Midwest Dynamical Systems Meeting – Titles and Abstracts
University of Illinois at Chicago – November 1-3, 2019

Alena Erchenko, SUNY Stony Brook [2:30 PM Saturday November 2]

Flexibility of Lyapunov Exponents with Respect to Two Classes of Measures on the Torus

We consider a family of Anosov area-preserving diffeomorphisms on the two-torus that are homotopic to a fixed Anosov automorphism. There are several interesting classes of invariant measures. We will concentrate on the invariant measure that is absolutely continuous with respect to the Lebesgue measure and the measure of maximal entropy. We show that positive Lyapunov exponents with respect to these two probability measures in the considered family of diffeomorphisms take on all values that satisfy some well-known inequalities.

David Fisher, Indiana University [3:00 PM Friday November 1]

Arithmeticity, Superrigidity and Totally Geodesic Submanifolds

Totally geodesic submanifolds play an important role in the theory of hyperbolic manifolds. I will discuss a new rigidity theorem in this context: if a finite volume hyperbolic manifold M contains infinitely many closed totally geodesic hypersurfaces, then M is arithmetic. This answers a question asked by Reid and McMullen. I will explain why it is natural to think of arithmetic manifolds as rare or special in this context. I will also discuss a variant of the theorem for closed totally geodesic submanifolds of higher codimension and also an analogue where M is complex hyperbolic.

I hope to give some ideas of the proofs. The proof in the real hyperbolic case is a combination of homogeneous dynamics with a superrigidity theorem also proven by dynamical methods. The proof in the complex hyperbolic case is more complicated. In addition to using those tools, it draws on the theory of Higgs bundles and also on a theorem about incidence geometry proven by Pozzetti in her study of maximal representations. This is joint work with Bader, Miller and Stover.

Ilya Khaytin, Northwestern University [9:00 AM Saturday November 2]

Equidistribution of Orthogonal Grids

For a point $v \in \mathbb{Z}^3$ with $\langle v, v\rangle = D$ consider all the integer points in $\mathbb{Z}^3$ of inner-product 1 with v $\Lambda_v := \left\{x \in \mathbb{Z}^3 \mid \langle x, v\rangle = 1\right\}$. Then $\Lambda_v - \frac{v}{\sqrt{D}}$ is a lattice coset in the plane orthogonal to v and it defines a unique, up to rotation, lattice coset in $\mathbb{R}^2$. Aka, Einsiedler and Shapira have asked whether the set $\left\{\Lambda_v - \frac{v}{\sqrt{D}} \mid \langle v, v\rangle = D\right\}$ equidistributes, up to rotation, in the space of lattice cosets in the plane as $D \to \infty$. The latter space is homogeneous and can be identified with $\mathbf{ASL}_2(\mathbb{Z})\backslash\mathbf{ASL}_2(\mathbb{R})$. If true this conjecture will be a strengthening of Duke's theorem about equidistribution of CM points on the modular curve to the setting of the universal elliptic curve.

I will discuss why is this a conjecture about equidistribution of periodic orbits in a homogeneous dynamical system and will sketch a proof of the conjecture for a sequence of D's that satisfy a congruence condition at two primes. The argument is a fusion of measure rigidity for diagonal flows, a "relative trace" method to exclude intermediate measures and subconvexity for class group L-functions of quadratic fields.

Nicole Looper, Brown University [9:00 AM Sunday November 3]

Global Quantitative Equidistribution and the Arithmetic of Points of Small Canonical Height

I will discuss how certain number theoretic questions in polynomial dynamics can be approached using the quantitative equidistribution of preperiodic points within filled Julia sets. Of particular importance is the uniformity of this equidistribution across families of maps. This talk will set up the tools for describing the quantitative equidistribution, and then address its applications to the Uniform Boundedness Conjecture and the Dynamical Lang Conjecture.

Brandon Seward, University California, San Diego [11:30 AM Saturday November 2]

Borel asymptotic dimension and hyperfinite equivalence relations

A well known and long-standing open problem in the theory of Borel equivalence relations asks if the orbit equivalence relation generated by a Borel action of a countable amenable group is hyperfinite. Previous progress on this problem has been confined to groups possessing coarse euclidean geometry and polynomial volume growth (ultimately leading to a positive answer for groups that are either virtually nilpotent or locally nilpotent). In this talk I will discuss the coarse geometric notion of asymptotic dimension and discuss its applications to this problem. Relying upon the framework of asymptotic dimension, it is possible to both significantly simplify the proofs of prior results and uncover the first examples of solvable groups of exponential volume growth all of whose Borel actions generate hyperfinite equivalence relations. This is joint work with Clinton Conley, Steve Jackson, Andrew Marks, and Robin Tucker-Drob.

Ralf Spatzier, University of Michigan [4:30 PM Saturday November 2]

On Global Rigidity of Hyperbolic Higher rank Commuting Actions

I will discuss commuting abelian actions and their rigidity properties, emphasizing recent results with Kurt Vinhage classifying Cartan actions.

Kurt Vinhage, Pennsylvania State University [10:30 AM Sunday November 3]

New Progress on the Katok-Spatzier Conjecture

We will discuss recent progress on the Katok-Spatzier conjecture, which aims to classify Anosov actions of higher-rank abelian groups under the assumption that there are no nontrivial smooth rank one factors. We develop new techniques to build homogeneous structures from dynamical ones. The remarkable features of the techniques are their low regularity requirements and their use of metric geometry over differential geometry to build group actions. We apply these techniques to obtain a classification result in the totally Cartan setting, where bundles associated to the hyperbolic structure are one-dimensional. Time permitting, we will also comment on ongoing work to adapt these techniques to some settings when the bundles are multidimensional.

Khadim War, IUniversity of Chicago [10:15 AM Saturday November 2]

Margulis Estimates for Geodesic Flows on Surfaces Without Conjugate Points of Genus at Least Two

In this talk we first discuss the construction of the measure of maximal entropy for the geodesic flow on surfaces without conjugate points via Patterson-Sullivan measures. We then use the geometric properties of this construction to give an exact asymptotic growth rate of closed geodesics which is known as Margulis estimates in the case of negative curvature, i.e. we prove that the number of free homotopy classes of closed geodesics of length less than $T > 0$ is of order of $\exp(hT)/(hT)$ where h is the topological entropy of the system. This is based on a joint work with Vaughn Climenhaga and Gerhard Knieper.

Alex Wright, University of Michigan [11:300 AM Sunday November 3]

The Eierlegende-Wollmilchsau and the Classification of GL(2,R) Orbit Closures of Translation Surfaces

The Eierlegende-Wollmilchsau* square-tiled surface is a perpetual counterexample in the study of translation surfaces. I will present a new family of orbit closures with similar properties, including higher dimensional orbit closures that resolve two open problems. I will also present new results that classify a large swath of orbit closures, and explain some of the more concrete challenges that arise in the proofs. This is joint work in progress with Paul Apisa.

*German for egg-laying wool-milk-sow. Colloquially, an all-in-one device that can do the work of several specialized tools.