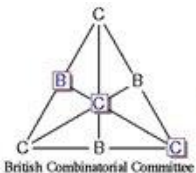


Supported by



LONDON
MATHEMATICAL
SOCIETY



Speakers and Chairs from CC2016

Report on 2016 Colloquia in Combinatorics

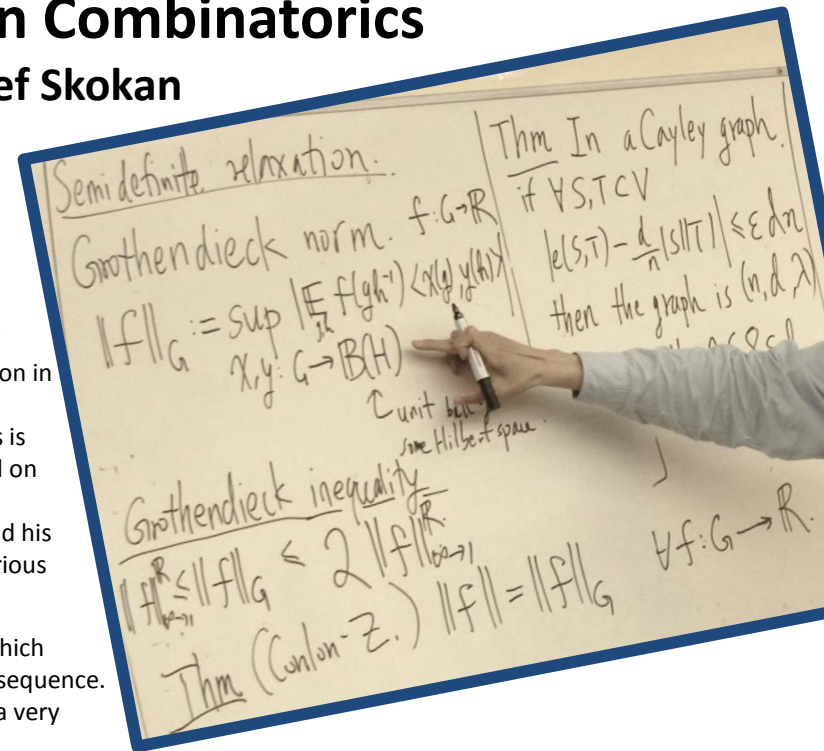
by Julia Böttcher & Jozef Skokan

Support for this event by the London Mathematical Society and the British Combinatorial Committee is gratefully acknowledged by the organisers.

The 2015/16 Colloquia followed the successful format established in the past: six invited talks were delivered on each of the two days. The meeting went according to plan, and our expectations were fully met. Most participants attended both days. The conference attracts both excellent speakers and a large audience, with participants coming from around the world.

The Queen Mary day started with an engaging talk by Béla Bollobás who spoke about percolation in various models of random geometric graphs. His results depend on proving bounds on the percolation threshold for the plane square lattice, where the probability measure on the bonds is not a product measure but has limited dependence. Interestingly, the strongest results depend on the evaluations of high-dimensional integrals whose values we cannot rigorously estimate. However using Monte Carlo methods one obtains a value with high confidence, so that Béla and his co-authors prove that with high probability they know the correct percolation thresholds in various geometric models.

Karim Adiprasito presented his exciting result, confirming the Heron-Rota-Welsh conjecture, which states that the coefficients of the characteristic polynomial of any matroid form a log-concave sequence. The proof of this result uses deep ideas from algebraic geometry but, as Karim explained, is of a very combinatorial nature.



Imre Leader's talk focused on combinatorial games, a topic on the border between combinatorics and game theory. He lectured on the existence of winning strategies of the first or second player in Misère games, and in particular highlighted the difference in applicability of strategy stealing arguments in Misère games compared to the more usual combinatorial games with winning sets.

Afterwards Yufei Zhao lectured on Cayley graphs, a topic with elements from both combinatorics and group theory. He talked about when Cayley graphs are quasirandom, proving that the well-studied discrepancy property and eigenvalue property are equivalent for all Cayley graphs, which was before only known for Cayley graphs of abelian groups.

The topic of Andrew Granville's talk concerned recently developed and powerful methods in number theory and their application to the study of classical combinatorial objects. He outlined the advances concerning the famous twin prime conjecture in the last decade, and explained his investigations connected to a better understanding of the methods that drove these developments. He also discussed connections to results concerning the structure of permutations and polynomials in finite fields.

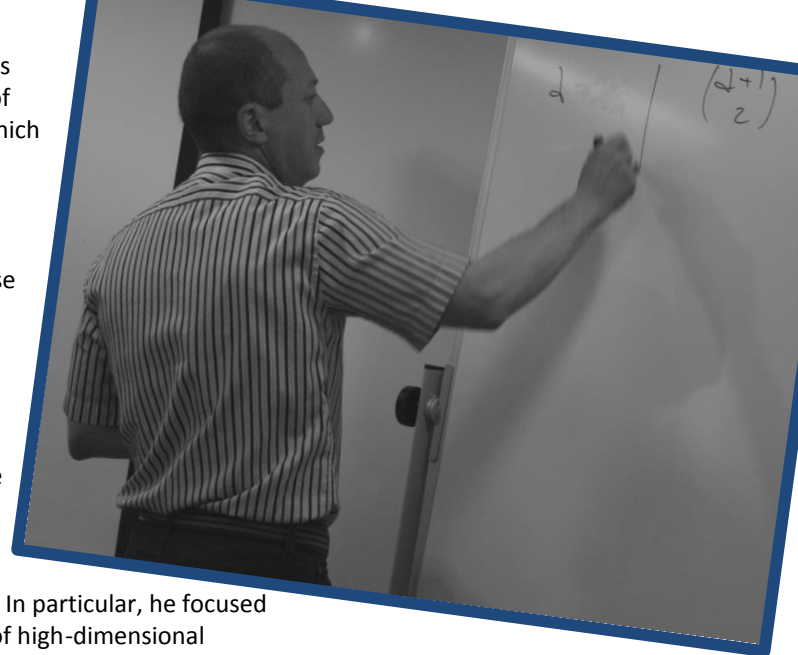


The last lecture of the day, by David Conlon, addressed the study of graph norms. This topic brings together elements from functional analysis and graph theory, and is closely related to the study of graph limits. He explained how reflection groups give rise to new examples of norming graphs, which is also connected to the well-known Sidorenko conjecture in graph theory and to the theory of quasirandom graphs.

Daniela Kühn opened the LSE day; her talk was on graph packing problems, a topic in extremal combinatorics with much recent progress. She talked about the development of a general purpose tool for solving long-standing conjectures in the area, a packing version of the so-called blow-up lemma. In particular this tool allows confirming a number of well-known tree packing conjectures for bounded-degree trees.

Benny Sudakov's lecture was on geometric problems. He discussed the question of determining bounds on the number of equiangular lines in the d -dimensional Euclidean space, when the angle is predetermined. This combined techniques from combinatorics, linear algebra, and spectral theory, and allows generalisations of the results to spherical codes.

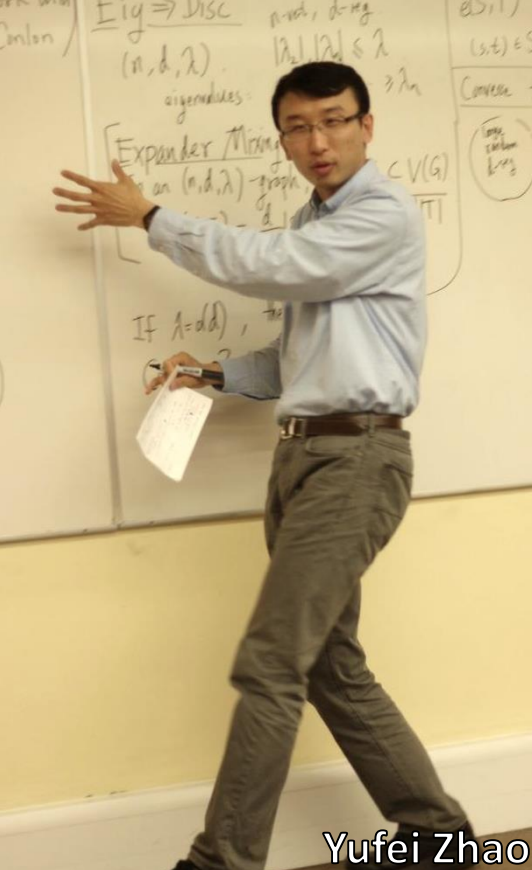
Nati Linial gave a lecture on the relatively young but rich area of high-dimensional combinatorics. In particular, he focused on higher-dimensional analogues of permutations and Latin squares. This is related to the study of high-dimensional expanders, which recently sparked much interest, and to questions in communication complexity. He explained that the enumerative properties and the typical behaviour of these objects are not yet well understood, but presented first important results and conjectures in this direction.



Monique Laurent's talk concerned the completion of positive semidefinite matrices. She focused in particular on two graph parameters arising in this context: the Gram dimension and the extremal Gram dimension of a graph. She explained how this is related to problems in distance geometry and problems from combinatorial optimisation, that it also has interesting connections to certain spectral graph parameters and presented new results in the area.

James Maynard's talk was of a number theoretical nature and concerned the problem of finding primes in thin sets without multiplicative structure. In particular he presented a new result stating that the set of (decimal) numbers with one excluded digit contains infinitely many primes. He also outlined the proof, which combines discrete Fourier analysis, Markov processes, sieve theory, and results about the geometry of numbers.

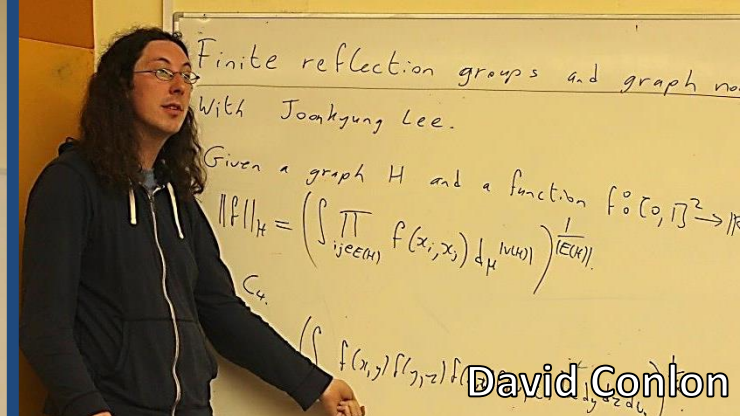
The meeting ended with Biggs Lecture delivered by Alan Frieze. Alan discussed an online purchasing game, in which the edges of a graph are given random costs and must be bought or rejected on-line in order to construct a specified subgraph as cheaply as possible. This is closely related to the famous Secretary Problem. The results depend on a careful interplay between strategy design and random graph theory.



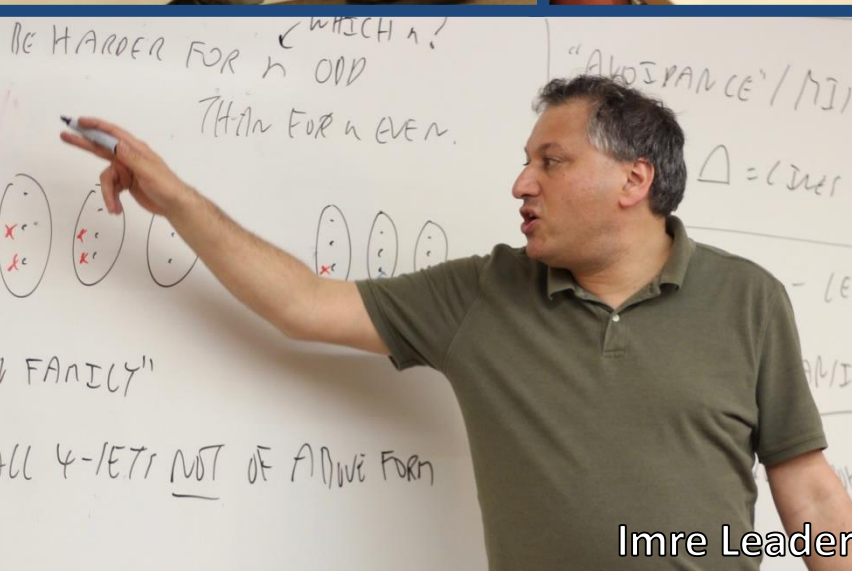
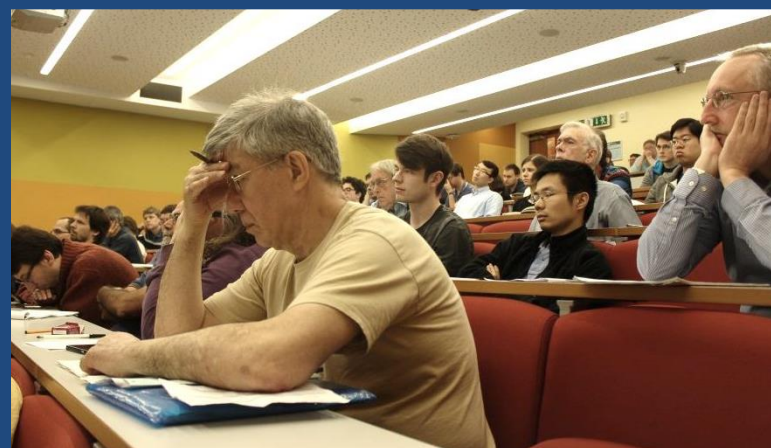
Yufei Zhao



Karim Adiprasito



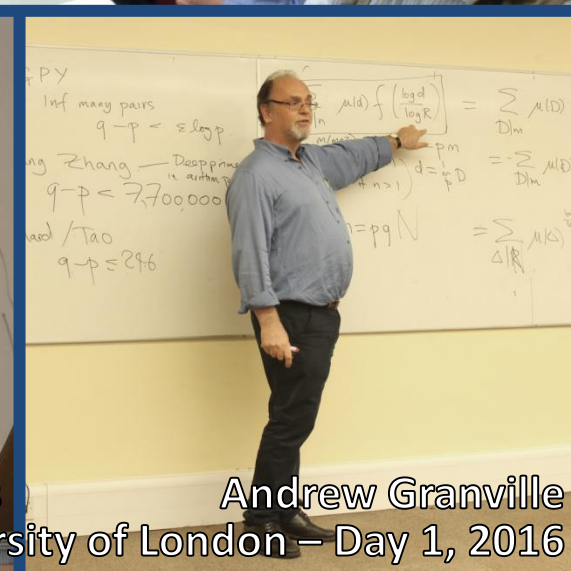
David Conlon



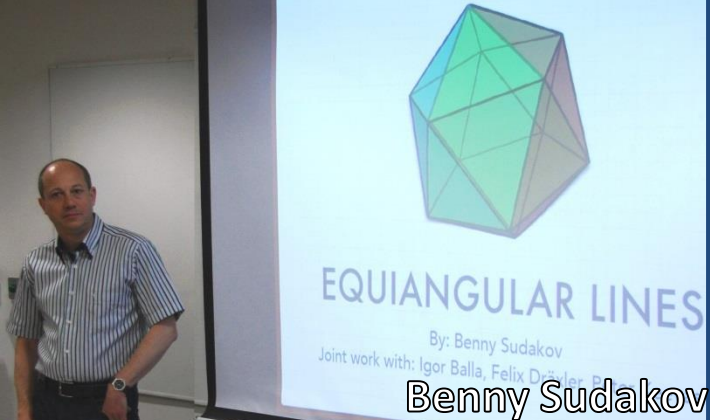
Imre Leader



Béla Bollobás
Queen Mary University of London – Day 1, 2016



Andrew Granville
Queen Mary University of London – Day 1, 2016



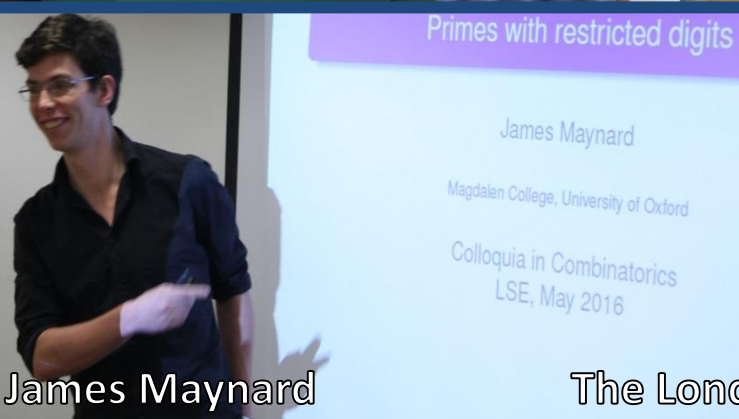
Benny Sudakov



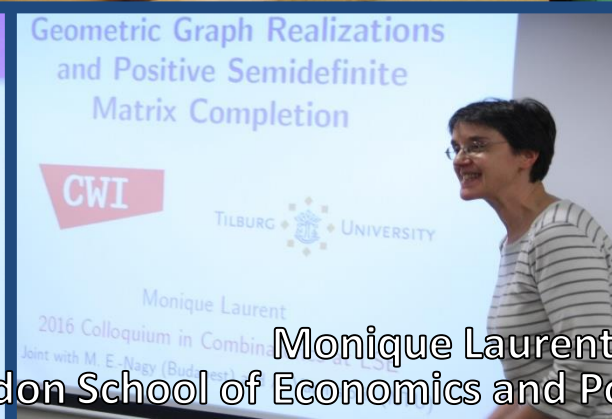
Daniela Kühn



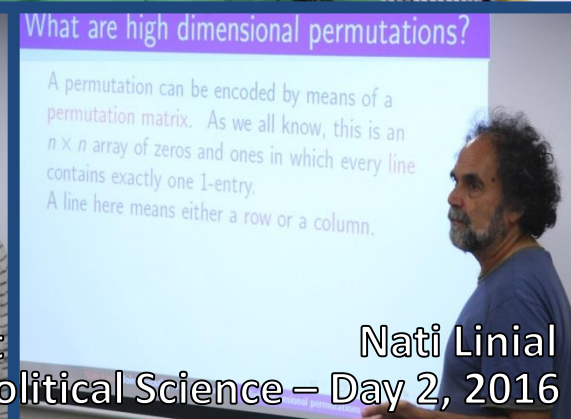
Alan Frieze



James Maynard



Monique Laurent



Nati Linial

