The William Rowan Hamilton Geometry and Topology Workshop:
Celebrating Martin Bridson's 60th Birthday

30 June - 4 July 2025

Joly Theatre, Hamilton Conference Centre,
Trinity College, Dublin, Ireland

VENUE

Hamilton Mathematics Institute

The Hamilton Mathematics Institute (HMI) at Trinity College Dublin was founded in 2005, marking the 200th anniversary of the birth of William Rowan Hamilton - Ireland's greatest mathematician.

How to find us

Found at the east end of the campus, the Joly Theatre is located in the Hamilton Conference Centre. The Centre is conveniently close to the Trinity Business School and just a short walk from Pearse Street train station.

PROGRAMME

Monday, 30 June

0930 - 1020	Alan Reid, Rice *Profinite rigidity: past present, future*
1030 - 1100	**COFFEE**
1100 - 1150	Emmanuel Breuillard, Oxford *Word maps and character varieties*
1200 - 1400	**LUNCH**
1400 -1450	Koji Fujiwara, Kyoto *Well-ordered growth rates in families of groups of negative curvature*
1500 - 1550	Tara Brendle, Glasgow *The kernel of the Birman-Craggs-Johnson homomorphism*
1600 - 1630	**BREAK**
1630 - 1720	Giles Gardam, Bonn *Groups, rings, and geometry*

PROGRAMME

0930 - 1020	Mladen Bestvina, Utah
1030 - 1100	**COFFEE**
1100 - 1150	Ruth Charney, Brandeis *Outer Space for Right-Angled Artin Groups*
1200 - 1400	**LUNCH**
1400 -1450	CLAY LECTURE: Alex Lubotsky, Weizmann Institute *From group theory to computer science and back*
1500 - 1550	Matthew Stover, Temple University *High dimensional hyperbolic Coxeter groups that virtually fiber*
1600 - 1630	**BREAK**
1630 - 1720	Claudio Llosa Isenrich, KIT *From geometric group theory to complex geometry (and back)*
1600 - 1820	**POSTER SESSION 1** *Posters displayed from beginning of afternoon coffee break*

PROGRAMME

0900 - 0950	CLAY LECTURE: Karen Vogtmann, Warwick *Graphs, surfaces, and handlebodies: markings and boundary complexes*
1000 - 1030	**COFFEE**
1030 - 1120	Dessislava Kochloukova, State University of Campinas *Weak commutativity, virtually nilpotent groups, and Dehn functions*
1130 - 1220	Richard Schwartz, Brown *The optimal paper Moebius band*
	FREE AFTERNOON

PROGRAMME

0930 - 1020	Ian Agol, UC Berkeley *Hyperbolic lattices as automorphism groups*
1030 - 1100	**COFFEE**
1100 - 1150	Anne Thomas, Sydney *Reflections, cubulations and Kazhdan-Lusztig polynomials*
1200 - 1400	**LUNCH**
1400 -1450	Kasia Jankiewicz, UC Santa Cruz *Cubical quotients of cubical nonproducts*
1500 - 1550	Richard Wade, Oxford *Duality for Cohen-Macaulay complexes and the top dimensional cohomology of Out(F_N)*
1600 - 1630	**BREAK**
1630 - 1720	Tatiana Nagnibeda, Geneva *Groups acting on rooted trees and their subgroups*
1600 - 1830	**POSTER SESSION II**
1900 - 2200	**CONFERENCE BANQUET** *Trinity College Dining Hall located in front square*

PROGRAMME

0900 - 0950	**Pierre-Emmanuel Caprace, UC Louvain** *Some BMW groups I have known*
1000 - 1030	**COFFEE BREAK**
1030 - 1120	Jean Pierre Mutanguha, McGill *Canonical decompositions of free-by-cyclic groups*
1130 - 1220	Wolfgang Lück, Bonn *K-theory, groups, and geometry*
	END OF CONFERENCE

ABSTRACTS

Alan Reid, Rice
Profinite rigidity: past present, future
This talk will survey profinite rigidity. This will include a discussion of recent history, some ongoing work as well as posing questions to hopefully stimulate further research in the area.

Emmanuel Breuillard, Oxford
Word maps and character varieties
I will discuss an on-going project (with O. Becker and P. Varju and with I. Glazer) to study the geometry of generic word maps on semisimple Lie groups, in particular the dimension and regularity of their fibers. The techniques are arithmetico-geometric in nature and the analysis involves uniform expanders in finite quotients. We obtain information on the geometry of character varieties of random groups in the few relators model. The case when the deficiency of the presentation is 1, gives rise to an interesting family of rigid Zariski-dense subgroups.

ABSTRACTS

Koji Fujiwara, Kyoto
Well-ordered growth rates in families of groups of negative curvature
It is known that the set of growth rates of a non-elementary hyperbolic group, over all finite generating sets, is well-ordered. In this talk, I will discuss the set of growth rates that occur in certain families of groups. I will focus on families of hyperbolic manifold groups and 3-manifold groups.

Tara Brendle, Glasgow
The kernel of the Birman-Craggs-Johnson homomorphism
The Torelli group is the subgroup of the mapping class group of a surface that acts trivially on the first homology group of that surface. In the 1980s, Dennis Johnson wrote a series of groundbreaking papers describing the structure of this group, culminating in the calculation of its abelianization. The Birman-Craggs Johnson homomorphism measures the 2-torsion part of this abelianization, via certain 3- and 4-manifold invariants. In this talk, we will describe a simple generating set for the kernel of the Birman--Craggs--Johnson homomorphism, which can then be used to give a new and simpler proof of Johnson's calculation of the abelianization of the Torelli group. This is joint work in progress with Andrew Putman.

ABSTRACTS

Giles Gardam, Bonn
Groups, rings, and geometry
I will discuss the interplay between groups, their group rings, and their geometry, with emphasis on the Kaplansky conjectures.

ABSTRACTS

Mladen Bestvina, Utah

Ruth Charney, Brandeis
Outer Space for Right-Angled Artin Groups
Culler and Vogtmann's Outer Space has played a central role in the study of automorphism groups of free groups. In joint work with Bregman and Vogtmann, we constructed an analogous space for any right-angled Artin group. In this talk, I will review the construction of this outer space, then discuss some recent (and ongoing) applications of these spaces.

ABSTRACTS

CLAY LECTURE: Alex Lubotsky, Weizmann Institute
From group theory to computer science and back
We will present several projects in computer science (CS) where group theory is involved and suggest some group-theoretic problems inspired by CS.

Matthew Stover, Temple University
High dimensional hyperbolic Coxeter groups that virtually fiber
I will describe an iterative procedure, devised jointly with Lafont, Minemyer, Sorcar, and Wells, for constructing hyperbolic Coxeter groups that virtually fiber over $\mathbb{Z}$. A topological argument shows that iteration increases virtual cohomological dimension (vcd) by exactly one, and hence produces infinitely many isomorphism classes in each vcd $n \geq 2$. Our procedure combines results of Jankiewicz, Norin, and Wise with a generalization of a construction due to Osajda involving a new simplicial thickening process.

ABSTRACTS

Claudio Llosa Isenrich, KIT
From geometric group theory to complex geometry (and back)

A classical problem in complex algebraic geometry is understanding the topology of closed complex submanifolds of complex projective space, so-called smooth complex projective varieties, and, more generally, of compact Kähler manifolds. Two natural invariants are the fundamental group and its profinite completion; also known as the algebraic fundamental group. I will explain how tools from geometric group theory can be used to understand these invariants and their relation.

In particular, I will address the following question: When is the fundamental group of a compact Kähler manifold (or even its homeomorphism type) uniquely determined by its profinite completion? I will explain a positive answer for direct products of closed non-positively curved Riemann surfaces. This is a consequence of the profinite invariance of the so-called universal morphism of a Kähler group to a direct product of (orbi)surface groups.

Time-permitting, I will indicate how, conversely, complex geometry can be used to solve problems in geometric group theory, with the example of the construction of subgroups of hyperbolic groups with exotic finiteness properties. This talk is based on joint works with Hughes, Py, Stover and Vidussi.

ABSTRACTS

CLAY LECTURE: Karen Vogtmann, Warwick
Graphs, surfaces, and handlebodies: markings and boundary complexes
In Teichmüller space Riemann surfaces are marked by a homeomorphism from a model surface. We define a notion of complex handlebody, which can be marked by either a homeomorphism or a homotopy equivalence from a model handlebody. In all of these situations the space T of marked objects has a partial compactification Tbar with a `` boundary complex" that encodes the structure of Tbar - T. These boundary complexes are, respectively, the curve complex of a surface, the disc complex of a handlebody and the simplicial closure of Outer space. In joint work with R. Ramadas, R. Silversmith and R Winarski we fill in the details of this picture, some of which are classical but many of which are new for surfaces and handlebodies with labelled points and graphs with leaves. We also argue that the cone on the boundary complex is a good candidate for the ``tropicalization" of the space of marked objects.

ABSTRACTS

Dessislava Kochloukova, State University of Campinas
Weak commutativity, virtually nilpotent groups, and Dehn functions
We will discuss some recent results (joint with Martin Bridson) on the weak commutativity construction X(G). This includes the fact that when G is finitely presented the group X(G) is finitely presented too. We will show that under some conditions X(G) satisfies polynomial isoperimetric inequalities.

Richard Schwartz, Brown
The optimal paper Moebius band
I will explain why you can twist a 1 x L rectangular strip of paper in space and glue the ends together to make an embedded Moebius band if and only if L exceeds the square root of three. This result was conjectured by B. Halpern and C. Weaver in 1977. I'll also discuss some further developments and conjectures related to optimal paper geometry.

ABSTRACTS

Ian Agol, UC Berkeley
Hyperbolic lattices as automorphism groups
We prove that a non-arithmetic lattice in PSL(2,C) is an automorphism group of a finite-index subgroup. This question is motivated by possible applications to profinite rigidity. Some generalizations will also be considered. This is joint work with Tam Cheetham-West and Yair Minsky.

Anne Thomas, Sydney
Reflections, cubulations and Kazhdan-Lusztig polynomials
Let W be any Coxeter group, with Coxeter generating set S. This means that W is generated by S, so that $s^2 = 1$ for all $s \in S$, and all other relations are of the form $(st)^m = 1$. A reflection in W is a conjugate of an element of S. There is a partial order on the elements of W, called Bruhat order, which involves both S-length and reflections. This partial order is very important in the combinatorial theory of Coxeter groups and its applications in representation theory.

ABSTRACTS

For example, the Combinatorial Invariance Conjecture, which was formulated by Lusztig and Dyer in the 1980s, says that the Kazhdan-Lusztig polynomial $P_{-}(x, y)$ indexed by a pair of elements $x, y \in W$, with $x \leq y$ in Bruhat order, is completely determined by the poset structure of the interval $[x, y]$. I will present a connection between the poset $[e, y]$ being cubulated, in a sense I will define, and $P_{-}(x, y) = 1$ for all $x \leq y$. The proofs use normal forms and volume growth series for W, and I will not assume any knowledge of Kazhdan-Lusztig polynomials. This is joint work with Alex Bishop and Elizabeth Milićević.

Kasia Jankiewicz, UC Santa Cruz
Cubical quotients of cubical nonproducts
Burger-Mozes constructed examples of simple groups acting geometrically on a CAT(0) complex, which is a product of trees. As a counterpoint, we prove that every group acting geometrically on a CAT(0) cube complex which is not a product, admits a nontrivial quotient which also admits a geometric action on a CAT(0) cube complex. Our construction relies on the cubical version of small cancelation theory. This is joint work with M. Arenas and D. Wise.

ABSTRACTS

Richard Wade, Oxford
Duality for Cohen-Macaulay complexes and the top dimensional cohomology of Out(F_N)
The thick part of Teichmüller space is a manifold with boundary, which allows one to use Poincaré duality to study the dualizing module of the mapping class group (in the sense of group cohomology).

Although Outer space is not a manifold, it is a Cohen-Macaulay complex. In joint work with Wasserman, we described how Cohen-Macualay complexes satisfy certain (weakened) versions of Poincaré duality, and used this to get a very coarse bound on the dimension of the rational cohomology of Out(F_n) in the vcd.

The bound is not easy to compute and is given in terms of the representation theory of the action of the hyperoctohedral group on the link of a rose in Outer space. However, we will shed light on the situation when n=3 by consulting work of Bridson.

ABSTRACTS

Tatiana Nagnibeda, Geneva
Groups acting on rooted trees and their subgroups
The class of groups acting by automorphisms on infinite rooted regular trees contains many examples of groups with exotic properties, like groups of intermediate growth, infinite finitely generated torsion groups, amenable but not elementary groups. Moreover, it contains interesting sub-classes of groups like branch groups or self-similar groups. We will discuss the structure of finitely generated subgroups in certain branch self-similar groups, their LERF property and its various reinforcements, application to the study of maximal subgroups and, if time permits, some results on decision problems for these groups.

ABSTRACTS

Pierre-Emmanuel Caprace, UC Louvain
Some BMW groups I have known
BMW groups are groups acting regularly on the vertices of the Cartesian product of two trees. They include the groups that factorize as a (possibly non direct) product of two free groups.

They are named after Burger-Mozes and Wise, who pioneered their study and revealed their importance in geometric group theory, notably by constructing various examples with striking properties (arithmeticity, non-residual finiteness, virtual simplicity).

The goal of this talk is to present an overview of this class of groups, based on a selection of explicit examples. I will emphasize that, in some cases, valuable information on the structure of a BMW group can be detected in a single finite quotient.

ABSTRACTS

Jean Pierre Mutanguha, McGill
Canonical decompositions of free-by-cyclic groups
Free-by-cyclic groups can be defined as mapping tori of free group automorphisms. I will discuss a dynamical decomposition of automorphisms that produces a canonical decomposition of the corresponding free-by-cyclic groups. This will involve the partial order on attracting laminations for an automorphism. The decomposition of free-by-cyclic groups can be considered an extension of the JSJ decomposition of 3-manifolds. This talk is on joint work with Spencer Dowdall, Yassine Geurch, Radhika Gupta, and Caglar Uyanik.

Wolfgang Lück, Bonn
K-theory, groups, and geometry
We give a gentle and brief introduction to the lower and middle K-groups of the integral group ring of a group and discuss the conjecture that they all vanish for torsionfree groups. This together with some information about L-groups has a lot of implications to questions and problems in group theory, geometry, and topology, e.g., it implies the conjectures due to Bass, Borel, Gromov, Kaplansky, Novikov, Wall, and Serre about topological rigidity of aspherical closed manifolds, boundaries of hyperbolic groups, idempotents in group rings, Poincare duality groups,and so on.

ABSTRACTS

On the other hand methods from geometric group theory play a key role in the proof of this conjecture which is known to be true for a large class of groups including hyperbolic groups, finite-dimensional CAT(0)-groups, and lattices. We are aware that this is the last talk of the conference and therefore will emphasise easy to formulate results and try to give an intriguing panorama, but no technical details. Finally we make some comments on fibering.