Spring 2021

- **February 25**
  Speaker: **Christopher Perez** (Loyola University New Orleans)
  Title: **Towers and elementary embeddings in toral relatively hyperbolic groups** *Abstract:* In a remarkable series of papers, Zlil Sela classified the first-order theories of free groups and torsion-free hyperbolic groups using geometric structures he called towers. It was later proved by Chloé Perin that if H is an elementarily embedded subgroup (or elementary submodel) of a torsion-free hyperbolic group G, then G is a tower over H. We prove a generalization of Perin's result to toral relatively hyperbolic groups using JSJ and shortening techniques.

- **March 4**
  Speaker: **Kevin Schreve** (University of Chicago)
  Title: **Generalized Tits Conjecture for Artin groups** *Abstract:* In 2001, Crisp and Paris showed the squares of the standard generators of an Artin group generate an “obvious” right-angled Artin subgroup. This resolved an earlier conjecture of Tits. I will introduce a generalization of this conjecture, where we ask that a larger set of elements generates another “obvious” right-angled Artin subgroup. I will give evidence that this is a good generalization, explain what classes of Artin groups we can prove it for, and give some applications. All of it is joint work with Kasia Jankiewicz.

- **March 25**
  Speaker: **Alexander Margolis** (Vanderbilt University)
  Title: **Topological completions of quasi-actions and discretisable spaces** *Abstract:* A fundamental problem in geometric group theory is the study of quasi-actions. We introduce and investigate discretisable spaces: spaces for which every cobounded quasi-action can be quasi-conjugated to an isometric action on a locally finite graph. Work of Mosher-Sageev-Whyte shows that free groups are discretisable spaces, but the property holds much more generally. For instance, most hyperbolic groups are discretisable, as are most finitely presented groups of cohomological dimension two. Along the way, we introduce the concept of the topological completion of a quasi-action. This is a locally compact group, well-defined up to a compact normal subgroup, reflecting the geometry of the quasi-action. We give several applications of the tools we develop. For instance, we show that any finitely generated group quasi-isometric to a Z-by-hyperbolic group is also Z-by-hyperbolic.

- **April 1**
  Speaker: **Olakunle Abawonse** (Binghamton University)
  Title: **Gelfand and MacPherson's combinatorial formula for Pontrjagin classes, part I: the topology** *Abstract:* Let X be a simplicial manifold. A *smoothing* of X is a smooth manifold M together with a homeomorphism from X to M that is smooth on each closed simplex. Rohlin and \v{S}varc(1957) and Thom(1958) showed that all smoothings of X have the same rational Pontrjagin classes. This raised the hope for a combinatorial formula for these classes. In 1992 Gelfand and MacPheron announced such a formula and gave a very terse proof. This is the first of two talks. The second will be given by Laura Anderson in the Combinatorics Seminar (on 4/6). In these two talks we'll explain their proof. The first part of their proof is an alternative form of Chern-Weil theory, which will be the topic of Part 1.

- **April 15**
  Speaker: **Nate Fisher** (Tufts University)

Title: **Boundaries, random walks, and nilpotent groups** *Abstract:* In this talk, we will discuss boundaries and random walks in the Heisenberg group. We will discuss a class of sub-Finsler metrics on the Heisenberg group which arise as the asymptotic cones of word metrics on the integer Heisenberg group and describe new results on the boundaries of these polygonal sub-Finsler metrics. After that, we will explore experimental work to examine the asymptotic behavior of random walks in this group. Parts of this work are joint with Sebastiano Nicolussi Golo.

- **April 22**
  Speaker: **Emily Stark** (Wesleyan University)
  Title: **Action Rigidity for Graphs of Manifold Groups** *Abstract:* The relationship between the large-scale geometry of a group and its algebraic structure can be studied via three notions: a group's quasi-isometry class, a group's abstract commensurability class, and geometric actions on proper geodesic metric spaces. A common model geometry for groups G and G' is a proper geodesic metric space on which G and G' act geometrically. A group G is action rigid if every group G' that has a common model geometry with G is abstractly commensurable to G. For example, a closed hyperbolic n-manifold group is not action rigid for all n at least three. In contrast, we prove certain graphs of manifold groups are action rigid. Consequently, we obtain examples of quasi-isometric groups that do not virtually have a common model geometry. This is joint work with Alex Margolis, Sam Shepherd, and Daniel Woodhouse.

- **April 29**
  Speaker: **Uylsses Alvarez** (Binghamton University)
  Title: **Order complexes and tropical phased matroids** *Abstract:* A topological poset is a Hausdorff space with a partial ordering such that the relation is closed in the product space. An interesting feature of topological posets is that they can be associated to a generalization of the order complex of discrete posets. In this talk, I will mainly focus on my favorite example of topological posets: the tropical phase hyperfield. More specifically I will give the homeomorphism type of the order complex of the covector set of a tropical phased matroid.

- **May 6**
  Speaker: **Wouter van Limbeek** (University of Illinois – Chicago)
  Title: **Do thin groups have discrete commensurators?** *Abstract:* Let G be a simple Lie group and \Gamma < G a lattice. In 1974, Margulis proved that if the commensurator of \Gamma is dense, then \Gamma is arithmetic. In 2015, Shalom asked if the same is true only assuming \Gamma is Zariski-dense in G. I will report on recent progress on this question for normal subgroups of lattices in rank 1 (e.g. hyperbolic space) using ideas from infinite ergodic theory, Brownian motion, random walks and harmonic maps. I will attempt to give a picture of how all these ideas combine to give information on commensurators. This is joint work with D. Fisher and M. Mj.

- **May 13**
  Speaker: **Achim Krause** (Muenster)
  Title: **Witt vectors with coefficients and characteristic polynomials over non-commutative rings** *Abstract:* Witt vectors are classically discussed as a means to canonically lift characteristic p objects to mixed characteristic. These “p-typical” Witt vectors also have an analogue that combines all primes at once, the “big Witt vectors”. These show up naturally in the study of refinements of topological Hochschild homology, as TR_0. Since the latter makes sense more generally for noncommutative rings, and even with coefficients in a bimodule, it is natural to ask for a similar generalisation of Witt vectors on the algebraic side. We describe these ``Witt vectors with coefficients'' algebraically, and show that they enjoy analogs of a lot of the usual structure of Witt vectors. We also see how in this perspective, the trace from cyclic K-theory can be interpreted as a kind of

noncommutative characteristic polynomial.