2024 Bloomington Geometry Workshop

Yair Minsky
Title: Horospherical dynamics and stretch maps
Abstract: (Joint work with James Farre and Or Landesberg) Horospherical flow is an important phenomenon in dynamics. It can be very rigid: since the work of Hedlund in the 30's it is known, for example, that horocycles in closed hyperbolic surfaces are always dense and equidistributed. In infinite-volume manifolds there is much more flexibility. The case of Z-covers of a closed hyperbolic manifold M has a particularly nice blend of flexibility and rigidity. There is an interesting connection between closures of horospherical orbits and optimal 1-Lipschitz maps from M to a circle. Such maps achieve their maximal stretch on a geodesic lamination, and the dynamics and geometry of this lamination influences the behavior of the orbit closures.

Jake Rasmussen
Title: Knot Floer homology, satellites, and curves
Abstract: It's a well known fact that the Alexander polynomial of a satellite knot can be expressed in terms of the Alexander polynomials of the pattern and companion. I'll use a geometric interpretation of bordered Floer homology (originating in earlier work with Hanselman and Watson) to address the question of when similar formulas exist for knot Floer homology, which categorifies the Alexander polynomial.

Malavika Mukundan
Title: On the holomorphic realization of branched covering maps
Abstract: William Thurston's theory of postcritically finite branched self-covers of the 2-sphere is an important breakthrough in modern complex dynamics. It explores the relationship between the topological properties of a branched cover, its dynamics, and the existence of a holomorphic 'model map' for the said branched cover. In this talk, we introduce this theory, and lay out progress in the last two decades to extend it to branched self-covers of the plane. We will focus on the applications of this theory to complex dynamics and its connections with more general questions of geometry such as the type problem.

Ben McReynolds
Title: Nilpotent quotients and homology
Abstract: In this talk, I will discuss a generalization of a theorem of Stallings on universal nilpotent quotients. The main application of this result is a construction for producing non-isomorphic groups with the same universal nilpotent quotients. Applications will be given for fundamental groups of hyperbolic n-manifolds and Galois groups of number fields. This is based on recent joint work with Milana Golich.

Samantha Fairchild
Title: The Mutetrahedron
Abstract: The mutetrahedron is a triply periodic surface whose quotient by a lattice in 3-space gives a compact half-translation surface admitting many symmetries. The talk will start with a friendly introduction to the muterahedron and one of its friends called the mucube. We will then highlight some explicit computations focused on understanding the behavior of geodesics on the Mutetrahedron. This is based on an ongoing project with Dami Lee and Sunrose Shresthra.

Boris Kalinin
Title: Non-stationary normal forms on contracting foliations and applications to rigidity.
Abstract: Let f be a diffeomorphism of a compact manifold M which contracts an invariant foliation W with smooth leaves. Various assumptions on the differential of f on TW ensure existence of coordinates $H_x : W(x) \to T_xW$ with respect to which the restrictions of f to $W(x)$ are linear or polynomial maps in a finite-dimensional Lie group G, and the leaves have a structure of a homogeneous space of G. We will discuss this theory and its applications to rigidity. As an example, we show that any Holder conjugacy between an ergodic irreducible partially hyperbolic toral automorphism and its symplectic perturbation must be smooth.

Marissa Loving
Title: Volumes of end-periodic mapping tori
Abstract: In this talk, I will introduce the notion of end-periodic homeomorphisms of infinite-type surfaces. My goal will be to illustrate the ways these homeomorphisms mimic the behavior of pseudo-Anosov homeomorphisms of finite-type surfaces by displaying interesting geometric, dynamical, and topological behavior. As part of this discussion, I will describe some joint work with Elizabeth Field, Autumn Kent, Heejoung Kim, and Chris Leininger (in various configurations) on the volumes of end-periodic mapping tori.

Aaron Calderon
Title: On Mirzakhani's twist torus conjecture
Abstract: Every hyperbolic surface (hence every Riemann surface or smooth algebraic curve over $\mathbb{C}$) can be described by the lengths and twist of the curves of a pants decomposition. Fixing lengths and taking arbitrary twists creates an immersed torus inside the moduli space of curves, which turns out to be related to the unipotent-like "earthquake flow." Mirzakhani asked if these twist tori equidistribute as lengths are taken to infinity: in this talk, I will explain joint work with James Farre in which we analyze these limiting distributions. The key tool is a bridge that allows for the transfer of ergodic-theoretic results between flat and hyperbolic geometry.

Yair Minsky
Title: Classifying horocyclic orbit closures in Z-covers
Abstract: (Joint work with James Farre and Or Landesberg) Continuing the story from the first lecture, we give a complete description of horocycle orbit closures in the case of Z-covers of a closed hyperbolic surface. In particular we were surprised to find that all proper orbit closures are fractal in some sense, and yet have integer Hausdorff dimension.