Geometric group theory
Théorie géométrique des groupes
(Org: **Katherine Goldman**, **Jean Pierre Mutanguha** and/et **Piotr Przytycki** (McGill University))

COREY BREGMAN, Tufts University
Automorphisms of reducible 3-manifolds

The symmetries of a smooth compact orientable 3-manifold M are encoded by its diffeomorphism group and associated classifying space. By the Kneser-Milnor and Geometrization theorems, every such M decomposes first into irreducible factors and then into geometric pieces, in an essentially unique way. We will discuss how understand the diffeomorphism group of M in terms of these decompositions, with applications to characteristic classes of 3-manifold bundles and mapping class groups. Part of this is joint work with Rachael Boyd and Jan Steinebrunner, and part with Bena Tshishiku.

TAM CHEETHAM-WEST, Yale University

KATHERINE GOLDMAN, McGill University
Injective metrics and affine hyperplane arrangements

A complex affine hyperplane arrangement is a locally finite collection of affine hyperplanes (complex codimension-1 subspaces) in a finite dimensional complex affine space. Since these subspaces have complex codimension 1, the complement of their union is a connected manifold. It is a broad, longstanding problem with many connections to different areas of mathematics to determine the arrangements for which this manifold is aspherical (has contractible universal cover). A subset of this problem dating back to the 1970s, commonly attributed to Arnol'd, Brieskorn, Thom, and Pham, concerns arrangements arising from reflection groups in real affine space.

One approach that has seen success is to construct a cell complex which is homotopy equivalent to this complement and endow it with some kind of non-positive curvature. Along these lines, by showing that a specific cell complex (based on a construction of Falk) carries an injective metric, we show that a broad class of affine arrangements (including the infinite families of affine reflection arrangements, modulo a conjecture about D_n-type) have aspherical complement. In particular, this provides some of the first examples of infinite affine arrangements which have aspherical complement, but do not arise from reflection groups. This also provides many new natural examples of injective metric spaces. This is joint work with Jingyin Huang.

CARL KRISTOF-TESSIER, McGill University
Blowup Coxeter groups and their computational complexity

Discrete reflection groups form a rich class of examples in Geometric group theory. More generally, Coxeter groups have many properties of interest to geometric group theorists, such as non-positive curvature, cubulations and biautomaticity.

In this talk, we investigate a natural analogue of blowups in the theory of Coxeter groups, called *Blowup Coxeter groups*. We show that our favorite properties enjoyed by Coxeter groups are preserved by their blowups. Namely, we show that they are biautomatic. In essence, this means that their structure can be encoded via a regular language that is insensitive to small perturbations by right and left multiplication of the group.

For simplicity, the talk will mostly focus on the special case of the Coxeter group of type $\widetilde{A}_2$, whose Cayley graph is the tiling of the plane by hexagons. However, the presented results apply to all Coxeter groups and their blowups.

Joint work with Piotr Przytycki.

ALEKSANDR (SASHA) TRUFANOV, Université de Montréal
Weak order on groups generated by involutions

An involution system (W,S), that is a group W generated by a set of involutions S, is naturally endowed with a weak order arising from orienting its Cayley graph. If (W,S) is a Coxeter system, Björner showed that the weak order is a complete meet-semilattice. This fact has many important consequences for Coxeter systems and their related structures. In this talk, we discuss the following question: For which involution systems is the weak order a complete meet-semilattice? The class of involution systems that satisfies this condition is larger than the class of Coxeter systems (it contains, for instance, Cactus groups). In the case of an involution system with sign character, we provide a finite presentation by generators and relations and a classification in rank 3. If time allows, we will also discuss open problems (e.g. in relation to automatic structures, geometric representations, CAT(0) cell complexes, ...). Joint work with Christophe Hohlweg and Fabricio Dos Santos.

GENEVIEVE WALSH, Tufts University
3-pseudomanifolds

3-pseudomanifolds are 3-dimensional cell complexes which are similar to 3-manifolds. In a 3-manifold, each link of a vertex is a 2-sphere. However, in a 3-pseudomanifold, we allow links of vertices to be arbitrary closed orientable surfaces. This results in some very interesting phenomena, which we will discuss. This is joint work with Lorenzo Ruffoni.

ABDUL ZALLOUM, Queens University
Recognizing convergence actions yields several questions

An action of a group G on topological space M is said to be a convergence action if the induced action on the space of distinct triples of M is properly discontinuous. In joint work with Ding, we show that every convergence action of a group G on a perfect compactum (a compact metrizable space with no isolated points) is realized as the boundary action of a proper isometric action of G on a hyperbolic space X. This yields intriguing consequences and questions. Taking G to be trivial realizes every perfect compactum as a Gromov boundary. Applying the theorem to the one-point compactification of a Cayley graph gives every finitely generated group a proper action on a hyperbolic space with that boundary. Given a hyperbolic group G, every subgroup H of G acts as a convergence group on ∂G, and hence admits a proper isometric action on a hyperbolic space X_H with ∂G as its Gromov boundary. How do the spaces X_H compare as H varies, given that they all have the same boundary ∂G? A closed hyperbolic surface group admits convergence actions on S^2 with limit set a circle (quasi-Fuchsian) or the whole sphere (Cannon–Thurston). How do the resulting hyperbolic spaces compare?