Geometrical Group Theory
Théorie géométrique des groupes
(Org: **Mikael Pichot** and/et **Daniel T. Wise** (McGill))

ALEJANDRO ADEM, University of British Columbia
Spaces of Representations for Abelian Groups

In this talk we will describe basic properties for spaces of commuting elements in a compact Lie group G. In particular we will provide calculations for the equivariant K-theory of these spaces for the conjugation action by G. This is joint work with Jose Gomez.

OWEN BAKER, McMaster University
Cannon–Thurston maps do not always exist

Given an embedding of hyperbolic groups $\imath : H \hookrightarrow G$, one can seek to define a map between the Gromov boundaries $\widehat{\imath} : \partial H \to \partial G$ by

$$\widehat{\imath}(\lim h_n) = \lim \imath(h_n).$$

When $\widehat{\imath}$ is well-defined, it is called the Cannon-Thurston map. I will construct an example where $\widehat{\imath}$ fails to be well-defined, answering a question of Mitra. This is joint work with Tim Riley.

JASON BEHRSTOCK, Lehman College, CUNY
Divergence, thick groups, and morse geodesics

In a metric space the divergence of a pair of rays is a way to measure how quickly they separate from each other. Understanding what divergence rates are possible in the presence of non-positive curvature was raised as a question by Gromov and then refined by Gersten. We will describe a construction of groups with several interesting properties, some of which shed light on the above question. (This will be on joint work with Cornelia Drutu and with Mark Hagen.)

HADI BIGDELY, McGill University
Quasiconvex Subgroups of Relatively Hyperbolic groups

After reviewing Bowditch's approach to relatively hyperbolic groups, I will explain a combination theorem of relatively hyperbolic groups along malnormal, quasiconvex subgroups. As an application, I will describe a criterion for detecting quasiconvexity of a subgroup of a relatively hyperbolic group that splits as a graph of groups. This is joint work with D. Wise.

IAN BIRINGER, Boston College
Growth of Betti numbers and a probabilistic take on geometric convergence

We will describe an asymptotic relationship between the volume and the Betti numbers of certain locally symmetric spaces. The proof uses a synthesis of Gromov-Hausdorff convergence of Riemannian manifolds and Benjamini-Schramm convergence from graph theory. Joint with Abert, Bergeron, Gelander, Nikolov, Raimbault, Samet.

STEVEN BOYER, UQAM
L-spaces, left-orderability and foliations

Much work has been devoted in recent years to examining relationships between the existence of a co-oriented taut foliation in a closed, connected, prime 3-manifold W, the left-orderability of the fundamental group of W, and the property that W not

be a Heegaard-Floer L-space. In this talk I will report on this work and in particular I will discuss evidence for the conjecture that an irreducible rational homology 3-sphere is an L-space if and only if its fundamental group is not left-orderable.

This is joint work with Cameron Gordon and Liam Watson, with Adam Clay, and with Michel Boileau.

ADAM CLAY, UQAM
Graph manifolds, orderability, L-spaces and foliations

Boyer, Gordon and Watson recently showed that having a left-orderable fundamental group (LO), supporting a co-orientable taut foliation (CTF), and being a non-L-space (NLS) are equivalent for all closed, connected, orientable prime Seifert fibred and Sol manifolds. In this talk I will outline why LO and CTF are equivalent for rational homology 3-sphere graph manifolds, and give a strategy for extending the equivalence to include NLS as well. This is joint work with Steve Boyer.

MARK HAGEN, University of Michigan
Thick cubulated groups

A CAT(0) cube complex X admitting a geometric action by a group G has an associated simplicial complex, the simplicial boundary, that is very similar to the Tits boundary but is defined in terms of combinatorial features of X rather than in terms of the CAT(0) metric. Whether G is relatively hyperbolic, or thick, can be detected by checking simple conditions on the action of G on the simplicial boundary of X. In particular, we give conditions on the simplicial boundary under which the divergence function of G is linear, and conditions under which it is quadratic. (This talk concerns joint work with Jason Behrstock.)

VADIM KAIMANOVICH, University of Ottawa
Boundary convergence and relative hyperbolicty

Random walks and their numerical characteristics have now become a popular tool for dealing with asymptotic problems in infinite groups. We shall discuss the problems related to boundary convergence in non-proper hyperbolic spaces which arise from relatively hyperbolic groups.

OLGA KHARLAMPOVICH, Hunter College, CUNY
Algorithmic problems for toral relatively hyperbolic groups

We will present some algorithmic results (joint with A. Myasnikov) for these groups, in particular, the following:

Let G be a toral relatively hyperbolic group and H and K finitely generated relatively quasi-convex subgroups of G given by finite generating sets. Then one can effectively find a finite family $\mathcal{J}$ of non-trivial intersections $J = H^g \cap K \neq 1$ such that any non-trivial intersection $H^{g_1} \cap K$ has form J^k for some $k \in K$ and $J \in \mathcal{J}$. One can effectively find the generators of the subgroups from $\mathcal{J}$.

THOMAS KOBERDA, Yale University
The curve complex for a right-angled Artin group

I will discuss an analogue of the curve complex for right-angled Artin groups and describe some of its properties. I will then show how it guides parallel results between the theory of mapping class groups and the theory of right-angled Artin groups. This represents joint work with Sang-hyun Kim.

JOHANNA MANGAHAS, Brown University
Some Schottky subgroups of mapping class groups

Farb and Mosher defined a notion of "convex cocompact" for subgroups of mapping class groups that models the original definition of convex cocompact for Kleinian groups; free groups of either kind are called Schottky. I'll describe a way to

construct examples of Schottky mapping class subgroups that is (at least, a priori), different from the original "abundant" examples Farb and Mosher described. These examples grow out of one way, described by Clay, Leininger, and myself, to quasi-isometrically embed free groups (and more generally, right-angled Artin groups) into mapping class groups.

JASON MANNING, University at Buffalo
Recognizing 3-manifold groups

Given a finite presentation, one can ask whether it presents the fundamental group of a closed 3-manifold group. This question is undecidable in general, but I'll talk about how to solve the problem in "well-behaved" classes of presentations.

This is joint work with Daniel Groves and Henry Wilton.

JEREMY MCDONALD, Stevens Institute of Technology
Algorithmic problems for groups discriminated by a locally quasi-convex hyperbolic group

A group H is discriminated by a group G if for every finite subset X of H there is a homomorphism from H to G that is injective on X. These groups play an important role in the theory of equations over G and are precisely the groups that satisfy the same existential sentences as G. We consider the case when G is hyperbolic and every finitely generated subgroup of G is quasi-convex. We prove that there are algorithms to embed H into extensions of centralizers of G and to construct presentations for finitely generated subgroups of H.

This is joint work with O. Kharlampovich and I. Bumagin.

BOGDAN NICA, Georg-August Universität Göttingen
Proper isometric actions of hyperbolic groups on L^p-spaces

I will discuss the following result: every non-elementary hyperbolic group G admits a proper isometric action on $L^p(\partial G \times \partial G)$ for large enough p.

TIM RILEY, Cornell
Cannon-Thurston maps, hyperbolic hydra, and subgroup distortion

For a hyperbolic subgroup of a hyperbolic group, a Cannon-Thurston map is a map between their boundaries that is induced by subgroup inclusion. I will explore how distortion leads to wildness in the behaviour of these maps. This is joint work with Owen Baker.

DALE ROLFSEN, UBC
Topology and ordering groups

Group theory and topology are old companions, but recently the special (but still very large) class of groups which have invariant orderings has made unexpected contributions to topology. There are applications in the other direction as well. This talk will discuss those interactions, including some new results and conjectures.

DMYTRO SAVCHUK, University of South Florida
Self-similar groups acting essentially freely on the boundary of a rooted tree

We give a complete classification of self-similar groups generated by 3-state automata over 2-letter alphabet that act essentially freely on the boundary of the binary tree. In my talk, I will give a motivation for our study and concentrate on 2 most interesting new examples that has not been studied before. One of these groups is isomorphic to an extension of the rank 2 lamplighter group by the group of order 2. This group rather surprisingly has a subgroup of infinite index, whose closure has index 2 in the

closure of the whole group. The other group is a metabelian group whose commutator subgroup is isomorphic to an additive group $\mathbb{Z}[\frac{1}{3}]$ of all rational numbers whose denominators are powers of 3. We also describe presentations of these groups. This is a joint work with Rostislav Grigorchuk.

LIOR SILBERMANN, University of British Columbia
Fixed points for Lipschitz actions of random groups

I will first discuss the fixed-point property for actions of finite groups on metric spaces by Lipschitz maps, and then discuss the passage to infinite groups. Finally I will discuss an application to the fixed-point property for certain Lipschitz actions of random groups in Gromov's density model, extending the fixed-point property for isometric actions, for example on Hilbert space.

NICHOLAS TOUIKAN, Carleton University
On the isomorphism problem for relatively hyperbolic groups. (Joint with François Dahmani)

The isomorphism problem asks whether two group presentations $\langle X \mid R\rangle$, $\langle Y \mid S\rangle$ of finite length define isomorphic groups. It is well known that this problem is undecidable in general, but it is reasonable to ask whether this problem is decidable if the groups corresponding to $\langle X \mid R\rangle$, $\langle Y \mid S\rangle$ are known to belong to a given class of groups.

A sequence of results due to Sela, Bumagin-Kharlampovich-Miasnikov, Dahmani-Groves, Dahmani-Guirardel culminate to the decidability of the isomorphism problem in the classes of hyperbolic groups and of toral relatively hyperbolic groups.

After briefly giving the general approach to the solution of the isomorphism problem in the class of relatively hyperbolic groups, I will present my joint result with François Dahmani which gives algorithmic and algebraic criteria on a class $\mathcal{C}$ of groups which enables us to solve the isomorphism problem for torsion free relatively hyperbolic with parabolics lying in $\mathcal{C}$. As an application we can now solve the isomorphism problem in the class of relatively hyperbolic groups with nilpotent parabolics.

SVETLA VASSILEVA, McGill University
The Magnus embedding is a quasi-isometry

We show that the Magnus embedding, which embeds the free solvable group $S_{d,r}$ of rank r and degree d into the wreath product $\mathbb{Z}^r \wr S_{d-1,r}$, is a quasi-isometric embedding.

ROBERT YOUNG, University of Toronto
Lipschitz spheres in the Heisenberg groups

Lipschitz maps from n-balls to the $(2n-1)$-dimensional Heisenberg group $\mathbb{H}^n$ (with a sub-Riemannian metric) are abundant, but Lipschitz maps from higher-dimensional balls are rare. That is, any Lipschitz $(n-1)$-sphere can be filled by a Lipschitz n-ball, but most n-spheres can't be filled by $(n+1)$-balls. What about higher dimensions? In this talk, we'll describe the Lipschitz homotopy groups of the Heisenberg group and construct fractals in $\mathbb{H}^n$ that fill some higher-dimensional spheres. Joint work with Stefan Wenger.