Fall 2023

- **August 31st**
  No seminar this week
- **September 7th**
  No seminar this week (cancellation)
- **September 14th**
  Speaker: **John Rached** (Binghamton)
  Title: **Quantitative behavior of horocycle flow on the moduli space of genus 2 surfaces**
  Abstract: The action of SL(2,R) on moduli space exhibits measure rigidity, analogously to Ratner's theorems for unipotent flows on homogeneous spaces, due to the seminal work of Eskin-Mirzakhani. Similar results cannot hold for the horocycle flow on moduli space, but for special subvarieties of strata (eigenform loci), some key tools from homogeneous dynamics have an incarnation in this inhomogeneous setting. A version of Ratner's theorem holds for eigenform loci, and a flurry of recent work on quantitative results for actions on homogeneous spaces begs a natural question - can one effectivize arguments for the horocycle flow on eigenform loci? We give some support for a positive answer to this question, and make some conjectures.
- **September 21st**
  No seminar this week (cancellation)
- **September 28th**
  Speaker: **Maxine Calle** (University of Pennsylvania)
  Title: **Nested cobordisms and TQFTs** *Abstract:* The folk theorem identifying 2-dimensional TFQTs with Frobenius algebras is a starting point for a lot of interesting mathematics, from mathematical physics to homotopy theory to higher category theory. In this talk, we will explore what happens if we replace the cobordism category with a category of nested cobordisms, where 2-dimensional surfaces may have embedded 1-dimensional submanifolds, and what kind of algebraic structure the corresponding nested TQFTs pick out. This is based on ongoing work joint with R. Hoekzema, L. Murray, N. Pacheco-Tallaj, C. Rovi, and S. Sridhar.
- **October 5th**
  Speaker: **Cary Malkiewich** (Binghamton)
  Title: **Higher scissors congruence** *Abstract:* Hilbert's Third Problem asks for sufficient conditions that determine when two polyhedra in three-dimensional Euclidean space are scissors congruent. Classically, the attempts to solve this problem (in this and other geometries) lead into group homology and algebraic K-theory, in a somewhat ad-hoc way. In the last decade, Zakharevich has shown that the presence of K-theory here is not ad-hoc, but is integral to the definition of scissors congruence itself. This leads to a natural notion of higher scissors congruence groups, in which the 0th group is the classical one that determines the answer to Hilbert's Third Problem. In this talk, I'll describe a surprising recent result that these higher groups arise from a Thom spectrum. Its base space is the homotopy orbit space of a Tits complex, and the vector bundle is the negative tangent bundle of the underlying geometry. Using this result, we can explicitly compute the higher scissors congruence groups for the one-dimensional geometries, and give exact sequences that express them for the two-dimensional geometries. Much of this is joint work with Anna-Marie Bohmann, Teena Gerhardt, Mona Merling, and Inna Zakharevich.

- **October 12th**
  Speaker: **Jenya Sapir** (Binghamton)
  Title: **Geometry of geodesic currents** *Abstract:* The space of projective, filling currents PFC(S) contains many structures relating to a closed, genus g surface S. For example, it contains the set of all closed curves on S, as well as an embedded copy of Teichmuller space, and many other spaces of metrics on S. We will discuss a structure theorem that compares each filling current with a suitably chosen point in Teichmuller space. We will then use this structure theorem to explore the geometry of PFC(S) under an extension of the Thurston metric.

- **October 19th**
  No seminar this week (Fall break)

- **October 26th**
  Speaker: **Brenda Johnson** (Union College)
  Title: **What is (functor) calculus?** *Abstract:* Goodwillie's calculus of homotopy functors is an important topological tool that has been used to shed light on and make connections between fundamental structures in homotopy theory and K-theory. It has also inspired the creation of new types of functor calculi to tackle problems in algebra and topology. In this talk, I will begin by describing Goodwillie's calculus and some of these other types of functor calculi. I will then address more general questions about what the essential features of something called "functor calculus" should be and the types of conditions and ingredients that are sufficient for creating new functor calculi.

- **November 2nd**
  Speaker: **Paul Apisa** (University of Wisconsin)
  Title: **Hurwitz Spaces, Hecke Actions, and Orbit Closures in Moduli Space** *Abstract:* The moduli space of Riemann surfaces is a space whose points correspond to the ways to endow a surface with a hyperbolic metric or, equivalently, complex structure. Geodesic flow on moduli space can be used to generate an action of GL(2, R) on its cotangent bundle. While work of Eskin, Mirzakhani, Mohammadi, and Filip implies that GL(2, R) orbit closures are varieties, the question of which ones occur is wide open. Aside from two well-understood constructions (taking loci of branched covers and subloci of rank two orbit closures) there are only 3 known families of orbit closures: the Bouw-Moller curves, the Eskin-McMullen-Mukamel-Wright (EMMW) examples, and 2 sporadic examples. Building on ideas of Delecroix-Rueth-Wright, I will describe work showing that the Bouw-Moller and EMMW examples can be constructed using just the representation theory of finite groups. The main idea is to connect these examples to Hurwitz spaces of G-regular covers of the sphere for an appropriate finite group G. In the end, I will describe a construction that inputs a finite group G and a set of generators satisfying a combinatorial condition and outputs a GL(2, R) orbit closure in moduli space.

- **November 9th**
  No seminar this week

- **November 16th**
  Speaker: **Andres Mejia** (University of Pennsylvania)
  Title: **A Genuine Linearization Map for Equivariant Algebraic K-theory** *Abstract:* The Algebraic K-theory of a smooth manifold is a receptacle for many sensitive invariants. The driving example is the classical fact that the H-cobordism type of a manifold is completely controlled by only the fundamental group of its Algebraic K-Theory space. In fact, there is a reduction to a related invariant that only depends on the fundamental group of the manifold M. Turning to higher invariants, we are not so lucky, but there is still a comparison map called the linearization map that lets us compute parts of the

Algebraic K-theory space in good situations. This talk will discuss a new construction of the linearization map when we are presented with a manifold together with the action of a finite group. If time permits, we will also discuss future directions with a view towards equivariant stable cobordism. These results are joint with D. Chan and M. Calle.

- **November 23rd**
  No seminar this week (Thanksgiving)

- **November 30th**
  No seminar this week

- **December 7th**
  Speaker: **Collin Bleak** (University of St Andrews) (virtual talk)
  Title: **On the maximal subgroups of R. Thompson's group V.** *Abstract:* The maximal subgroups of various groups have been a focus of study since the highly influential O'Nan–Scott Theorem of 1979, which classified the maximal subgroups of the finite symmetric groups. Motivated by our perspective on R. Thompson's group V as a natural generalisation of the finite symmetric and alternating groups to an infinite context, we have been exploring the maximal subgroup structure of V, working to move beyond the previously known maximal subgroups: the automorphic images of T and the set-wise stabilisers of finite sets of points in Cantor space (all with the same tail class). We introduce the concept of a type system P, that is, a partition on the set of finite words over the alphabet {0,1} compatible with the partial action of Thompson's group V, and associate a subgroup Stab_V(P) of V. We classify the finite simple type systems and show that the stabilizers of various simple type systems, including all finite simple type systems, are maximal subgroups of V. A byproduct of our approach is that we can specify an uncountable family of pairwise non-isomorphic maximal subgroups of V. Joint with Jim Belk, Martyn Quick, and Rachel Skipper.