Fall 2020

- **September 10**
  Speaker: **Abdalrazzaq Zalloum** (Queen's University)
  Title: **Hyperbolic-like boundaries of non-hyperbolic spaces.** *Abstract:* While a quasi-isometry between two hyperbolic spaces X,Y induces a homeomorphism between their respective Gromov boundaries, the conclusion fails if X,Y are replaced by cocompact CAT(0) spaces. This has motivated a bulk of recent work introducing “hyperbolic-like” boundaries for CAT(0) spaces, and more generally, for proper geodesic metric spaces. For a proper geodesic metric space X, instead of considering the collection of all geodesic rays shooting to infinity, if you collect only those possessing some “hyperbolic-like” behavior, you obtain a boundary which is invariant under-quasi isometries. I will describe few such boundaries along with the way they relate to each other. Some of the results I will mention are joint with Incerti-Medici while others are joint with Qing and Murray.

- **September 17**
  Speaker: **Mark Pengitore** (OSU)
  Title: **Coarse embeddings and homological filling functions** *Abstract:* In this talk, we will relate homological filling functions and the existence of coarse embeddings. In particular, we will demonstrate that a coarse embedding of a group into a group of geometric dimension 2 induces an inequality on homological Dehn functions in dimension 2. As an application of this, we are able to show that if a finitely presented group coarsely embeds into a hyperbolic group of geometric dimension 2, then it is hyperbolic. Another application is a characterization of subgroups of groups with quadratic Dehn function. If there is enough time, we will talk about various higher dimensional generalizations of our main result.

- **September 24**
  Speaker: **Matt Haulmark** (Binghamton University)
  Title: **Introduction to relatively hyperbolic groups and Bowditch boundaries** *Abstract:* The notion of a group being hyperbolic relative to class of subgroups was introduced by Gromov to generalize word hyperbolic and geometrically finite Kleinian groups. Associated to a group with a relatively hyperbolic structure is a compact metric space called the Bowditch boundary. The topology of this boundary can provide information about the group. In this talk, we will introduce relatively hyperbolicity for finitely generated groups. We will also discuss the Bowditch boundary and survey some results. The goal of this lecture is to prepare the audience for Ashani Dasgupta's talk the following week.

- **October 1**
  Speaker: **Ashani Dasgupta** (UW-Milwaukee)
  Title: **Local connectedness of Bowditch Boundary** *Abstract:* Bowditch associated a topological space ∂G to Relatively Hyperbolic Group G. Topological information about ∂G is often useful to understand algebraic information about the group G. In this talk we will sketch a proof of the following theorem: if G is a finitely generated, relatively one-ended, relatively hyperbolic group then ∂G is locally connected. Earlier Bowditch proved the local connectedness of ∂G with a more restricted hypothesis. We will sketch the proof of the general result.

- **October 8**
  Speaker: **Kathryn Mann** (Cornell University)
  Title: **Reconstructing maps out of groups** *Abstract:* This talk is about the relationship between the algebraic structure of a discrete group and the possible dynamics of its actions. I'll explain a result with Maxime Wolff where we show that, under some circumstances, one can completely reconstruct a homeomorphism of a space out of algebraic (group structure) data. As a consequence of this, we gave an independent short proof of a recent

theorem of Kim and Koberda: you can distinguish the group of C^r diffeomorphisms of a 1-manifold from the group of C^s diffeomorphisms just by knowing their finitely generated subgroups.

- **October 15**
  Speaker: **Daniel Studenmund** (Binghamton University)
  Title: **Vanishing in top-dimensional cohomology of $GL_n(\mathcal{O})$** *Abstract:* In this talk, we will address one instance of the general question: Given a group G, what is the cohomology of G with rational coefficients? A celebrated result of Borel and Serre implies that $G = GL_n(\mathcal{O})$ has finite virtual cohomological dimension (vcd) when $\mathcal{O}$ is the ring of integers of a number field K. This implies that cohomology with rational coefficients vanishes in dimensions greater than the vcd, but leaves open the question of whether cohomology vanishes in the vcd. After surveying some results in the area, I will discuss joint work with Andy Putman which computes cohomology of $GL_n(\mathcal{O})$ in the vcd for certain $\mathcal{O}$, and how there is a surprisingly subtle dependence on the number ring $\mathcal{O}$.

- **October 22**
  Speaker: **Francisco Arana Herrera** (Stanford University)
  Title: **Counting hyperbolic multi-geodesics with respect to the lengths of individual components.** *Abstract:* In her thesis, Mirzakhani showed that on any closed hyperbolic surface of genus g, the number of simple closed geodesics of length at most L is asymptotic to a polynomial in L of degree $6g-6$. Wolpert conjectured that analogous results should hold for more general countings of multi-geodesics that keep track of the lengths of individual components. In this talk we will present a proof of this conjecture which combines techniques and results of Mirzakhani with ideas introduced by Margulis in his thesis.

- **October 29**
  Speaker: **Rylee Lyman** (Rutgers)
  Title: **Nielsen realization for infinite-type surfaces** *Abstract:* We learn the classification of surfaces early in our mathematical careers: the homeomorphism type of an orientable surface with finitely generated fundamental group is determined by genus, punctures and boundary components. Without the finite generation assumption, there is still a classification, due to Kerékjártó and Richards. These surfaces are of infinite type. Associated to any surface is its mapping class group. A famous theorem of Kerckhoff from 1983 solves the “Nielsen realization” problem posed in 1932: finite subgroups of the mapping class group of a finite-type surface of negative Euler characteristic are exactly the groups of isometries of some hyperbolic metric on the surface. Recently, joint with Santana Afton, Danny Calegari and Lvzhou Chen, I extended Kerckhoff's theorem to orientable, infinite-type surfaces. I'd like to introduce infinite-type surfaces and discuss the theorem and some of its consequences.

- **November 5**
  Speaker: **Ignat Soroko** (LSU)
  Title: **Groups of type FP: their quasi-isometry classes and homological Dehn functions** *Abstract:* There are only countably many isomorphism classes of finitely presented groups, i.e. groups of type F_2. Considering a homological analog of finite presentability, we get the class of groups FP_2. Ian Leary proved that there are uncountably many isomorphism classes of groups of type FP_2 (and even of finer class FP). R.Kropholler, Leary and I proved that there are uncountably many classes of groups of type FP even up to quasi-isometries. Since `almost all' of these groups are infinitely presented, the usual Dehn function makes no sense for them, but the homological Dehn function is well-defined. In an on-going project with N.Brady, R.Kropholler and myself, we show that for any integer $k\ge4$ there exist uncountably many quasi-isometry classes of groups of type FP with a homological Dehn function n^k. In this talk I will give the relevant definitions and describe the construction of these groups. Time permitting, I will describe the connection of these groups to the Relation Gap Problem.

- **November 19**
  Speaker: **Bena Tshishiku** (Brown University)
  Title: **Arithmeticity of free-abelian by cyclic groups** *Abstract:* We discuss arithmeticity of groups $G(A) = \mathbb{Z}^n \rtimes \mathbb{Z}$, where $\mathbb{Z}$ acts on $\mathbb{Z}^n$ by powers of an irreducible, hyperbolic matrix $A \in GL(n,\mathbb{Z})$. The question of when $G(A)$ is arithmetic was studied systematically by Grunewald-Platonov, but there are basic things that we still don't know. For example, for what values of n is there an arithmetic example? We discuss some progress toward answering this question.

- **December 3**
  Speaker: **Hakan Doga** (SUNY Buffalo)
  Title: **A Combinatorial Description of the Knot Concordance Invariant Epsilon** *Abstract:* The knot concordance group is one of the central objects in the study of topological knot types and low-dimensional topology. Concordance invariants obtained from knot Floer homology have resulted in some important classification results. In this talk, I will describe a new method to compute the concordance invariant epsilon using combinatorial knot Floer homology and show the computations for torus knots and positive braids. This is a joint work with S. Dey.

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