Topological Methods in Group Theory

Ross Geoghegan's 70th birthday

Ohio State University
June 16th - 20th, 2014

Monday, June 16th

Plenary Talks (Cockins Hall, CH 240)

9:00am - 9:50am, CH 240

The BNS-invariant for the pure braid group.

John Meier (Lafayette College)

In 1987 Bieri, Neumann, and Strebel introduced a geometric invariant of a discrete group G, $\Sigma^1(G)$. Among other things, Σ^1 determines which subgroups containing the commutator subgroup are finitely generated. Nic Koban, Jon McCammond and I have recently established:

Theorem The complement of the BNS-invariant for the pure braid group P_n, $\Sigma^1(G)^c$, consists of $\binom{n}{3} + \binom{n}{4}$ circles.

10:10am - 11:00am, CH 240

Contracting boundaries.

Ruth Charney (Brandeis University)

Boundaries of hyperbolic spaces play an important role in the study of hyperbolic groups. Analogous boundaries exist for CAT(0) spaces but they are not quasi-isometry invariant and hence do not give a well-defined boundary for a CAT(0) group. I will discuss a new type of boundary, the contracting boundary, for a CAT(0) space. This boundary is quasi-isometry invariant and shares many properties with hyperbolic boundaries. The talk will conclude with an application to right-angled Coxeter groups. (Joint work with Harold Sultan.)

11:20am - 12:10pm, CH 240

Hilbert cube manifolds, shape theory, and beyond (?)

Steve Ferry (Rutgers University)

I'll talk about the key results from these areas, especially as they tie in to Ross' early work.

2:00pm - 2:50pm, CH 240

The fundamental group at the end of a group.

Mike Mihalik (Vanderbilt University)

If a finitely presented group satisfies a certain asymptotic condition called *semistability* at ∞, then the fundamental group at an end of that group is independent of base ray converging to that end (in analogy with a space being path connected so that fundamental group is independent of base point). The following are long standing open (and associated) questions:

Question 1 *Are all finitely presented groups semistable at* ∞*?*

Question 2 *Is $H^2(G, \mathbb{Z}G)$ free abelian for all finitely presented groups G?*

We begin this talk with motivation, history, examples and classical results associated with these questions. We end the talk with a proof of the following theorem:

Theorem (G. Conner and M. Mihalik) If a finitely presented group G contains an infinite, finitely generated commensurated subgroup of infinite index, then G is semistable at infinity and $H^2(G, \mathbb{Z}G)$ is free abelian.

This result generalizes many of the classical results on semistability. If H is a subgroup of a group G then H is *commensurated* in G if $gHg^{-1} \cap H$ has finite index in both H and gHg^{-1}. So commensurated is weaker than normal.

Special Session I (Dulles Hall, DU 20)

3:10pm - 3:30pm, DU 20

Property (T) from a spectral gap of the 1*-dimensional links.*

Izhar Oppenheim (Ohio State University)

I'll present a new spectral gap criterion for property (T) for a group Γ acting on an n-dimensional simplicial complex X. The main novelty of this criterion is that it works even in cases where the group action is not proper, but only "mildly proper". The main idea is to use X to construct a 2-dimensional simplicial complex X' such that the action of Γ on X' is proper and that X' still has the desired spectral gap property.

3:40pm - 4:00pm, DU 20

The horofunction boundary of the lamplighter group with the Diestel-Leader generating set.

Keith Jones (SUNY - Oneonta)

Joint work with Gregory Kelsey. In this preliminary report, we describe the horofunction boundary of the lamplighter group using the generating set whose corresponding Cayley graph is the Diestel-Leader graph $DL(2, 2)$. We show that there is a one-to-one correspondence between the Busemann points of the horofunction boundary and the visual boundary of $DL(2, 2)$. We then provide some examples of non-Busemann points and describe the families of points that make up the horofunction boundary. Time permitting, we will briefly discuss our approach to proving these points are the entirety of the boundary.

4:10pm - 4:30pm, DU 20

Relative divergence of finitely generated groups.

Hung Tran (University of Wisconsin - Milwaukee)

We generalize the concept of divergence of finitely generated groups by introducing the relative divergence of a finitely generated group with respect to a subgroup. Upper relative divergence generalizes Gersten's notion of divergence, and lower relative

divergence generalizes the definition of Cooper-Mihalik. While divergence in term of Cooper-Mihalik can only be linear or exponential, relative lower divergence can be any polynomial or exponential function. In this paper, we examine relative divergence (both upper and lower) of a group with respect to a normal subgroup or a cyclic subgroup. We also explore relative divergence of CAT(0) groups and relatively hyperbolic groups with respect to their subgroups to better understand geometric properties of these groups.

4:40pm - 5:00pm, DU 20

The weighted Singer conjecture for Coxeter groups in dimensions three and four.

Wiktor Mogilski (University of Wisconsin - Milwaukee)

Given a Coxeter system (W, S) there is a contractible simplicial complex Σ called the Davis complex on which W acts properly and cocompactly. Appearing in a 2001 paper of Davis-Okun, the Singer conjecture for Coxeter groups states that if Σ is an n-manifold, then the L^2-(co)homology of Σ is concentrated in dimension $\frac{n}{2}$. In a 2006 paper of Dymara, the weighted L^2-(co)homology groups of Σ were defined, and in a 2011 paper of Davis-Dymara-Januszkiewicz-Okun, the Singer conjecture was appropriately formulated for weighted L^2-(co)homology theory. Furthermore, it is proved in dimensions $n \leq 4$ under the assumption that W is right-angled. In this talk I will prove the weighted version of the Singer conjecture in dimension three under the assumption that W is not Lánner. Of note is the fact that Lánner groups only exist in dimensions $n \leq 4$, and there are only nine in dimension three. If time permits, I will briefly discuss progress in dimension four.

Special Session II (Dulles Hall, DU 24)

3:10pm - 3:30pm, DU 24

Geometry of spin manifolds.

Donco Dimovski (Mathematics Institute, Macedonia)

We generalize the well known geometric characterizations of orientable n-dimensional manifolds, i.e. an n-dimensional closed PL manifold M is orientable if and only if each embedded circle in M has a regular neighborhood homeomorphic to the product of the circle with an $(n-1)$ ball.

Theorem. An n-dimensional, orientable, closed PL manifold M, $n > 4$, is spin if and only if each embedded closed orientable surface F in M has a regular neighborhood homeomorphic to the product of the surface F with an $(n-2)$ ball, and each embedded closed nonorientable surface F in M has a regular neighborhood homeomorphic to the neighborhood of F in the Euclidean space E^n.

3:40pm - 4:00pm, DU 24

On finite decomposition complexity.

David Rosenthal (St. John's University)

The notion of asymptotic dimension was introduced by Gromov as a tool for studying the large scale geometry of finitely generated groups. In 1998 Yu stimulated widespread interest in this concept when he proved the Novikov conjecture for groups that have finite asymptotic dimension and a classifying space with the homotopy type of a finite CW-complex. More recently, Guentner, Tessera and Yu developed a new coarse geometric invariant, called finite decomposition complexity (FDC), generalizing the notion of asymptotic dimension. In this talk I will present some of the basic properties of FDC, providing several examples and open problems along the way, and will discuss joint work in progress with Andrew Nicas on FDC.

4:10pm - 4:30pm, DU 24

Commensurability and quasi-isometric classification of hyperbolic surface group amalgams.

Emily Stark (Tufts University)

Two groups are abstractly commensurable if they contain isomorphic subgroups of finite index. Finitely generated groups that are abstractly commensurable are quasi-isometric, though the converse is false in general. Two questions in geometric group theory are to characterize the abstract commensurability and quasi-isometry classes within a class of groups, and to understand for which classes of groups the classifications coincide. We will present a solution within the class of groups isomorphic to the fundamental group of two closed hyperbolic surfaces identified along an essential simple closed curve in each.

4:40pm - 5:00pm, DU 24

Revisiting Farrell's nonfiniteness of Nil.

Kun Wang (Ohio State University)

We study Farrell Nil-groups associated to a finite order automorphism of a ring R. We show that any such Farrell Nil-group is either trivial, or infinitely generated (as an abelian group). Building on this first result, we then show that any finite group that occurs in such a Farrell Nil-group occurs with infinite multiplicity. If the original finite group is a direct summand, then the countably infinite sum of the finite subgroup also appears as a direct summand. We use this to deduce a structure theorem for countable Farrell Nil-groups with finite exponent. Finally, as an application, we show that if V is any virtually cyclic group, then the associated Farrell or Waldhausen Nil-groups can always be expressed as a countably infinite sum of copies of a finite group, provided they have finite exponent (which is always the case in dimension 0). This is joint work with Jean Lafont and Stratos Prassidis.

Tuesday, June 17th

Plenary Talks (Cockins Hall, CH 240)

9:00am - 9:50am, CH 240

Dynamics and polynomial invariants of free-by-cyclic groups.

Ilya Kapovitch (University of Illinois - Urbana-Champaign)

The theory developed by Thurston, Fried and McMullen provides a near complete picture of the various ways a hyperbolic 3-manifold M can fiber over the circle. Namely, there are distinguished convex cones in the first cohomology $H^1(M;R)$ whose integral points all correspond to fibrations of M, and the dynamical features of these fibrations are all encoded by McMullen's "Teichmuller polynomial." This talk will describe recent work developing aspects of this picture in the setting of a free-by-cyclic group G. Specifically, we will describe a polynomial invariant that determines a convex polygonal cone C in the first cohomology of G whose integral points all correspond to algebraically and dynamically interesting splittings of G. The polynomial invariant additionally provides a wealth of dynamical information about these splittings. This is joint work with Spencer Dowdall and Christopher Leininger.

10:10am - 11:00am, CH 240

Boundaries of CAT(0) spaces with Isolated Flats.

Kim Ruane (Tufts University)

In previous joint work with Mihalik and Tschantz, we showed that certain CAT(0) amalgamated products will have non locally connected boundary regardless of the CAT(0) space on which they act. In this talk we will discuss a full converse to that theorem in the setting of groups acting on CAT(0) spaces with the Isolated Flats Property. This is joint work with C. Hruska.

11:20am - 12:10pm, CH 240

Groups of piecewise linear homeomorphisms of the interval.

Matt Brin (Binghamton University)

Information about the subgroup structure of $PL(I)$, the group of orientation preserving, piecewise linear self homeomorphisms of $[0,1]$ has been accumulating slowly for several decades. For both $PL(I)$ and its most famous subgroup, Thompson's group F, the full subbgroup structure is still poorly understood. However there is promise that this will change. My talk will be mostly a survey of what is known, but will include a few recent developments. The recent developments are joint with Collin Bleak, Martin Kassabov and Justin Moore.

2:00pm - 2:50pm, CH 240

Negatively curved and Anosov bundles.

Tom Farrell (Binghamton University)

I will report on joint work with Pedro Ontaneda on negatively curved bundles which leads to more recent joint work with Andrey Gogolev on Anosov bundles. We consider smooth bundles $p : E \to B$ whose abstract fiber is a fixed closed smooth manifold M; but whose concrete fibers $M(x) = p^{-1}(x)$, $x \in B$, are equipped with some extra structure varying continuously with x. This extra structure is a negatively curved Riemannian metric in the case of negatively curved bundles, and either an Anosov diffeomorphism or an Anosov flow in the case of Anosov bundles. Our results on negatively curved bundles led Pedro and I to conjecture that these bundles must be topologically trivial when B is simply connected. Serendipitiously, Andrey and my work on Anosov bundles sheds some positive light on this conjecture.

Special Session I (Dulles Hall, DU 20)

3:10pm - 3:30pm, DU 20

Curtis-Tits Groups.

Rieuwert Blok (Bowling Green State University)

Curtis-Tits groups are generalizations of groups of Kac-Moody type. We will focus on finitely generated Curtis-Tits groups that are not of Kac-Moody type and discuss topological and geometric aspects of their classification, their existence, and some of their applications.

3:40pm - 4:00pm, DU 20

Delaunay tessellations of hyperbolic manifolds.

Jason DeBlois (University of Pittsburgh)

Given a locally finite set S on a finite-volume hyperbolic manifold M, there is a decomposition of M into a union of compact and ideal polyhedra with S as the vertex set. I will outline a "convex hull" construction of such a decomposition, compare it to previous versions, and give some reasons it can be useful.

4:10pm - 4:30pm, DU 20

An example of an automatic graph of intermediate growth.

Dmytro Savchuk (University of South Florida)

The class of Cayley automatic groups was recently introduced by Kharlampovich, Khoussainov and Miasnikov as a generalization of the class of automatic groups. This class retains many nice algorithmic properties of automatic groups, but is significantly wider. In particular, it includes many groups that are not finitely presented. One of the open questions about these groups is whether there is a Cayley automatic group of intermediate growth, or, equivalently, whether there is a group of intermediate growth whose Cayley graph is automatic. We give an example of a 4-regular infinite automatic graph of intermediate growth. It is constructed as a Schreier graph of a group generated by 3-state Mealy automaton. This is a joint work with Alexei Miasnikov.

Special Session II (Dulles Hall, DU 24)

3:10pm - 3:30pm, DU 24

Point-pushing and Nielsen realization.

Bena Tshishiku (University of Chicago)

Let M be a manifold with mapping class group $\mathrm{Mod}(M)$. Any subgroup $G \subset \mathrm{Mod}(M)$ can be represented by a collection of diffeomorphisms that form a group up to isotopy. The Nielsen realization problem asks whether or not G can be represented as an honest subgroup of diffeomorphisms. We will discuss a special case of this problem when M is a locally symmetric manifold and $G \simeq \pi_1(M)$ is the "point-pushing" subgroup. This generalizes work of Bestvina-Church-Souto.

3:40pm - 4:00pm, DU 24

Aspherical manifolds that cannot be triangulated.

Jim Fowler (Ohio State University)

Kirby and Siebenmann showed that there are manifolds that do not admit PL structures, and yet the possibility remained that all manifolds could be triangulated. Freedman showed that there are 4-manifolds that cannot be triangulated. Davis and Januszkiewicz applied a hyperbolization procedure to Freedman's 4-manifolds to get closed aspherical 4-manifolds that cannot be triangulated. But what about higher dimensions?

In the late 1970s, Galewski and Stern and independently, Matumoto, showed that non-triangulable manifolds exist in all dimensions > 4 if and only if homology 3-spheres with certain properties do not exist. Manolescu showed that there were no such homology 3-spheres, and hence non-triangulable manifolds exist in every dimension > 4.

By carefully applying a hyperbolization technique to the Galewski-Stern examples, we show, for all $n \geq 6$, that there exists a closed aspherical n-manifold which cannot be triangulated.

This is joint work with Michael W. Davis and Jean-François Lafont.

4:10pm - 4:30pm, DU 24

On Thompsons group T and algebraic K-theory.

Marco Varisco (SUNY - Albany)

In joint work with Ross Geoghegan, we show that the Whitehead group of Thompsons group T is infinitely generated, even when tensored with the rationals. To this end we describe the structure of the centralizers and normalizers of the finite cyclic subgroups of T, using a direct geometric approach based on rotation numbers. This also leads to an explicit computation of the source of the Farrell-Jones assembly map for the rationalized higher algebraic K-theory of the integral group ring of T.

Wednesday, June 18th

Plenary Talks (Cockins Hall, CH 240)

9:00am - 9:50am, CH 240

Limit sets for modules over groups acting on CAT(0)-spaces.

Robert Bieri (University of Frankfurt and Binghamton University)

This will be a survey on joint work with Ross Geoghegan – see arXiv:1306.3403

The fact that the BNSR-Geometric Invariants can be interpreted as horospherical limit sets and extended to groups acting on arbitrary CAT(0)-spaces opens a trail from the classical limit set of a discrete group of Möbius transformations to tropical geometry. Along it, we find attractive hard problems, and nice look-outs over unknown territory.

10:10am - 11:00am, CH 240

A new solution to the von Neumann-Day problem for finitely presented groups. Part I.

Justin Moore (Cornell University)

In this talk, I will describe a finitely presented subgroup of Monod's group of piecewise projective homeomorphisms of the real line. This in particular provides a new example of a finitely presented group which is nonamenable, and yet does not contain a non-abelian free subgroup. Our example is moreover torsion free. This is joint work with Yash Lodha.

11:20am - 12:10pm, CH 240

A new solution to the von Neumann-Day problem for finitely presented groups. Part II.

Yash Lodha (Cornell University)

In this talk, I will describe a finitely presented subgroup of Monod's group of piecewise projective homeomorphisms of the real line. This in particular provides a new example of a finitely presented group which is nonamenable, and yet does not contain a non-abelian free subgroup. Our example is moreover torsion free. The talk will focus on the combinatorial analysis of words in the group and finiteness properties. A part of this is joint work with Justin Moore.

2:00pm - 2:50pm, CH 240

Ends and boundaries of groups.

Craig Guilbault (University of Wisconsin - Milwaukee)

In 1986 Ross Geoghegan posed a series of questions that, in their original forms, might seem foreign to some of today's geometric group theorists. In reality, the issues and ideas raised there have simply evolved, taking on new forms that are of significant

interest today. For example, Gromov boundaries of hyperbolic groups, CAT(0) group boundaries, and Bestvina's Z-boundaries are all incarnations of the "shape of a group", which is the central theme of that 1986 paper. Progress has been made, but many of the questions raised there remain open. In current terminology, we will discuss progress on the question: When does a group have a boundary?

Thursday, June 19th

Plenary Talks (Cockins Hall, CH 240)

9:00am - 9:50am, CH 240
Projection complex and applications.
Mladen Bestvina (University of Utah)

I will describe the construction of the projection complex, which is joint work with Ken Bromberg and Koji Fujiwara. I will also talk about some applications of the construction, mostly to mapping class groups and $Out(F_n)$.

10:10am - 11:00am, CH 240
Groups with context-free co-word problem.
Dan Farley (Miami University)

Let G be a group, and let S be a finite set that generates G as a monoid. The word problem of G is the kernel of the associated monoid homomorphism from the free monoid on S to G, and the co-word problem is the complement of the word problem. Both the word problem and the co-word problem are thus formal languages in this point of view, and one way to classify groups is via the complexity of these formal languages. Recent work of various authors has led to the conjecture that Thompson's group V is a universal group with context-free co-word problem – that is, it is conjectured that the class of groups with context-free co-word problem consists precisely of the class of finitely generated subgroups of V. I will discuss examples related to the conjecture.

11:20am - 12:10pm, CH 240
Amenability via actions of groups.
Kate Juschenko (Northwestern University)

I will discuss a theorem on amenability which unifies many known technical proofs of amenability to the one common proof, as well as produces examples of groups for which amenability was an open problem. This is joint with V. Nekrashevych and M. de la Salle.

2:00pm - 2:50pm, CH 240
Sigma theory for the generalised Thompson groups of type F.

Dessislava Kochloukova (Universidade Estadual de Campinas, Brasil)

After a short review of existing results on general Sigma theory we discuss the specific case of the Thompson group F (this is a joint result with R. Geoghegan and R. Bieri) and some low dimensional results for the generalised Thompson groups of type F.

Special Session I (Dulles Hall, DU 20)

3:10pm - 3:30pm, DU 20

Acylindrically hyperbolic groups.

Michael Hull (University of Illinois - Chicago)

The class of acylindrically hyperbolic groups is a generalization of hyperbolic and relatively hyperbolic groups which includes mapping class groups, $Out(F_n)$, directly indecomposable non-cyclic RAAGS, and various 3-manifold groups. Many aspects of the theory of hyperbolic and relatively hyperbolic groups can be generalized and applied to this large class of groups, yielding new results in a number of particular cases. We will discuss some recent progress in this direction.

3:40pm - 4:00pm, DU 20

Action dimension of right-angled Artin groups.

Kevin Schreve (University of Wisconsin - Milwaukee)

The action dimension of a group is the smallest dimension of a contractible manifold that the group acts on properly discontinuously. A right-angled Artin group is a group with a presentation determined by a finite graph: the generators are the vertices of the graph and two generators commute if the corresponding vertices are connected by an edge. I'll describe the relation between the action dimension of a right-angled Artin group and the topology of the flag complex determined by the graph.

Main Theorem: Let L be a k-dimensional flag complex, and let A_L be the associated right-angled Artin group.

- If $H_k(L, \mathbb{Z}_2) \neq 0$, then the action dimension of A_L is $2k + 2$.
- If $H_k(L, \mathbb{Z}_2) = 0$ and $k \neq 2$, then the action dimension of A_L is $\leq 2k + 1$.

This is joint work with Grigori Avramidi, Mike Davis, and Boris Okun.

4:10pm - 4:30pm, DU 20

Relatively hyperbolic Coxeter groups of type HM.

Giang Le (Ohio State University)

A Coxeter group is type HM if it has an effective, proper and cocompact action on some contractible manifold. We study relatively hyperbolic Coxeter groups of type HM with flats of codimension 1. In this talk, we will present one of our results which says that the dimension of these groups is bounded above.

4:40pm - 5:00pm, DU 20

Flat strips in rank one CAT(0) spaces.

Russell Ricks (University of Michigan)

Let X be a proper, geodesically complete CAT(0) space and Γ be a group acting geometrically (that is, properly discontinuously, cocompactly, and by isometries) on X; further assume X admits a rank one axis. Using the Patterson-Sullivan measure on the boundary, we construct a generalized Bowen-Margulis measure on the space of geodesics in X modulo the Γ-action. This additional structure allows us to prove some results about the original CAT(0) space X; for instance, almost no geodesic in X (with respect to the Bowen-Margulis measure) bounds a flat strip of any positive width. In this talk, we aim to present these results and highlight some of the topological dynamics at work.

Special Session II (Dulles Hall, DU 24)

3:10pm - 3:30pm, DU 24

Finite-dimensionality of $\mathscr{Z}$-boundaries.

Molly Moran (University of Wisconsin - Milwaukee)

An interesting feature of CAT(0) and hyperbolic group boundaries is that they must have finite covering dimension, even if the space the group acts on is infinite-dimensional. When Bestvina axiomatized the theory of group boundaries to larger classes of groups, he included a condition which forced these boundaries, known as $\mathscr{Z}$-boundaries, to be finite-dimensional. In generalizing the definition of group boundaries to permit the study of groups with torsion, Dranishnikov removed the condition that, a priori, forced the finite-dimensionality of these boundaries. We show that a very general class of $\mathscr{Z}$-boundaries, which include the type as defined by Dranishnikov, must be finite-dimensional. In doing so, we unify the treatments of group boundaries put forth by Bestvina and Dranishnikov.

3:40pm - 4:00pm, DU 24

Quasi-isometry classification of right-angled Coxeter groups.

Pallavi Dani (Louisiana State University)

I will report on progress on the quasi-isometry classification of right-angled Coxeter groups, beginning with an outline of what may be discerned using previously studied invariants such as divergence. I will then describe a finer classification of a class of hyperbolic right-angled Coxeter groups using splittings over 2-ended subgroups and topological features of the visual boundary. This is joint work with Anne Thomas.

4:10pm - 4:30pm, DU 24

Rigidity of quasiisometries of negatively curved solvable Lie groups.

Xiangdong Xie (Bowling Green State University)

We will present results of the following two types:

1. There are relatively few quasiisometries between general negatively curved solvable Lie groups;

2. If a finitely generated group quasi-acts on a negatively curved solvable Lie group, then this quasi-action can be coarsely conjugated into an isometric action.

This is joint work with Tullia Dymarz.

4:40pm - 5:00pm, DU 24

Thompson groups for systems of groups, and their finiteness properties.
Matt Zaremsky (Binghamton University)

Thompson's group V provides a structure in which the family of symmetric groups is arranged in a sort of limit, and the resulting group is still finitely presented (and even still of type F_∞). Note that other limiting processes, like the direct limit, are drastically poorly behaved with respect to such finiteness properties. In joint work with Stefan Witzel, we construct a Thompson-like group out of any family of groups equipped with what we call a *cloning system*, and inspect the finiteness properties of the Thompson limit. We find examples where the finiteness properties of the Thompson limit are precisely the limit of the finiteness properties of the groups in the family. In particular we find examples, implementing certain matrix groups, of Thompson-like groups that are of type F_{n-1} but not type F_n (for example finitely generated but not finitely presented).

Friday, June 20th

Plenary Talks (Cockins Hall, CH 240)

9:00am - 9:50am, CH 240

The space of nonpositively curved metrics of a negatively curved manifold.
Pedro Ontaneda (Binghamton University)

Previously Tom Farrell and I proved that the space of negatively curved metrics on a closed negatively curved manifold M^n has infinitely many path-components, provided $n > 9$. Similar results were proved for some higher homotopy groups. In this talk we will show how to extend these results to the nonpositively curved case. This is joint work with Tom Farrell.

10:10am - 11:00am, CH 240

Action dimension, L^2-homology, and hierarchies.
Boris Okun (University of Wisconsin - Milwaukee)

The Singer conjecture states that L^2-homology of the fundamental group of an aspherical closed manifold vanishes except possibly in the middle dimension.

The cocompact action dimension of a group G, cadim(G), is the least dimension of a contractible manifold (possibly with boundary) which admits a proper cocompact G-action. The cadim conjecture states that L^2-homology of any group G vanishes above cadim$(G)/2$.

We prove that the Singer conjecture and the cadim conjecture are equivalent. We also prove the Singer conjecture for 4-dimensional Coxeter group manifolds.

Both proofs are using the notion of a hierarchy for a group action, which generalizes the idea of a Haken manifold. This is a joint work with Kevin Schreve.

11:20am - 12:10pm, CH 240

Separability of free groups and surface groups.

Kai-Uwe Bux (University of Bielefeld, Germany)

The word problem for a given finitely generated group is the problem of telling whether a word in the generators represents the identity element. For any finitely presented group, this problem has an easy part: if the word is trivial, then it follows from the given finitely many relations; hence it is possible to algorithmically list all trivial words. Thus, in a group with unsolvable word problem, it is impossible to algorithmically list the non-trivial words.

For a finitely presented group, it is easy to list all actions on finite sets: for a proposed action of the generators, just check whether the relations hold. Hence, one can algorithmically list all finite quotients of a finitely presented group. This provides an obvious way of listing *some* non-trivial words: put down those, that represent a non-trivial element in some finite quotient. A group where this algorithm eventually finds each non-trivial word is called *residually finite*. Residually finite groups have an obvious solution to the word problem.

The conjugacy problem of telling which words represent conjugate elements allows for a similar treatment. In any finitely presented group, it is algorithmically easy to list all pairs of words representing conjugate elements. The hard part is to list the pairs of words representing non-conjugate elements. A group is called *conjugacy separable*, if any two non-conjugate elements stay non-conjugate in some finite quotient. Thus, finitely presented conjugacy separable groups admit an obvious solution to the conjugacy problem.

Other classical algorithmic problems can be treated analogously. Each leads to a corresponding notion of separability. The problem of telling whether two finitely generated subgroups are conjugate gives rise to the notion of subgroup conjugacy separability. A group is *subgroup conjugacy separable* if any two non-conjugate finitely generated subgroups have non-conjugate images in some finite quotient. We show that finitely generated free groups and fundamental groups of closed oriented surfaces are subgroup conjugacy separable.

Plenary Talks

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
9:00 - 9:50am	Meier	Kapovich	Bieri	Bestvina	Ontaneda
10:10-11:00am	Charney	Ruane	Moore	Farley	Okun
11:20 - 12:10am	Ferry	Brin	Lodha	Juschenko	Bux
12:10 - 2:00pm	Lunch	Lunch	Lunch	Lunch	Lunch
2:00 - 2:50pm	Mihalik	Farrell	Guilbault	Kochloukova	
3:00 - 5:30pm	Parallel sessions	Parallel sessions		Parallel sessions	

Parallel Sessions

	Monday		**Tuesday**		**Thursday**	
3:10 - 3:30pm	Oppenheim	Dimovski	Blok	Tshishiku	Hull	Moran
3:40 -4:00pm	Jones	Rosenthal	DeBlois	Fowler	Schreve	Dani
4:10 - 4:30pm	Tran	Stark	Savchuk	Varisco	G. Le	Xie
4:40 - 5:00pm	Mogilski	K. Wang			Ricks	Zaremsky