Colloquium Talks
2015-2016

The School Colloquia are given by world-famous speakers and present an overview of important topics of general interest in the mathematical sciences.

These invited lectures are intended to be accessible to all graduate students and academics in the department. MMath and MSc students may also benefit from these presentations.The talks normally take place on Wednesdays, 15:10 - 16:10, at the lecture room E/0.15 on the ground floor of the School.

All are welcome to attend. For more information, please contact;
Dr Timothy Logvinenko

20 April 2016
Speaker: Prof. Clément Mouhot (Cambridge)
Title: Kac's program in Kinetic Theory.
Abstract: We will discuss a program set up by Kac in the late 1950s for understanding the rigorous derivation of collisional nonlinear partial differential equations of Boltzmann-type in terms of the many-particle limit of Markov jump processes. We shall discuss some contributions to this program and open problems. The talk is based on joints works with Golse, Mischler, Ricci, Wennberg.

13 April 2016
Speaker: Prof. Martin Henk (TU-Berlin)
Title: The logarithmic Minkowski problem
Abstract: The classical Minkowski problem asked for a characterization of surface area measures of convex bodies among the finite Borel measures on the sphere. In the discrete setting, i.e., for polytopes, this problem was solved by Minkowski (1903), the general case by Fenchel&Jessen (1938) and independently by Aleksandrov (1939).The logarithmic Minkowski problem asks in the same spirit for acharacterization of cone volume measures of convex bodies. Itis the particular interesting case $p=0$ of the generalL_p-Minkowski problem which is at the core of theL_p-Brunn-Minkowski theory, one of the cornerstones of modernconvex geometry.In the talk we will discuss

recent progress on this problem and some applications. In particular, if time permits we will point out a relation to the roots of Ehrhart polynomials of lattice polytopes.

24 February 2016
Speaker: Prof. Mikhail B. Malioutov (Northeastern)
Title: Regression under sparsity assumption
Abstract: The theory of Compressed Sensing (highly popular in recent years) has a close relative that was developed around thirty years earlier and has been almost forgotten since -- the design of screening experiments. For both problems the main assumption is SPARSITY OF ACTIVE INPUTS, and the fundamental feature in both theories is the threshold phenomenon: reliable recovery of sparse active inputs is possible when the rate of design is less than the so-called capacity threshold, and impossible with higher rates.Another close relative of both theories is multi-access information transmission. A collection of tight and almost tight screening capacity bounds for non-adaptive experimental designs were obtained by 1980. We compare here the simulated capacity and operation time of two analysis methods:(i) linear programming relaxation methods used in compressed sensing, and(ii) separate testing of inputs for non-adaptive strategies. The parallel implementation of the latter allows fast processing of high-dimensional models.An unexpected independence of estimates of ALL parameters of factorial models under random samples from the full factorial designs eliminates application of fractional factorials.

11 November 2015
Speaker: Professor Mark Gross (Cambridge)
Title: Mirror symmetry and tropical geometry
Abstract: Mirror symmetry is a phenomenon discovered by string-theorists around 1990. Initially, it involved predictions for the numbers of certain kinds of curves contained in certain three-dimensional complex manifolds. For example, it gave predictions for the number of lines, conics, etc. contained in a three-dimensional hypersurface defined by a quintic equation. There has been a huge amount of work devoted to understanding this phenomenon over the last 25 years. I will explain how mirror symmetry connects naturally with a much more recent concept, tropical geometry, a kind of combinatorial piecewise linear geometry, and how this helps explain why mirror symmetry works.

28 October 2015
Speaker: Professor Nick Trefethen FRS(Oxford)
Title: Mathematics of the Faraday Cage
Abstract: Everybody has heard of the Faraday cage effect, in which a wire mesh does a good job of blocking electric fields. Surely the mathematics of such a famous and useful phenomenon has been long ago worked out and written up in the textbooks? But it seems to be not so. One reason may be that that the effect is not as simple as one might expect: it depends on the wires having finite radius. Nor is it as strong as one might imagine: the shielding improves only linearly as the mesh spacing decreases. Mathematically, the subject is an appealing case study in the behaviour of harmonic functions, with links to Brownian motion and diffusion processes. Physically, Faraday cage shielding can be regarded as a process of electrostatic induction by a surface of limited capacitance. The talk will present results developed jointly with Jon Chapman and Dave Hewett, published in the current issue of SIAM Review.