Midwest Dynamical Systems, Spring 2025

Northwestern University, April 25-27

Titles and abstracts

Prasuna Bandi (University of Michigan)

Title: Ergodic Theorem for sub manifold actions of $\mathbb{R}^d$ and application to Diophantine approximation

Abstract: Consider a measure preserving action of $\mathbb{R}^d$ on a probability space (X, μ). Let M be a compact $k-$ dimensional C^1 submanifold of $\mathbb{R}^d$ where $1 \leq k \leq d-1$. Under certain assumptions on the action, we prove an effective pointwise ergodic theorem that holds for smooth functions for the action of M on (X, μ). We use this result to prove a partial analogue of Khintchine's 0 – 1 law in uniform multiplicative Diophantine approximation. This is a joint work with Reynold Fregoli and Dmitry Kleinbock.

Jairo Bochi (Pennsylvania State University)

Title: Angles between Oseledets spaces

Abstract: This talk is based on joint work with Pablo Lessa. We provide an example of a probability distribution on the group GL(2,R) with finite first moment such that the corresponding random product of i.i.d. matrices has two distinct Lyapunov exponents, but the angle between the Oseledets directions is not log-integrable. We prove that, on the other hand, if the second moment is finite, then this angle, if defined, is log-integrable. Next, we turn our attention to general GL(2,R)-cocycles over ergodic automorphisms, and ask ourselves if there is any criterion for log-integrability of the angle between the Oseledets directions in terms of a suitable integrability condition. The answer is negative. In fact, we show the following flexibility result: given any ergodic automorphism T of a non-atomic Lebesgue probability space, we can find a GL(2,R)-cocycle over T whose Lyapunov exponents and joint distribution of Oseledets spaces are prescribed a priori, and meeting any prescribed integrability condition.

Beibei Liu (Ohio State University)

Title: Uniform spectral gap and ortho-geodesic counting for Kleinian groups

Abstract: Strongly convergent sequences of hyperbolic manifolds arise naturally in the study of Kleinian group representations, for example, the Dehn surgeries on hyperbolic knots. It turns out that such sequences usually have uniform control on the geometry and dynamics, such as the uniform convergence of small eigenvalues of the Laplacian, and the Patterson-Sullivan measures. We will talk about the uniform convergence results in this talk and apply them to count uniformly along the sequence the number of simple closed geodesics and ortho-geodesics. This is joint work with Franco Vargas Pallete.

Gabriel Paternain (University of Washington)

Title: Geometric inverse problems and hyperbolic dynamics

Abstract: I will discuss recent developments at the intersection of
these two fields, with a focus on shared concepts and insights that bridge both areas.

Jennifer Jones-Baro (Northwestern University)

Title: The stabilized automorphism group of minimal systems

Abstract: The stabilized automorphism group of a dynamical system (X,T) is the group of all self-homeomorphisms of X that commute with some power of T. While this is an algebraic object, we show that it captures rich dynamical information. We begin by characterizing the stabilized automorphism groups of odometers and Toeplitz subshifts, establishing an invariance property in these settings. We then extend our results to a broader class of minimal systems, proving that if two such systems have isomorphic stabilized automorphism groups and each has a non-trivial rational eigenvalue, then they must share the same set of rational eigenvalues. We further identify a class of systems for which the assumption of having a non-trivial rational eigenvalue can be removed. Finally, we generalize a known result for mixing shifts of finite type to include all irreducible shifts of finite type.

Giulio Tiozzo (University of Toronto)

Title: The Poisson-Furstenberg boundary of hyperbolic groups without moment conditions

Abstract: The Poisson(-Furstenberg) boundary is a measure-theoretic object attached to a group equipped with a probability measure, and is closely related to the notion of harmonic function on the group. In many cases, the group is also endowed with a topological boundary arising from its geometric structure, and a recurring research theme is to identify the Poisson boundary with the topological boundary.

In this talk, we prove that the Poisson boundary of a random walk with finite entropy on a non-elementary hyperbolic group can be identified with its hyperbolic boundary, without assuming any moment condition on the measure. In this generality, this identification result is new even for free groups. We will also discuss extensions of this result to other groups with hyperbolic properties, as well as discrete subgroups of Lie groups.

Joint with K. Chawla, B. Forghani, and J. Frisch.

Caglar Uyanik (University of Wisconsin)

Title: Cannon-Thurston maps, dynamics, and rigidity

Abstract: Cannon and Thurston showed that a hyperbolic 3-manifold that fibers over the circle gives rise to a sphere-filling curve. The universal cover of the fiber surface is quasi-isometric to the hyperbolic plane, whose boundary is a circle, and the universal cover of the 3-manifold is 3-dimensional hyperbolic space, whose boundary is the 2-sphere. Cannon and Thurston showed that the inclusion map between the universal covers extends to a continuous map between their boundaries, whose image is onto. In particular, any measure on the circle pushes forward to a measure on the 2-sphere using this map. We compare several natural measures coming from this construction. (Joint with Gadre, Maher, and Pfaff)

Wendy Wang (University of Chicago)

Title: Centralizer Rigidity on semisimple Lie group

Abstract: In this talk we discuss rigidity and classification of the smooth centralizer of a perturbation of an affine map on a homogeneous space. We mainly focus on the left multiplication of a diagonal matrix on SL_nR/Γ, where Γ is a cocompact lattice. We show that the smooth centralizer of a perturbation of a generic diagonal matrix is either a Lie group of dimension 0 or 1, or virtually R^{n-1}, and in the latter case, the perturbation is smoothly conjugate to a diagonal matrix acting by left multiplication. For some non-generic cases, we also obtain conjugacy to diagonal matrices if the centralizer is as large as the original one.

Max Weinreich (Harvard University)

Title: The pentagram zoo

Abstract: Schwartz's pentagram map is an algebraic dynamical system defined on moduli spaces of polygons by intersecting diagonals. It is an integrable system, meaning that in appropriate coordinates, the map becomes a family of translations on complex tori. Some natural generalizations of the pentagram map produce integrable systems, but numerical experiments by Khesin-Soloviev suggest that others do not. In this talk, we use tools from algebraic dynamics to prove that the skew pentagram map is non-integrable.

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