The 2023 Midwest Dynamics Conference - UIC

Titles and Abstracts

1. Aaron Calderon (U Chicago)

Title: A tale of two flows: unipotent-like dynamics on moduli space

The moduli space Mg of Riemann surfaces has many different incarnations, each of which equips it with different geometric structures. Thinking about Mg as the space of complex structures gives rise to the well-studied (Teichmüller) horocycle flow and the field of Teichmüller dynamics, while thinking about it as the space of hyperbolic metrics yields the much more mysterious earthquake flow. In this talk, I'll discuss to what extent these flows are "the same" and how this connection can be used to transfer results between flat to hyperbolic geometry. No prior experience with Teichmüller theory will be assumed. This represents joint work (some of which is in progress) with James Farre.

2. Jacopo De Simoi (Toronto)

Title: Billiards with uncountable length spectrum are dense

Abstract: Given a billiard table, we can record the lengths of all periodic orbits in a set called the "Length spectrum"; we can then ask how much of the Geometry of the domain is encoded in the Length Spectrum. This question is tightly related to the analogous (quantum) question for the Spectrum of the Laplace operator, that is known as "Can one hear the shape of a drum?".

It is known that a marking of the length spectrum (i.e. knowing "which" orbit corresponds to "which" length) allows to gather lots of dynamical and geometrical information (in some cases the whole geometry of the domain).

In this talk we try to understand to which extent can such results be obtained without a marking. Does the length spectrum have any structure that can be used to recover a marking? The task seems to be quite intricate: we will construct (a dense set of) smooth convex billiard domains with a very degenerate (uncountable) Length Spectrum.

3. Meg Doucette (U Chicago)

Title: Smooth Models for certain Fibered Partially Hyperbolic Systems

Abstract: We prove that under certain restrictions on the fiber, any fibered partially hyperbolic system over a nilmanifold is leaf conjugate to a smooth model that is isometric on the fibers and descends to a hyperbolic nilmanifold endomorphism on the base.

4. Adi Glücksam (Northwestern)

Title: Multi-fractal spectrum of planar harmonic measure

Abstract: In this talk, I will define various notions of the multi-fractal spectrum of harmonic measures and discuss finer features of the relationship between them and properties of the corresponding conformal maps. Furthermore, I will describe the role of multifractal formalism and dynamics in the universal counterparts.

5. John Johnson Jr. (Ohio State)

Title: Khintchine recurrence and affine cubes for sets with relative density

Abstract: The Khintchine's recurrence theorem is a classical quantitative and qualitative improvement of Poincaré recurrence theorem for probability measure preserving actions. As in known from the Ergodic Ramsey Theory folklore, an analogous recurrence theorem also holds for sets with positive upper Banach density (a "notion of size"), and this result implies sets with positive upper Banach density contains affine cubes—a ubiquitous combinatorial structure found among a large class of objects studied in Ramsey theory.

I'll introduce a 'relative' notion of density that generalizes upper Banach density and relate it to several previously considered relative notions of size. In this 'relative' context, I'll prove that an analog of the Khintchine recurrence theorem also holds, and, further as a combinatorial application, show that sets with relative density also contains affine cubes.

(Based on joint work with Florian K. Richter.)

6. Sarah Koch (Michigan)

Title: Dynamical data: from algebra to topology

Abstract: We explore which dynamical data arise for postcritically finite rational maps.

7. Kathryn Mann (Cornell)

Title: Anosov flows on 3-manifolds

Abstract: Anosov flows are a fascinating class of dynamical systems, generalizing and including geodesic flows on manifolds of negative curvature. These systems exhibit "local chaos but global stability" - individual orbits diverge wildly, but the systems as a whole are stable under perturbation. This stability means there is some hope to classify them by discrete algebraic invariants. Even on 3-dimensional spaces, this is an interesting and challenging problem. In this talk, I will describe some of the history and motivation for classification (dating back to work of Anosov and Smale in the 60s), connections with low-dimensional geometric topology, and will describe recent joint work with Barthelmé, Bowden, Frankel and Fenley (in various combinations) giving answering one thread of the classification problem in dimension 3.

8. Yankl (Jacob) Mazor (Stony Brook)

Title: Combining rational maps and Kleinian reflection groups

Abstract: Combination and mating questions often arise in complex dynamics, especially in the fields of rational maps and Kleinian groups. In the 1990s S. Bullett and C. Penrose constructed the first matings of objects from these two settings, namely between some quadratic

polynomials and the modular group $PSL_2(\mathbb{Z})$. Recently Bullett and Lomonaco showed that in fact every quadratic polynomial can be mated with the modular group in this way. I will explain what the matings are, and discuss an alternative approach showing that all parabolic anti-rational maps (of arbitrary degree) can be mated with reflection groups arising from ideal hyperbolic polygons. Time permitting I will also talk about questions arising in some one-parameter families of these matings. Based on joint work with Mikhail Lyubich and Sabyasachi Mukherjee.

9. Alex Wright (Michigan)

Title: Spheres in the curve graph and linear connectivity of the Gromov boundary

Abstract: For a vertex c and an integer radius r, the sphere $S_r(c)$ is the induced graph on the set of vertices of distance r from c. We will show that spheres in the curve graph are typically connected, and discuss connectivity properties of the Gromov boundary. We will also explain the motivation and context for this work, touching on Cannon's conjecture and convex cocompactness.