Abstracts

Radoslaw Adamczak (University of Warsaw)

Functional inequalities and concentration of measure

Abstract: Concentration inequalities are one of the basic tools of probability and asymptotic geometric analysis, underlying the proofs of limit theorems and existential results in high dimensions. Original arguments leading to concentration estimates were based on isoperimetric inequalities, which are usually difficult to obtain. Over the years however simpler methods were found, allowing for extension of concentration inequalities to more general classes of measures. In the lectures I will discuss the arguably softest approach to concentration, relying on functional inequalities. The focus will be put on classical inequalities, such as the Poincare inequality, the log-Sobolev inequality and some of their modifications. I will present their basic common properties (e.g., tensorization) and show how they imply various forms of concentration for Lipschitz functions. I will first present the continuous setting, starting with the simplest cases of the exponential and Gaussian measures, and subsequently move to discrete examples. If time permits I will also discuss some concentration results for non-Lipschitz functions, which can be obtained from functional inequalities.

Persi Diaconis (Stanford University)

Haar-distributed random matrices - in memory of Elizabeth Meckes

Abstract: Elizabeth Meckes spent many years studying properties of Haar measure on the classical compact groups along with applications to high dimensional geometry. I will review some of her work and some recent results I wish I could have talked about with her.
Bo’az Klartag (Weizmann Institute of Science)

On Yuansi Chen’s work on the KLS conjecture

Abstract: The Kannan-Lovasz-Simonovits (KLS) conjecture is concerned with the isoperimetric problem in high-dimensional convex bodies. The problem asks for the optimal way to partition a convex body into two pieces of equal volume so as to minimize their interface. The conjecture suggests that up to a universal constant, the optimal solution is obtained by bisecting the convex body with a hyperplane. Some years ago it was proven that the KLS conjecture implies Bourgain’s slicing conjecture. In these lectures we will survey significant progress obtained recently towards the KLS conjecture, and consequently towards the slicing problem. The key technique that we plan to study is Eldan’s Stochastic Localization. While we attempt to keep prerequisites at minimum, some familiarity with log-concave measures and with basic concepts in stochastic differential equations, at least intuitively, would not hurt anyone.

Monika Ludwig (Vienna University of Technology)

Geometric probabilities and valuation theory

Abstract: Classical and new applications of geometric valuation theory to geometric probabilities and integral geometry are discussed. These include Cauchy-Kubota and kinematic formulas for convex bodies and recent results (joint with Andrea Colesanti and Fabian Mussnig) for convex functions.

Joe Neeman (University of Texas)

Gaussian isoperimetry and related topics

Abstract: The Gaussian isoperimetric inequality gives a sharp lower bound on the Gaussian surface area of any set in terms of its Gaussian measure. Its dimension-independent nature makes it a powerful tool for proving concentration inequalities in high dimensions. We will explore several consequences of Gaussian isoperimetry and connections to other areas. In probability, we will show applications to concentration and Gaussian noise stability. In analysis, we will show that the Gaussian isoperimetric inequality is equivalent to a certain Sobolev-type inequality. Finally, we will prove the Gaussian isoperimetric inequality (and some stronger versions) using methods from geometric measure theory.

Giovanni Peccati (University of Luxembourg)

(1) Some variance estimates on the Poisson space  
(2) Second-order Poincaré inequalities and related convergence results  
(3) Beyond Poincaré: quantitative two-scale stabilization

Abstract:
(1) I will introduce some basic tools of stochastic analysis on the Poisson space, and describe how they can be used to develop variational inequalities for assessing the magnitude of variances of geometric quantities. Particular attention will be devoted to Poincaré, L1/L2, OSSS and Schramm-Steif inequalities, as well as to their connections with the notions of noise sensitivity and superconcentration. Based on joint works with I. Nourdin and X. Yang, and with Yogeshwaran D. and G. Last.
(2) I will introduce the notion of second-order Poincaré inequalities on the Poisson space and describe their use in a geometric context - with specific emphasis on quantitative CLTs for strongly stabilizing functionals, and on fourth-moment theorems for sequences of multiple stochastic integrals. Based on
(3) I will describe a new collection of probabilistic bounds on the Poisson space, allowing one to measure the distance to Gaussianity for (possibly multidimensional) random elements displaying a form of ‘two-scale stabilization’. These estimates (that do not make use of Poincaré inequality, and that are inspired by a strategy of proof recently developed by Chatterjee and Sen for deriving a quantitative CLT for the length of the minimal spanning tree) are specifically tailored for providing quantitative CLTs for sequences of weakly stabilizing functionals (see Penrose and Yukich, 2001). In the case of strongly stabilizing functionals, they provide novel quantitative bounds that are applicable under virtually no assumption on the stabilization radii. Based on joint work with R. Lachièze-Rey and X. Yang.

Tomasz Tkocz (Carnegie Mellon University)

Khinchin inequalities with sharp constants

Abstract: I shall survey some classical results and present some recent results on sharp moment comparison inequalities for weighted sums of i.i.d. random variables, a.k.a. Khinchin inequalities.