Fall 2022

- **August 25th**
  Speaker: **Cary Malkiewich** (Binghamton)
  Title: **A Farrell-Jones isomorphism for scissors congruence K-theory** *Abstract:* Scissors congruence K-theory is an algebraic object that captures solutions to variants of Hilbert's Third Problem, in other words, when one polytope can be cut into pieces and rearranged to form another. In this talk I will describe a new trace map from scissors congruence K-theory to group homology. It turns out that a refinement of this map provides an inverse to the assembly map, proving the Farrell-Jones isomorphism for this form of K-theory. This allows us to make the first computations of scissors congruence K-theory groups above K_1. Much of this is joint work with Mona Merling and Inna Zakharevich.

- **September 1st**
  Speaker: **Matt Haulmark** (Binghamton)
  Title: **Cube Complexes and Stuff** *Abstract:* Much of this talk will be introductory. Some of the topics covered will be CAT(0) cube complexes, wallspaces, and the CAT(0) cube complex dual to a wallspace. Then I will briefly discuss work in progress with Jason Manning.

- **September 8th**
  Speaker: **William Menasco** (University at Buffalo)
  Title: **Surface Embeddings in $\mathbb{R}^2 \times \mathbb{R}$** *Abstract:* In this joint work with Margaret Nichols, we consider $\mathbb{R}^3$ as having the product structure $\mathbb{R}^2 \times \mathbb{R}$ and let $\pi : \mathbb{R}^2 \times \mathbb{R} \rightarrow \mathbb{R}^2$ be the natural projection map onto the Euclidean plane. Let $ \epsilon : S_g \rightarrow \mathbb{R}^2 \times \mathbb{R}$ be a smooth embedding of a closed oriented genus g surface such that the set of critical points for the map $\pi \circ \epsilon$ is a piece-wise smooth (possibly multi-component) 1-manifold, $\mathcal{C} \subset S_g$. We say $\mathcal{C}$ is the {\em crease set of ϵ} and two embeddings are in the same {\em isotopy class} if there exists an isotopy between them that has $\mathcal{C}$ being an invariant set. The case where $\pi \circ \epsilon |_\mathcal{C}$ restricts to an immersion is readily accessible, since the turning number function of a smooth curve in $\mathbb{R}^2$ supplies us with a natural map of components of $\mathcal{C}$ into $\mathbb{Z}$. The Gauss-Bonnet Theorem beautifully governs the behavior of $\pi \circ \epsilon (\mathcal{C})$, as it implies $\chi(S_g) = 2 \sum_{\gamma \in \mathcal{C}} t(\pi \circ \epsilon (\gamma))$, where t is the turning number function. Focusing on when $S_g \cong S^2$, we give a necessary and sufficient condition for when a disjoint collection of curves $\mathcal{C} \subset S^2$ can be realized as the crease set of an embedding $\epsilon: S^2 \rightarrow \mathbb{R}^2 \times \mathbb{R}$.

- **September 15th**
  Speaker: **Gage Martin** (MIT) Zoom talk
  Title: **Annular links, double branched covers, and annular Khovanov homology** *Abstract:* Given a link in the thickened annulus, you can construct an associated link in a closed 3-manifold through a double branched cover construction. In this talk we will see that perspective on annular links can be applied to show annular Khovanov homology detects certain braid closures. Unfortunately, this perspective does not capture all information about annular links. We will see a shortcoming of this perspective inspired by the wrapping conjecture of Hoste-Przytycki. This is partially joint work with Fraser Binns.

- **September 22nd**
  Speaker: **Alexandra Kjuchukova** (Notre Dame) Zoom talk

Title: **Coxeter groups and bridge numbers of links** *Abstract:* The 1970s meridional rank conjecture of Cappell and Shaneson posits equality between two invariants of links in S^3, the bridge number and meridional rank. I will define these invariants and outline the history of the conjecture. Then, I will describe an approach which relies on finding Coxeter quotients of the fundamental groups of link complements. I will use this approach to establish the conjecture for certain infinite families of links, as well as to derive explicit formulas for the bridge numbers for the links in question. Based on joint works with Blair, Baader, Misev.

- **September 29th**
  Speaker: **J Williams** (Binghamton)
  Title: **Nullhomotopic crown maps** *Abstract:* I'll present a straightforward way to convert any crown map (which is a special kind of map from a 4-manifold to the 2-sphere) into a nullhomotopic crown map, while keeping track of the combinatorial data of the original map. The construction will also bring salient sets into the very active world of trisections and multisections.

- **October 6th**
  Speaker: **Gary Guth** (University of Oregon) Zoom talk
  Title: **Satellites, Stabilizations, and Exotic Surfaces** *Abstract:* A long standing question in the study of exotic behavior in dimension four is whether exotic behavior is "stable". For example, in thinking about the four-dimensional h-coboridism theorem, Wall proved that simply connected, exotic four-manifolds always become smoothly equivalent after applying a suitable stabilization operation enough times. Similarly, Hosokawa-Kawauchi and Baykur-Sunukjian showed that exotic surfaces become smoothly equivalent after stabilizing the surfaces some number of times. The question remains, "how many stabilizations are necessary, and is one always enough?" By considering certain satellite operations, we provide an answer to this question in the case of exotic surfaces with boundary.

- **October 13th**
  Speaker: **Rhiannon Griffiths** (Cornell)
  Title: **Slices of higher categories** *Abstract:* Fully weak higher categories are often the most useful for applications to areas such as algebraic topology and homotopy theory, but become too complex for practical use in dimensions greater than 2. A solution is to find a notion of semi-strict higher category: higher categories which are just weak enough to be equivalent to the fully weak variety, while still being tractable enough to work with directly. In this talk I will show how it is possible to take 'slices' of higher categories. Roughly speaking, the k-th slice is the symmetric operad corresponding to the algebra formed by the k-cells of a higher category. I will explain the ways in which these slices can give us a way to recognise when some notion of higher category is equivalent to the fully weak variety, and discuss some examples and potential applications.

- **October 20th**
  Fall Break

- **October 27th**
  Speaker: **Prayagdeep Parija** (UW-Milwaukee) Zoom talk
  Title: **Random quotients of hyperbolic groups and Property (T)** *Abstract:* What does a random quotient of a group look like? Gromov introduced the density model of quotients of free groups. The density parameter d measures the rate of exponential growth of the number of relators compared to the size of the Cayley ball. Using this model, he proved that for d<1/2 a random quotient of a free group is non-elementary hyperbolic. Ollivier extended Gromov's result to show that for d<1/2 a random quotient of even a non-elementary hyperbolic group is non-elementary hyperbolic. Żuk/Kotowski-Kotowski proved that for d>1/3 a typical quotient of a free group has Property (T). We show that for 1/3<d<1/2 (in a closely related density model) a random quotient of a non-

elementary hyperbolic group is non-elementary hyperbolic and has Property-(T). This provides an answer to a question of Gromov (and Ollivier)

- **November 3rd**
  Speaker: **Thomas Brazelton** (Penn)
  Title: **Equivariant enumerative geometry** *Abstract:* Classical enumerative geometry asks geometric questions of the form “how many?” and expects an integral answer. For example, how many circles can we draw tangent to a given three? How many lines lie on a cubic surface? The fact that these answers are well-defined integers, independent upon the initial parameters of the problem, is Schubert’s principle of conservation of number. In this talk we will outline a program of “equivariant enumerative geometry”, which wields equivariant homotopy theory to explore enumerative questions in the presence of symmetry. Our main result is equivariant conservation of number, which states roughly that the sum of regular representations of the orbits of solutions to an equivariant enumerative problem are conserved.

- **November 10th**
  Speaker: **Meenakshy Jyothis** (Binghamton)
  Title: **Automorphisms of geodesic currents the preserves intersection form** *Abstract:* In this talk we will be looking at Ivanov's conjecture in the context of geodesic currents. The space of geodesic currents generalizes various objects of interest on a surface, such as the set of closed curves up to homotopy and the Teichmüller space. I will talk about a particular group of automorphisms of this space and will compare it to the mapping class group. Invanov's conjectured that every object naturally associated to a surface and having a `sufficiently rich' structure has mapping class group as its groups of automorphisms. It is already known that the conjecture holds true for various combinatorial objects associated with a surface as well as for the Teichmüller space of a surface.

- **November 17th**
  No seminar this week

- **November 24th**
  Thanksgiving Break

- **December 1st**
  Speaker: **Nobukata Asano** (National Institute of Technology, Tsuyama College) Zoom talk
  Title: **Some lower bounds for the Kirby-Thompson invariant of 4-manifolds** *Abstract:* A trisection is a decomposition of a closed 4-manifold X into a 3-tuple of 4-dimensional 1-handlebodies, which was introduced by Gay and Kirby. Kirby and Thompson defined an invariant of X by using trisections. This invariant is called the Kirby-Thompson invariant. In this talk, we give some lower bounds for the Kirby-Thompson invariant of certain 4-manifolds. As an application, we find the first example of a 4-manifold whose Kirby-Thompson invariant is non-zero. This is a joint work with Hironobu Naoe (Chuo University) and Masaki Ogawa (Saitama University).

- **December 8th**
  Speaker: **Lea Kenigsberg** (Columbia)
  Title: **Coproduct structures, a tale of two outputs** *Abstract:* I will tell the elusive story of coproduct structures in Floer theory and string topology, and explain why we care about them. I will then define a new coproduct structure on the symplectic cohomology of Liouville manifolds. Time permitting, I will indicate how to compute it in an example to show that this structure is not trivial. This will be an accessible talk; I will not assume knowledge of Floer theory or string topology. This is based on my thesis work, in progress.