Geometric Group Theory
Théorie géométrique des groupes
(Org: **Inna Bumagin** (Carleton), **Denis Serbin** (McGill) and/et **Benjamin Steinberg** (Carleton))

MONTSERRAT CASALS-RUIZ, McGill University, 805 Sherbrooke St. West, Montreal, Quebec, H3A 2K6
On systems of equations over free partially commutative groups

Using an analogue of Makanin–Razborov diagrams, we give an effective description of the solution set of systems of equations over a partially commutative group (right-angled Artin group) G. Equivalently, we give a parametrisation of $\mathrm{Hom}(H, G)$, where H is a finitely generated group.

SEAN CLEARY, The City University of New York
Random subgroups of Thompson's group F

There are a number of possible notions of constructing k-generator subgroups "at random" from a fixed group G. Given such a process, we can try to understand properties that a random subgroup has. For random subgroups of Thompson's group F, a number of interesting phenomena occur which are not present in other known examples. For example, there are positive densities of many isomorphism classes of k-generator subgroups, rather than there just being one isomorphism class of density 1. I will also describe a persistence phenomenon seen in Thompson's group, where some isomorphism classes of subgroups are present with positive density in the space of k-generator subgroups for all k larger than some K, with respect to one of the natural processes for constructing subgroups at random.

This is joint work with Murray Elder, Andrew Rechnitzer and Jennifer Taback.

TULLIA DYMARZ, Yale University
Large scale geometry of certain solvable Lie groups

In their proof of quasi-isometric rigidity for lattices in SOL, Eskin–Fisher–Whyte develop a technique of "coarse differentiation" to prove a theorem on the structure of quasi-isometries of SOL. This structure theorem combined with a theorem on bilipshitz maps of the real line completes the proof of quasi-isometric rigidity for lattices in SOL. Eskin–Fisher–Whyte and Peng use similar techniques to extend this structure theorem to quasi-isometries of more general solvable Lie groups. We will present the ingredients needed to complete the proof of quasi-isometric rigidity for these more general solvable Lie groups. This involves, among other things, a rigidity theorem on the boundaries of certain negatively curved homogeneous spaces.

BOB GILMAN, Stevens Institute of Technology
Randomized Word Problems

The word problem for finitely presented groups was posed in 1911 by Max Dehn. Recent results in complexity theory and cryptography have drawn attention to randomized versions of the word problem as well as to corresponding versions of the conjugacy and isomorphism problems. We survey these developments and discuss current progress.

SUSAN HERMILLER, University of Nebraska, Lincoln, Nebraska 68588-0130, USA
The shortest language spoken by a group

Let $\mathrm{Geo}(G, X)$ be the set of all words over a generating set X of a group G that label geodesic paths in the corresponding Cayley graph for G. For many classes of groups, including word hyperbolic groups, Coxeter groups, and Garside groups, it

is known that there are finite generating sets X for which $\mathrm{Geo}(G, X)$ is regular. In this talk I will discuss geometric and combinatorial properties of finitely generated groups for which $\mathrm{Geo}(G, X)$ satisfies stronger language-theoretic conditions, in particular lying in the classes of star-free, locally excluding, and locally testable languages.

ILYA KAZACHKOV, McGill University
Elementary equivalence of right-angled Coxeter groups and graph products of finite abelian groups

We show that graph products of finite abelian groups are elementarily equivalent if and only if they are $\exists\forall$-equivalent if and only if they are isomorphic. In particular, two right-angled Coxeter groups are elementarily equivalent if and only if they are isomorphic.

OLGA KHARLAMPOVICH, McGill University, Dept Math., 805 Sherbrooke St. W, Montreal, QC, H3A 2K6
Non-orientable surface groups actions on R-trees

We discuss the dynamics of free action of a non-orientable surface group on an R-tree. This is related to linear involutions with flips.

JEREMY MACDONALD, McGill

EDUARDO MARTINEZ-PEDROZA, McMaster University
Separation of Quasiconvex Subgroups

Suppose that all hyperbolic groups are residually finite. Then in relatively hyperbolic groups with peripheral structures consisting of finitely generated nilpotent subgroups, quasiconvex subgroups are separable.

Joint work with J. Manning (SUNY Buffalo).

JOHN MEIER, Lafayette College
Geometric Realizations of Buildings

A building Φ is a combinatorial object that come with an "W-valued distance function", where W is a Coxeter group. I will 'remind' everyone of the definitions and of two standard ways to give buildings a geometric structure. One is due to Tits, which works very well for spherical and Euclidean buildings, and another is due to Davis, that has been important in geometric group theory. A third approach is something of a hybrid, and it has been used recently in the computation of the compactly supported cohomology of buildings.

This is joint work with Davis, Dymara, Januszkiewicz and Okun.

ALEXEI MYASNIKOV, McGill

ANDREI NIKOLAEV, McGill

ALEXANDRA PETTET, University of Michigan
Twisting out fully irreducible automorphisms

By a theorem of Thurston, in the subgroup of the mapping class group generated by Dehn twists around two curves which fill, every element not conjugate to a power of one of the twists is pseudo-Anosov. We prove an analogue of this theorem for the outer automorphism group of a free group.

This is joint work with Matt Clay.

AKBAR RHEMTULLA, Alberta

MAHMOOD SOHRABI, Carleton University, Ottawa, Canada
Elementary theory of f.g. nilpotent groups

In this talk I shall give a survey of results on elementary theory of f.g. nilpotent groups. Then my work on characterizing groups elementary equivalent to a free nilpotent group of finite rank will be discussed. I shall end the talk with a discussion of certain possible connections between elementary theory and coarse geometry of f.g. nilpotent groups.

NICKOLAS TOUIKAN, McGill University, 805 Sherbrooke Street West, Montreal, QC, H3A 2K6
The Solvability Problem for Quadratic equations over free groups is NP-complete

We prove that the problems of deciding whether a quadratic equation over a free group has a solution is NP-complete.

This is joint work with O. Kharlampovich, I. G. Lysenok and A. G. Myasnikov.

ALEXANDER USHAKOV, Stevens Institute of Technology
The Word and Geodesic Problems in Free Solvable Groups

We study the computational complexity of the Word Problem (WP) in free solvable groups $S_{r,d}$, where $r \geq 2$ is the rank and $d \geq 2$ is the solvability class of the group. It is known that the Magnus embedding of $S_{r,d}$ into matrices provides a polynomial time decision algorithm for WP in a fixed group $S_{r,d}$. Unfortunately, the degree of the polynomial grows together with d, so the uniform algorithm is not polynomial in d. In this paper we show that WP has time complexity $O(rn \log_2 n)$ in $S_{r,2}$, and $O(n^3 rd)$ in $S_{r,d}$ for $d \geq 3$. However, it turns out, that a seemingly close problem of computing the geodesic length of elements in $S_{r,2}$ is NP-complete.