Fall 2025

- **August 28th**
  Speaker: **Cary Malkiewich (Binghamton)**
  Title: **Higher scissors congruence** *Abstract:* Scissors congruence is the study of polytopes, up to the relation of cutting into finitely many pieces and rearranging the pieces. In the 2010s, Zakharevich defined a “higher” version of scissors congruence, where we don't just ask whether two polytopes are scissors congruent, but also how many scissors congruences there are from one polytope to another. Zakharevich's definition is a form of algebraic K-theory, which is famously difficult to compute, but I describe some recent work that makes these calculations possible, at least for low-dimensional geometries. This allows us to compute the homology of the group of cut-and-paste operations in new cases, including the group of interval exchange transformations, and a new proof of Szymik and Wahl's theorem that Thompson's group V is acyclic. Much of this talk is based on joint work with Anna-Marie Bohmann, Teena Gerhardt, Mona Merling, and Inna Zakharevich, and also with Alexander Kupers, Ezekiel Lemann, Jeremy Miller, and Robin Sroka.

- **September 4th**
  Speaker: **Liz Tatum (Rochester)**
  Title: **Some applications of equivariant Brown-Gitler spectra** *Abstract:* In the 1980s, Mahowald and Kane used integral Brown-Gitler spectra to construct splittings of the cooperations algebras for ko, connective real k-theory, and ku, connective complex k-theory. These splittings helped make it feasible to do computations using the ko- and ku-based Adams spectral sequences. These spectral sequences have proven to be powerful tools for better understanding the structure of the stable homotopy groups of the sphere, with a variety of interesting applications. For example, Mahowald used them to verify the Telescope Conjecture at height one, and Gonzalez later used them to classify stunted lens spaces. In this talk, I will discuss progress towards developing analogues of these tools in the C_2 equivariant setting. In particular, Guchuan Li, Sarah Petersen, and I have constructed models for C_2-equivariant analogues of the integral Brown-Gitler spectra, and used them to construct an analogue of the ku-splitting.

- **September 18th**
  Speaker: **Lorenzo Ruffoni (Binghamton)**
  Title: **A Pontryagin sphere at infinity in real hyperbolic space** *Abstract:* Given a discrete group of isometries of hyperbolic space, we can look at its limit set, i.e., the set of accumulation points of its orbits on the sphere at infinity. This is a compact metric space embedded in the sphere at infinity, and it often displays interesting geometric and topological features that can reveal algebraic information about the group itself. In this talk, first we will discuss the general theory and present classical examples of limit sets, including some simple fractals (Cantor set, Sierpinski carpet). Then, we will present the construction of groups whose limit set is a Pontryagin sphere. These groups are obtained as reflection groups, and the construction is based on the existence of certain right-angled hyperbolic polyhedra. This is joint work with S. Douba, G.-S. Lee, and L. Marquis.

- **October 9th**
  Speaker: **Liam Keenan (Brown)**
  Title: **On products of skeleta** *Abstract:* Given simplicial complexes, X and Y, a classical result of Eilenberg and Zilber tells us that the complex of integral chains on the product, X x Y, is quasi-isomorphic to the tensor product of complexes associated to X and Y. Their result relies on the basic

observation that the product of an n-simplex with an m-simplex, can be built by gluing together simplices of dimension (n+m). Remarkably, this basic observation has much farther reaching-consequences than one might expect. In joint work with Maximilien Peroux, we showed that whenever you have two objects, X and Y, built up out of simplicies, the skeletal filtrations of X and Y can always be related to the skeletal filtration of X x Y, in an entirely canonical fashion. I will introduce this circle of ideas, explain my work with Peroux, and discuss its relation with the Dold-Kan correspondence.

- **October 14th (Tuesday 1:30-2:30pm – cross-listed from the Combinatorics Seminar)**
  Speaker: **Lee Kennard (Syracuse)**
  Title: **Regular Matroids and Torus Representations** *Abstract:* Recent work with Michael Wiemeler and Burkhard Wilking presents a link between arbitrary finite graphs and torus representations all of whose isotropy groups are connected. The link is via combinatorial objects called regular matroids, which were classified in 1980 by Paul Seymour. We then apply Seymour's deep result to classify and to compute geometric invariants of this class of torus representations. The applications to geometry are significant. A highlight of our analysis of these representations is the first proof of Hopf's 1930s Euler Characteristic Positivity Conjecture for metrics invariant under a torus action where the torus rank is independent of the manifold dimension.

- **October 16th**
  Speaker: **John Abou-Rached (Binghamton)**
  Title: **Integral models for non-Shimura curves and the Eichler-Shimura congruence relation**
  Abstract: We construct integral models for an infinite family of algebraic curves that includes noncongruence modular curves, as well as curves whose uniformizers are non-arithmetic Fuchsian groups. Most of these curves are not Shimura curves. We affirm a conjecture of Mukamel that the set of primes of good reduction of such curves have arithmetic significance and obtain an explicit description of this set. We conjecture that a version of Deligne-Rapoport's study of the reduction of modular curves holds in this context, and conjecture that a version of the Eichler-Shimura congruence relation holds in this setting, in resonance with Shimura curves.

- **October 23th**
  Speaker:
  Title: *Abstract:*

- **October 30th**
  Speaker: **Tam Cheetham-West (Yale)**
  Title: **Splittings and finite quotients of 3-manifold groups** *Abstract:* Embedded essential surfaces in a 3-manifold correspond to non-trivial splittings of its fundamental group. We give some conditions on the fundamental group of a Haken hyperbolic 3-manifold which guarantee that any other 3-manifold group with the same finite quotients must have a non-trivial splitting. Using one of these conditions, we obtain restrictions on the possible first Betti numbers of regular covers of aspherical integer homology spheres. This is joint work with Khánh Lê.

- **November 6th**
  Speaker: **Genevieve Walsh (Tufts)**
  Title: **Hyperbolic groups vs relatively hyperbolic groups** *Abstract:* A hyperbolic group is a group that acts geometrically on a hyperbolic metric space, and a relatively hyperbolic group is a group that acts geometrically finitely on a hyperbolic metric space. Sometimes, these spaces are quasi-isometric. This turns out to be exceedingly rare. We will discuss the consequences of such quasi-isometries, and give lots of examples of these types of group actions. This is joint work with Emily Stark.

- **November 13th**
  Speaker: **Maximilien Peroux (Michigan State University)**
  Title: **Algebraic characterization of cobordism theories** *Abstract:* Cobordism theories are fundamental invariants in geometry and topology: they organize closed manifolds according to whether or not they bound. They play a central role in classification problems and have deep connections to index theory, characteristic classes, and even modern mathematical physics. Each variant of cobordism is represented in stable homotopy theory by a Thom spectrum, linking geometric questions with homotopical constructions. Recognizing which spectra arise as Thom spectra is a subtle problem, since it amounts to detecting when an abstract homotopy-theoretic object has a geometric origin in cobordism. In ongoing joint work with Brazelton, Calle, Chan, and Keenan, we introduce an algebraic characterization of Thom spectra as certain algebraic objects in stable homotopy theory. This approach provides a new algebraic perspective on geometric phenomena.

- **November 20th**
  Speaker: **David Chan (Michigan State University)**
  Title: **Building equivariant infinite loop spaces** *Abstract:* Infinite loop spaces are important kinds of topological spaces which can be used to construct cohomology theories. For a finite group G, there is an equivariant refinement of infinite loop spaces which represent cohomology theories for G-spaces. Infinite loop G-spaces play an important role in recent applications of equivariant homotopy theory, but constructing examples can be difficult. In this talk we will describe some results about how to construct every possible infinite loop G-space from algebraic input.

- **November 27th**
  No seminar

- **December 4th**
  Speaker: **Hongbin Sun (Rutgers)**
  Title: **On virtual chirality of 3-manifolds** *Abstract:* We prove that if a prime 3-manifold M is not finitely covered by the 3-sphere or a product manifold, then M is virtually chiral, i.e. it has a finite cover that does not admit an orientation-reversing self-homeomorphism. For a non-prime 3-manifold, it is virtually chiral if it has a virtually chiral prime summand. This is joint work with Zhongzi Wang.