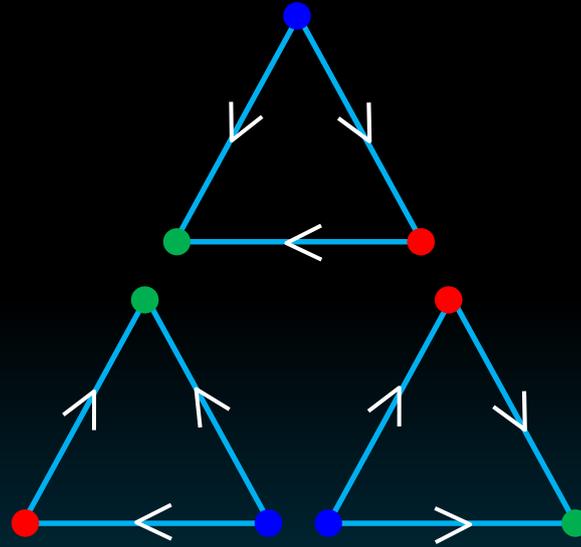




Queen Mary
University of London



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■



Two one-day

Colloquia in Combinatorics

10 and 11 May 2017

If attending both days, please keep this programme for day two

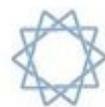
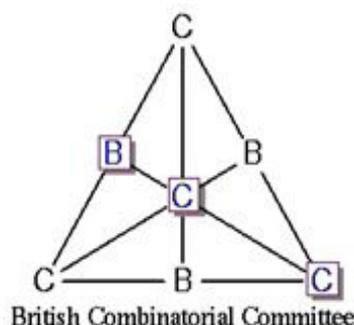


#CC2017 @QMULMaths @LSEMaths

QMUL & LSE have hosted the Colloquia in Combinatorics for the past eleven years. Thank you for joining us and supporting us through the years.

SUPPORT

Support for this event from the London Mathematical Society (www.lms.ac.uk) and the British Combinatorial Committee (www.britishcombinatorial.wordpress.com) is gratefully acknowledged.



LONDON
MATHEMATICAL
SOCIETY

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INFORMATION

Those interested are welcome to attend for all or any part of the event; it is hoped that many people will be able to attend for both days.

Some funds are available to contribute to the **basic** travel expenses of **UK-based research students** who attend the meetings. We ask you to keep costs to a minimum, using public transport on **all** occasions and off-peak student travel tariffs wherever possible. Receipts for all journeys must be maintained as proof of travel. At this stage, we are unable to confirm the maximum amount available. Expense claim forms are available at the event from the event organisers. Please contact Rebecca Lumb (r.c.lumb@lse.ac.uk) for further information.

Event organisers: Dr Julia Böttcher (LSE), Prof Mark Jerrum (QMUL), Dr Robert Johnson (QMUL) and Prof Jozef Skokan (LSE).

WEDNESDAY 10 MAY 2017

Schedule

The first day of the Colloquia in Combinatorics will be held at Queen Mary, University of London, starting at 10.30am. Everyone interested is welcome to attend any part of the event. All the talks will be held in the Peston Lecture Theatre, Graduate Centre, Mile End Campus, QMUL (please note this is a change to last year's venue – listed as 18 on page 7 map). Refreshment breaks will be taken in the Graduate Centre Foyer.

Time	Speaker	Presentation title
10:00	Coffee (<i>Graduate Centre Foyer</i>)	
10:30	Kitty Meeks (Glasgow)	The complexity of finding and counting sum-free subsets
11:20	Andrew Treglown (Birmingham)	Ramsey properties of the Erdős–Renyi graph and random sets of integers
12:10	Lunch (<i>own arrangements – options on campus and nearby</i>)	
13:30	Oliver Riordan (Oxford)	The phase transition in Achlioptas processes
14:20	Sophie Huczynska (St Andrews)	Graph classes under homomorphic image order
15:10	Afternoon tea break (<i>Graduate Centre Foyer</i>)	
15:40	Uli Wagner (IST Austria)	Elimination of multiple intersections, and the topological Tverberg conjecture
16:30	Tibor Jordan (Budapest)	Globally rigid braced triangulations
17:15	FINISH	

10:30am **The complexity of finding and counting sum-free subsets**

Kitty Meeks (University of Glasgow)

A set A of natural numbers is said to be sum-free if it does not contain x , y and z such that $x + y = z$. Sum-free sets have been studied extensively in additive combinatorics (Paul Erdős was particularly interested in these sets) but algorithmic questions relating to sum-free sets have thus far received very little attention. We consider the problem, given a set A , of determining whether A contains a sum-free subset of size at least k . We show that this problem is NP-complete in general and also hard to approximate, but is tractable with respect to certain parameterizations; in the cases where the decision problem is tractable, we also consider the complexity of counting all sum-free subsets of size exactly k .

This is joint work with Andrew Treglown.

11:20am **Ramsey properties of the Erdős–Renyi graph and random sets of integers**

Andrew Treglown (University of Birmingham)

In the mid-1990s, Rödl and Ruciński made a significant breakthrough in the study of Ramsey properties of graphs. Indeed, they determined the threshold for the (H, r) -Ramsey property in the Erdős–Renyi random graph. (Here, we say a graph G is (H, r) -Ramsey if whenever the edges of G are r -coloured, there is a monochromatic copy of H in G .) In this talk we revisit this result, giving a so-called resilience version of this Random Ramsey theorem. As well as strengthening the result of Rödl and Ruciński, our theorem also implies the random version of Turán’s theorem due to Conlon and Gowers, and Schacht, and also resolves a conjecture of Kohayakawa and Kreuter in certain general cases.

We will also discuss analogous results concerning a random version of Rado’s theorem. This is joint work with Robert Hancock and Katherine Staden.

1:30pm **The phase transition in Achlioptas processes**

Oliver Riordan (University Oxford)

The classical random graph process starts with a fixed set of n vertices and no edges. Edges are then added one-by-one, uniformly at random. One of the most interesting features of this process, established by Erdős and Rényi more than 50 years ago, is the phase transition near $n/2$ edges, where a single ‘giant’ component emerges from a sea of small components. This example serves as a

starting point for understanding phase transitions in a wide variety of other contexts. Around 2000, Dimitris Achlioptas suggested an innocent-sounding variant of the model: at each stage two edges are selected at random, but only one is added, the choice depending on (typically) the sizes of the components it would connect. This may seem like a small change, but these processes do not have the key independence property that underlies our understanding of the classical random graph process. One can ask many questions about Achlioptas processes; the most interesting concern the phase transition: does the critical value change from $n/2$? Is the nature of the transition the same or not?

I will describe a number of results on these questions from joint work with Lutz Warnke.

2:20pm **Graph classes under homomorphic image order**

Sophie Huczynska (University of St Andrews)

Combinatorial structures have been considered under various orders, including substructure order and homomorphism order. In this talk, I will introduce and discuss the homomorphic image order, corresponding to the existence of a surjective homomorphism between two structures. I will focus on partial well-order and antichains, exploring how the homomorphic image order behaves in the context of graphs and graph-like structures. In particular, I will discuss a near-complete characterization of partially well-ordered avoidance classes with one obstruction.

This is joint work with Nik Ruškuc.

3:40pm **Elimination of multiple intersections, and the topological Tverberg conjecture**

Uli Wagner (IST Austria)

We survey some classical results on embeddings of simplicial complexes in Euclidean spaces (higher-dimensional analogues of embeddings of graphs in the plane) and some recent generalizations (obtained in joint work with Mabillard) from embeddings (maps without double points) to maps without triple, quadruple, and higher-multiplicity intersections. Furthermore, we discuss how these results, together with work of Özaydin and of Gromov, Blagojevic, Frick, and Ziegler, imply the existence of counterexamples to some long-standing conjectures in topological combinatorics, in particular the topological Tverberg conjecture.

4:30pm

Globally rigid braced triangulations

Tibor Jordan (Eötvös Loránd University, Budapest)

Cauchy proved that if the vertex-edge graphs of two convex polyhedra are isomorphic and corresponding faces are congruent then the two polyhedra are the same. It follows that a convex polyhedron with triangular faces, as a bar-and-joint framework, is rigid. It is also well-known that the graph of such a polyhedron - a maximal planar graph - is rigid in three-space, provided it is realised in a sufficiently general position.

Global rigidity is stronger than rigidity: a framework is said to be globally rigid if the bar lengths determine all pairwise distances between the joints. The graphs of triangulated polyhedra are not globally rigid. We shall consider - the graphs of - braced triangulated polyhedra and characterise the bracing patterns which make them globally rigid in three-space.

This is joint work with Shin-ichi Tanigawa.

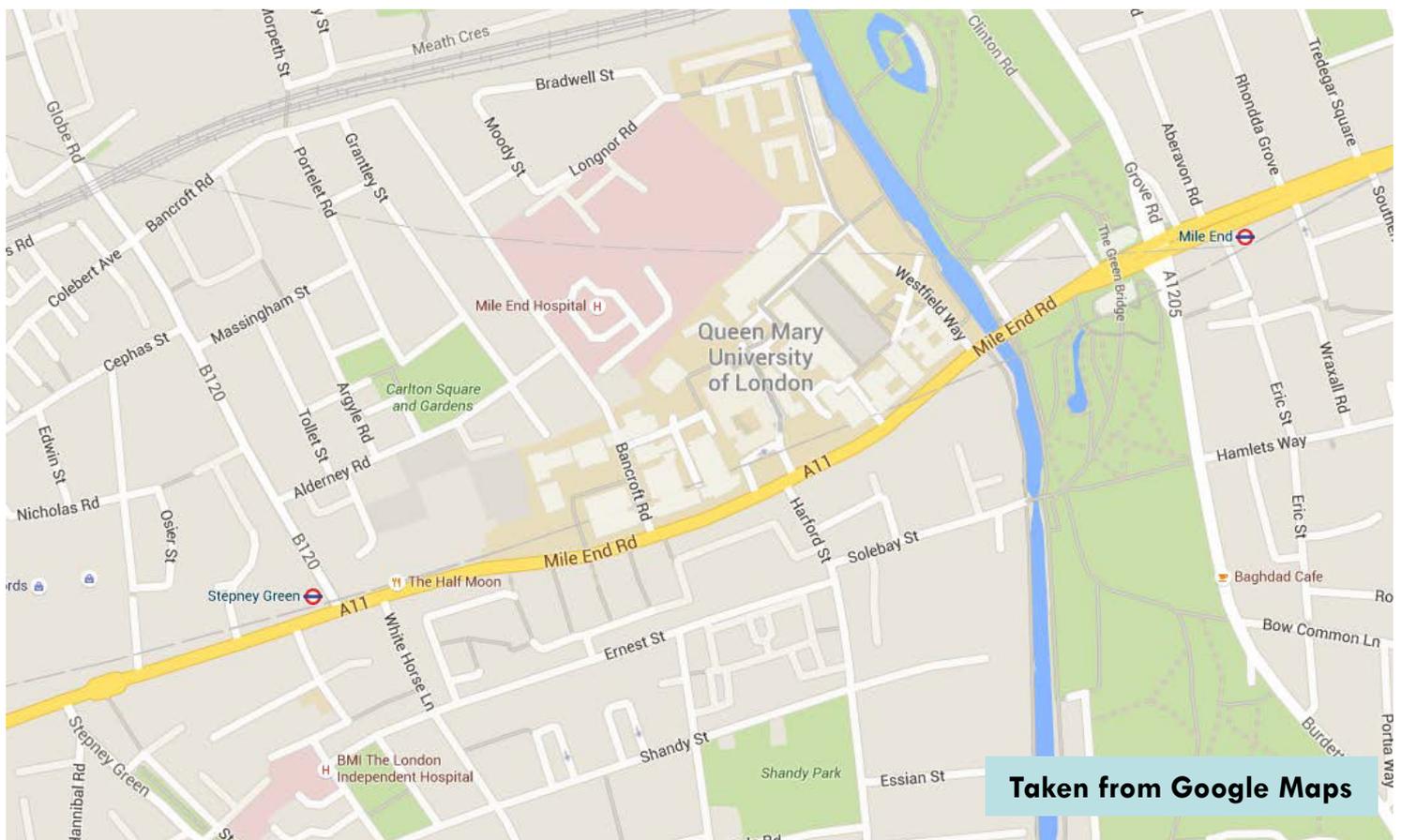
PLACES TO EAT: in and around QMUL

Close by:

- 90-degree Melt** – Vegetarian, molten-cheese-based menu – 235 Mile End Rd
- Costa** – standard café – 556 Mile End Rd
- Efes** – Turkish: kebabs, etc. – 230 Mile End Rd
- Greedy Cow** – burgers, salads & steaks – 2 Grove Rd
- Morgan Arms** – gastropub, possibly too far for lunch – 43 Morgan St
- Nandos** – Portuguese-style chicken chain – 552 Mile End Rd
- The Coffee Room** – best coffee in the 'hood – 6A Grove Rd
- The Half Moon** – Wetherspoon's, standard pub food – 213–223 Mile End Rd
- The Pizza Room** – pizzas – 2A Grove Rd
- Verdi's** – upscale Italian (by Mile End standards) – 237 Mile End Rd

On campus:

- Cafe Grad** – Starbucks coffee and sandwiches – Graduate Centre
- Drapers Bar & Kitchen** – basic student union-run operation – Godward Square
- Infusion** – shop with take-away sandwiches, etc. – Godward Square
- Mucci's** – pasta & pizza – Library Square
- SCR Bar** – freshly made sandwiches, limited hot food – Queen's Building
(Note that Curve, the on-campus cafeteria, is shut for May and June 2017)





THURSDAY 11 MAY 2017

Schedule

The second day of the Colloquia in Combinatorics will be held at The London School of Economics and Political Science, starting at 10.30am. Everyone interested is welcome to attend any part of the event. The talks will be held in Sheikh Zayed Theatre, New Academic Building, LSE (please note this is a change to last year's venue – listed as NAB on the LSE map on page 12). Refreshment breaks will be taken Lower Ground Floor Atrium, New Academic Building, LSE; the reception will be held on the 8th Floor, New Academic Building, LSE.

Time	Speaker	Presentation title
10:00	Coffee and arrival (<i>Lower Ground Floor Atrium, New Academic Building</i>)	
10:30	Ewan Davies (LSE, UK)	Tight bounds of the coefficients of partition functions via stability
11:20	Asaf Shapira (Tel-Aviv)	Removal lemmas with polynomial bounds
12:10	Lunch (<i>own arrangements – options on campus and nearby</i>)	
13:30	Dömötör Pálvölgyi (Cambridge)	Coloring geometric hypergraphs
14:20	Shoham Letzter (Zürich)	Ramsey theory in directed graphs
15:10	Afternoon tea break (<i>Lower Ground Floor Atrium, New Academic Building</i>)	
15:40	Guillem Perarnau (Birmingham)	Critical percolation on random regular graphs
16:30	Ronitt Rubinfeld (MIT/Tel-Aviv)	Biggs Lecture: Local computation algorithms
17:30	Reception (<i>8th Floor, New Academic Building</i>)	

10:30am **Tight bounds of the coefficients of partition functions via stability**

Ewan Davies (LSE, UK)

Partition functions arise in statistical physics and probability theory as the normalising constant of Gibbs measures and in combinatorics as graph polynomials. The partition functions of the hard-core model and monomer-dimer model are the independence and matching polynomials respectively.

We show how stability results follow naturally from the recently developed occupancy method for maximising and minimising physical observables over classes of regular graphs, and then show these stability results can be used to obtain tight extremal bounds on the individual coefficients of the corresponding partition functions.

As applications, we prove new bounds on the number of independent sets and matchings of a given size in regular graphs. For large enough graphs and almost all sizes, the bounds are tight and confirm the Upper Matching Conjecture of Friedland, Krop, and Markström and a conjecture of Kahn on independent sets for a wide range of parameters.

11:20am **Removal lemmas with polynomial bounds**

Asaf Shapira (Tel Aviv University)

Addressing a problem of Alon and Fox, we prove new sufficient and necessary criteria, guaranteeing that a graph property admits a removal lemma with a polynomial bound. Although both are simple combinatorial criteria, they imply almost all prior positive and negative results of this type, as well as many new ones. In particular, we show that every semi-algebraic graph property admits a polynomially bounded removal lemma. This confirms a conjecture of Alon.

This is joint work with L. Gishboliner

1:30pm **Coloring geometric hypergraphs**

Dömötör Pálvölgyi (University of Cambridge)

A covering of the plane by a family of sets is called m -fold if every point is contained in at least m members of the family. Such a covering is called decomposable if the family can be partitioned into two subfamilies that each form a (1-fold) covering of the whole plane. Pach conjectured in 1980 that for every plane convex set D there is an m such that every m -fold covering of the plane with the translates of D is decomposable. I will give a short summary of related results (mainly when D is a polygon), then disprove the conjecture (when D is a disk) and propose a new conjecture, and mention several further open problems.

2:20pm

Ramsey theory in directed graphs

Shoham Letzter (ETH Zurich)

The classical result, by Gallai, Hasse, Roy and Vitaver, which states that every orientation of a graph with chromatic number n contains a directed path on n vertices, can be used to prove that every 2-colouring of a tournament on n^2 vertices contains a monochromatic directed path on n vertices. We generalise this result, showing that for some constant c , every 2-colouring of a tournament on cn^2 edges contains monochromatic copies of every oriented tree on n vertices; this is tight up to a constant factor.

This is joint work with Matija Bucić and Benny Sudakov.

3:40pm

Critical percolation on random regular graphs

Guillem Perarnau (University of Birmingham)

We show that for all $d \in \{3, \dots, n-1\}$ the size of the largest component of a random d -regular graph on n vertices at the percolation threshold $p = 1/(d-1)$ is $\Theta(n^{2/3})$, with high probability. This extends known results for fixed $d \geq 3$ and for $d = n-1$, confirming a prediction of Nachmias and Peres on a question of Benjamini. In contrast to previous approaches, our proof is based on a simple application of the switching method.

This is joint work with Felix Joos.

‘The Norman Biggs Lecture’

Local computation algorithms

Ronitt Rubinfeld (MIT and Tel Aviv University)

Consider a setting in which inputs to and outputs from a computational problem are so large, that there is not time to read them in their entirety. However, if one is only interested in small parts of the output at any given time, is it really necessary to solve the entire computational problem? Is it even necessary to view the whole input? We survey recent work in the model of *local computation algorithms* which for a given input, supports queries by a user to values of specified bits of a legal output. The goal is to design local computation algorithms in such a way that very little of the input needs to be seen in order to determine the value of any single bit of the output. In this talk, we describe results on a variety of problems for which sublinear time and space local computation algorithms have been developed – we will give special focus to finding maximal independent sets and sparse spanning graphs.

PLACES TO EAT: in and around LSE

Close by:

All Bar One – modern chain with full menu – 58 Kingsway

Belgo – Belgian beer & food – 67 Kingsway

Bill's – European chain with full menu – 42 Kingsway

Café Amici – Italian café – 7-9 Kingsway

Costa – standard café – 9-11 Kingsway

EAT – sandwich bar (chain) – 7-9 Kingsway

Paul – bakery & café – 36-38 Kingsway

Pret a Manger – standard café – 29 -33 Kingsway

Sainsburys – supermarket – 129-133 Kingsway

Shakespeare's Head – Wetherspoon's, standard pub food – 64-78 Kingsway

Starbucks – standard café – 10 Kingsway

Subway – fast food sandwich shop – 15 Kingsway

The Delaunay Counter – casual café-deli – 55 Aldwych

Viet Eat – Vietnamese – 48 Kingsway

Wasabi – Japanese chain serving bento boxes, sushi & hot food – 19 Kingsway

On campus:

The Bean Counter – café with hot & cold snacks – 32 Lincoln's Inn Fields

Café 54 – grab & go – New Academic Building

Fields Bar and Kitchen – perfect for a relaxed lunch – Lincoln's Inn Fields

Fourth Floor Café Bar – relaxing café with freshly made deli sandwiches – Old Building

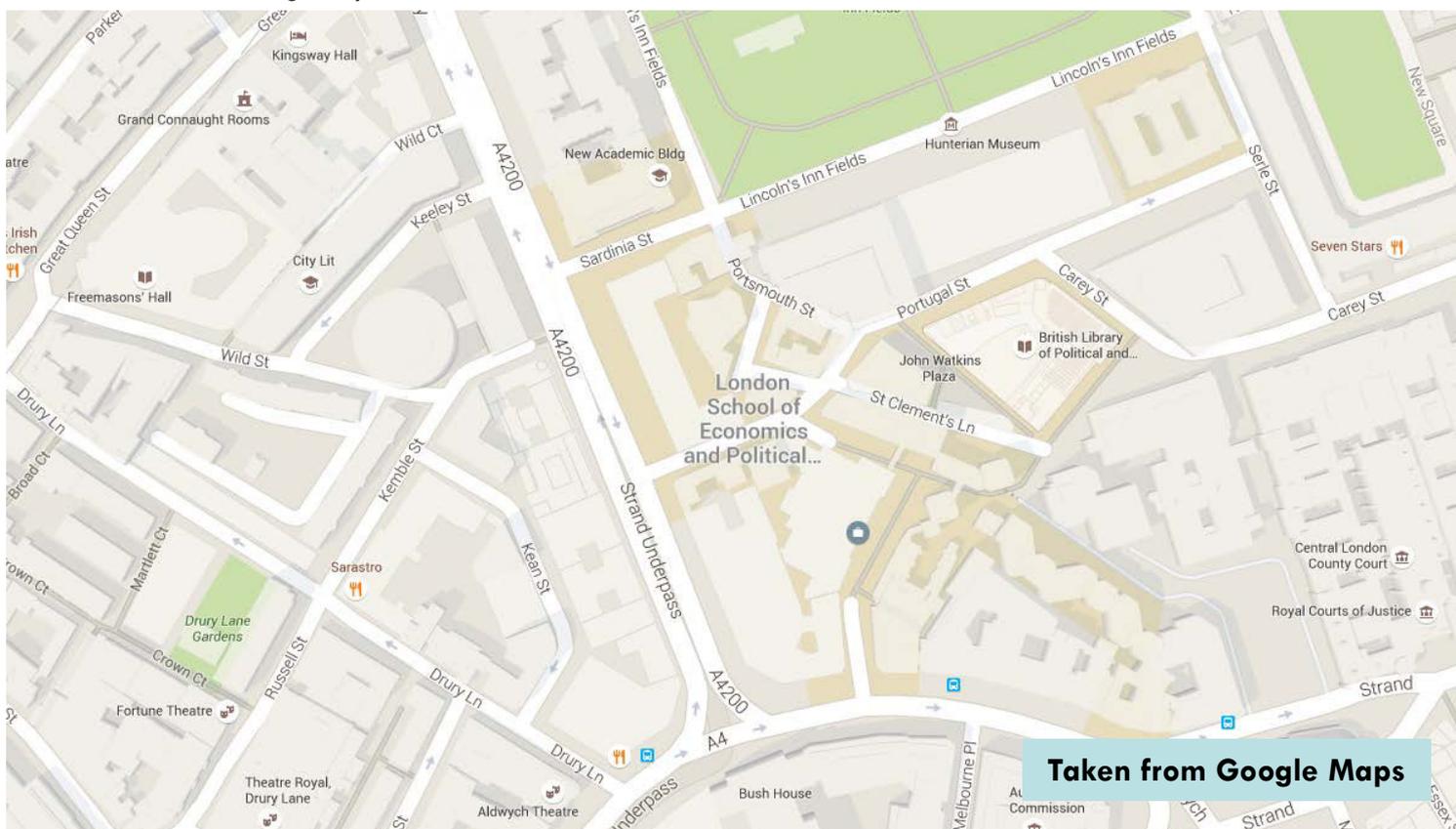
Fourth Floor Restaurant – offers a wealth of eating options – Old Building

George IV Pub – perfect for a pub lunch – Portugal Street

LSE Garrick – cafe & restaurant – Columbia House

Mezzanine Café – pop up with different daily options – New Academic Building

Plaza Café – coffee and snacks – John Watkins Plaza





Get the discussion going: when tweeting about the Colloquia, please use the hashtag **#CC2017**

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