROTEM, Liran

Contribution ID: 16

Type: **not specified**

Matthieu Fradelizi: On Fenchel and Bézout type inequalities for the Lebesgue and the Gaussian measures

Thursday, June 1, 2023 9:45 AM (45 minutes)

I shall start by presenting an overview of some recent results on Fenchel and Bézout type inequalities on mixed volumes and Minkowski sums of convex bodies. In particular, there are better bounds in these inequalities in the case of zonoids. I shall also mention recent extensions to the Gaussian measures and other rotationally invariant measures.

Based on work in common with Dylan Langharst, Mokshay Madiman, Mathieu Meyer and Artem Zvavitch

Presenter: FRADELIZI, Matthieu

Contribution ID: 17

Type: **not specified**

Nathael Gozlan: Transport-Entropy forms of direct and reverse Santalo type inequalities

Thursday, June 1, 2023 11:10 AM (45 minutes)

In this talk, we will present new equivalent formulations of direct and converse Santalo inequalities involving the relative entropy functional and various optimal transport costs. We will explore this connection on various model probability spaces. We will see in particular that the Mahler conjecture for the volume product of convex bodies is equivalent to sharp bounds on the deficit in the logarithmic Sobolev inequality for the Gaussian measure or for the uniform probability measure on the unit Euclidean sphere. Based on joint works with Matthieu Fradelizi, Shay Sadowsky and Simon Zugmeyer.

Presenter: GOZLAN, Nathael

Contribution ID: 18

Type: **not specified**

Mokshay Madiman: Qualitative observations on some one-dimensional ensembles in statistical physics

Thursday, June 1, 2023 11:55 AM (45 minutes)

Presenter: MADIMAN, Mokshay

Contribution ID: 19

Type: **not specified**

Andrea Colesanti: Around the log-Brunn-Minkowski inequality

Thursday, June 1, 2023 2:00 PM (45 minutes)

After reviewing the log-Brunn-Minkowski inequality and its infinitesimal form, we will present some considerations about a possible functional form of this inequality. This will lead us to a functional inequality related to the standard Poincaré inequality for the Gaussian measure.

Presenter: COLESANTI, Andrea

Contribution ID: 20

Type: **not specified**

Alexander Volberg: Dimension free discrete Remez inequality and dimension free Bohnenblust—Hille inequality for cyclic groups

Thursday, June 1, 2023 2:45 PM (45 minutes)

We consider a very high dimensional torus

T^n and a rather sparse lattice of points on it. Then if an analytic polynomial of degree $d \ll n$ is bounded on this lattice, then it is bounded on

T^n independent of n . It is a joint project with Joe Slote and Haonan Zhang.

Presenter: VOLBERG, Alexander

Contribution ID: 21

Type: **not specified**

Joseph Lehec: The Kannan-Lovasz-Simonovits conjecture up to polylog.

Thursday, June 1, 2023 4:55 PM (45 minutes)

The talk will be mostly based on a joint work with Bo'az Klartag from last year in which we prove a polylog estimate for the Kannan, Lovasz, Simonovits (KLS) conjecture. If time permits I will also discuss more recent improvements of the bound.

Presenter: LEHEC, Joseph

Contribution ID: 22

Type: **not specified**

Dario Cordero Erasquin: Comparison beyond curvature bounds : some observations around the non-gaussian case

Thursday, June 1, 2023 4:10 PM (45 minutes)

In proving inequalities for log-concave measures and convex bodies (often with the extra assumption of symmetry) one is lead to understand Poincaré type inequalities for all (symmetric) measure that are log-concave with respect to some given log-concave measure. When this reference measure is not Gaussian, this family does not belong to a classical $CD(\rho, \infty)$ family. We will present some results and some questions related to the (B) inequality for dilates of symmetric convex bodies.

Presenter: CORDERO ERAUSQUIN, Dario

Contribution ID: 23

Type: **not specified**

Pietro Caputo: Subadditivity and factorization of the relative entropy in spin systems and random permutations

Friday, June 2, 2023 9:45 AM (45 minutes)

We discuss some recent developments in the analysis of subadditivity and factorization properties of the relative entropy for spin systems on arbitrary graphs, and for uniformly random permutations. For spin systems these imply optimal modified log-Sobolev inequality for arbitrary block dynamics in the uniqueness region, including the case of non-local evolutions such as the Swendsen-Wang dynamics. For random permutations, an application our bounds proves a long standing conjecture on the permanent of any matrix with nonnegative entries.

Presenter: CAPUTO, Pietro

Contribution ID: 24

Type: **not specified**

Artem Zvavitch: Comparison problems for bodies, measures and functions

Friday, June 2, 2023 11:10 AM (45 minutes)

The Busemann-Petty problem asks whether symmetric convex bodies in \mathbb{R}^n with smaller $(n-1)$ -dimensional volume of central hyperplane sections necessarily have smaller n -dimensional volume. The answer to this problem is affirmative for n less or equal to 4 and negative starting from dimension 5. Several extensions of this result have been shown in the case of measures on convex bodies, and isomorphic results of the same type have been established. Moreover, the isomorphic Busemann-Petty problem is equivalent to the isomorphic slicing problem of Bourgain. In this talk we will discuss generalization of this problem to the comparison problems related to the Radon transform of functions and their L_p norms. Based on the joint work with Alexander Koldobsky and Michael Roysdon.

Presenter: ZVAVITCH, Artem

Contribution ID: 25

Type: **not specified**

Max Fathi: Sergey's work on pointwise bounds for convolutions, and applications

Friday, June 2, 2023 11:55 AM (45 minutes)

In this talk, I will discuss a recent work of Sergey Bobkov on pointwise upper bounds for convolved probability density. In that work he shows a beautiful explicit estimate using the Cramer transform of the sum, which applies in particular to subgaussian random variables. If time allows, I will discuss some applications in the context of Stein's method and rates of convergence in the CLT, based on ongoing joint work with Murat Erdogdu, Xiao Fang and Adrian Röllin.

Presenter: FATHI, Max

Contribution ID: 26

Type: **not specified**

Esther Bou Dagher

Monday, May 29, 2023 4:55 PM (45 minutes)

Presenter: BOU DAGHER, Esther

Contribution ID: 27

Type: **not specified**

Soccer game