Spring 2023

- **January 19th**
  Speaker: **Marco Varisco** (SUNY Albany)
  Title: **Universal Spaces for Proper Actions, Vietoris–Rips Complexes, and Equivariant Discrete Morse Theory** *Abstract:* I will talk about a joint article with Matt Zaremsky (now at Albany and formerly a postdoc at Binghamton, like me). Our main result is that all asymptotically CAT(0) groups have finite universal spaces for proper actions, given by Vietoris–Rips complexes. My goal is to introduce all these concepts and explain why we care about them. The technique we develop to prove this result is an equivariant version of Bestvina–Brady discrete Morse theory, which we believe to be of independent interest. https://doi.org/10.1112/blms.12534

- **January 26th**
  Speaker: **Bastiaan Cnossen** (U Bonn) Zoom talk
  Title: **Traces and categorification** *Abstract:* The trace of a linear operator is simple to define, yet appears all over mathematics in many disguises: from characters of representations, through fixed-point formulas, to various geometric transfer maps. The theory of oo-categories and higher algebra allows one to organize many of these occurrences of the trace within a formal unified calculus. This calculus is more intricate and elaborate than one might expect, because some of its fundamental features are revealed only by *categorification*, leading to investigations of traces in $(\infty,2)$-categories. In this talk, I will describe joint work with Shachar Carmeli, Maxime Ramzi and Lior Yanovski that sets up a general “character theory” for studying, among other things, the interaction of traces with colimits by an “induced character formula” (generalizing and refining work of Ponto-Shulman). The interaction between traces and categorification plays a key role in our approach. I will also explain how this theory can be applied to the study of the Becker-Gottlieb transfer and of topological Hochschild homology of Thom spectra.

- **February 2nd**
  No seminar this week

- **February 9th**
  Speaker: **Carissa Slone** (Rochester)
  Title: **Two-slices over cyclic groups of prime power order** *Abstract:* The slice filtration focuses on producing certain spectra, called slices, from a genuine G-spectrum X over a finite group G. We have a complete characterization of all 1-, 0-, and (-1)-slices for any such G, and a characterization for 2-slices over C_2 and Klein-4. We will characterize 2-slices over C_p (p odd) and expand this characterization to C_{p^n}.

- **February 16th**
  Speaker: **Patricia Cahn** (Smith College)
  Title: **Trisected 4-Manifolds as Branched Covers of the 4-Sphere** *Abstract:* Trisections of 4-manifolds, introduced by Gay and Kirby as a 4-dimensional analog of Heegaard splittings in dimension 3, are a powerful mechanism for importing techniques from 3-dimensional topology into dimension 4. A branched cover of the 4-sphere, equipped with its standard trisection, along a (possibly singular) surface in bridge position, gives rise to a trisected 4-manifold. A natural question is which trisected 4-manifolds arise this way, and for those that do, what can be said about the degree of the cover or complexity of the branching set. We discuss this problem for the case of geometrically simply-

connected 4-manifolds, joint with Blair, Kjuchukova and Meier. If time permits, we will discuss algorithms for computing invariants of the trisected covering manifold in terms of the corresponding permutation representation of the group of the branching set, joint with Alishahi, Matic, Pinzón-Caicedo, and Ruppik.

- **February 23rd**
  Speaker: **Didac Martinez-Granado** (UC-Davis)
  Title: **Two notions of duality for geodesic currents** *Abstract:* Geodesic currents are a suitable closure of the space of curves on a hyperbolic surface introduced by Bonahon in 1986. Notions such as the geometric intersection number of curves extend to geodesic currents. I will discuss two equivalent viewpoints on geodesic currents: as dual curve functionals and as dual spaces. On the one hand, a geodesic current induces a functional on the space of curves on the surface via intersection number with the current. We say that such a curve functional is ``dual to the current". In joint work with Dylan Thurston, we give sufficient and necessary conditions for curve functionals to be dual to geodesic currents. On the other hand, a geodesic current together with a choice of hyperbolic metric induces a Gromov hyperbolic space, that we call a ``dual space of the current". In joint work with Luca De Rosa, we describe the metric structure of such spaces.

- **March 2nd**
  No seminar this week

- **March 9th**
  Speaker: **Daniel Gulbrandsen** (University of Wisonsin Milwaukee)
  Title: **Cubical Collapses and a New Compactification of Locally-Finite CAT(0) Cube Complexes**
  Abstract: In this talk we will define what it means for a cube complex to be collapsible. In particular, our definition will apply to the case that the complex is not finite. Then, we will show that all locally-finite CAT(0) cube complexes are collapsible. The process will yield an inverse sequence of finite convex subcomplexes whose inverse limit provides a Z-compactification of the complex in which the boundary (which we call the cubical boundary) incorporates properties of both the visual and Roller boundaries.

- **March 16th**
  No seminar this week

- **March 23rd**
  Speaker: **Thomas Koberda** (U Virginia)
  Title: **The first order theory of homeomorphism groups of compact manifolds** *Abstract:* I will describe some recent work on the first order theory of homeomorphism groups of manifolds. I will discuss a new result which shows that the homeomorphism groups of two compact manifolds are elementarily equivalent if and only if the two manifolds are homeomorphic, which resolves an old conjecture of Rubin. I will then describe some of the expressive power of the language of groups in the theory of homeomorphism groups, with implications for the subgroup structure of homeomorphism groups, and for the descriptive set theory of these groups.

- **March 30th**
  Speaker: **Justin Barhite** (U Kentucky)
  Title: **Traces and Cotraces in Bicategories** *Abstract:* Traces arise in many different places in math: traces of matrices, characters of group representations, and even the Euler characteristic of a CW complex! There are very general notions of trace, expressed in the language of category theory, that capture these examples of traces and whose properties imply familiar results like the Lefschetz fixed point theorem and the induction formula for characters. The formalism of traces doesn't tell the whole

story though; there are some constructions that feel trace-like in certain ways but also have a distinct flavor, and what's really needed to explain them from this category-theoretic perspective is a dual notion of “cotrace.” I will talk about some of these things that I have been working to understand by developing a theory of bicategorical cotraces.

- **April 6th**
  No seminar this week (spring break)

- **April 13th**
  Speaker: **Maru Sarazola** (Johns Hopkins)
  Title: **Fibrant transfer for model structures** *Abstract:* Model structures are robust categorical structures that provide an abstract framework to do homotopy theory. Unfortunately, in practice it is often very hard to prove that something satisfies the requirements of a model structure. To this end, there are several results in the literature that explore techniques for constructing model structures on a given category. Of particular note is the Transfer theorem, allowing the user to transfer a model structure along an adjunction. After a review of model structures, this talk will present a new generalization of the transfer theorem where the relevant homotopical structure is only transferred between fibrant objects. Time permitting, we will explore some applications. Based on recent work with Leonard Guetta, Lyne Moser and Paula Verdugo.

- **April 20th**
  Speaker: **Benjamin Thompson** (Cornell)
  Title: **Khovanov homology of rational tangles** *Abstract:* Links are fundamental objects of study in low-dimensional topology, and are generalized by tangles. One of the most well-studied link invariants, the Jones polynomial, was generalized by Khovanov to a homology theory in the late 90s, before being extended to tangles in 2004 by Bar-Natan. Working with tangles instead of links in Khovanov homology can greatly simplify calculations and more easily shed light on the underlying properties of the theory. In this talk we examine a subclass of tangles known as rational tangles, and show that their Bar-Natan homology can be computed with a string replacement algorithm. This essentially makes computing Khovanov homology for rational knots trivial, and provides an elementary explanation of the resulting homological phenomena.

- **April 27th**
  Speaker: **Sahana Balasubramanya** (SUNY Buffalo)
  Title: **Actions of solvable groups on hyperbolic spaces** *Abstract:* (joint work with A.Rasmussen and C.Abbott) Recent papers of Balasubramanya and Abbott-Rasmussen have classified the hyperbolic actions of several families of classically studied solvable groups. A key tool for these investigations is the machinery of confining subsets of Caprace-Cornulier-Monod-Tessera. This machinery applies in particular to solvable groups with virtually cyclic abelianizations.

- **May 4th**
  Speaker: **Alexander Kupers** (U Toronto)
  Title: **Pontryagin classes of Euclidean space bundles** *Abstract:* Tangent bundles of smooth manifolds are vector bundles, and tangent bundles of topological manifolds are Euclidean space bundles. Characteristic classes of vector bundles, like the Pontryagin classes, also make sense to Euclidean space bundles, but surprisingly behave very differently. I will explain recent joint work with Manuel Krannich on this topic, with a focus on the relationship to diffeomorphism groups of discs.