

Midwest Dynamical Systems Meeting: Oct 30th-Nov 1st 2015

Department of Mathematics, The Ohio State University

FRIDAY

Friday afternoon talks will take place in the **auditorium of the MBI** (Mathematical Bioscience Institute), 3rd floor of Jennings Hall, 1735 Neil Ave. Registration and Drinks Reception will take place in the Math Tower 7th floor lounge, 231 W. 18th Ave. It is a 10-15 minute walk between these two locations.

- 2:00 - 2:50pm Registration (7th Floor Lounge, Math Tower)
- 3:00 - 3:50pm **Conference Plenary Talk: Yakov Pesin (Penn State)**
“The essential coexistence phenomenon in dynamics”
- 3:50 - 4:20pm Break
- 4:20 - 5:10pm **Jon Chaika (University of Utah)**
“There exists a mixing C^∞ area preserving flow on a surface with all fixed points non-degenerate”
- 5:20 - 7:00pm Drinks Reception (7th Floor Lounge, Math Tower)

SATURDAY

All Saturday talks will take place in **EA0170** in the ‘Math Annex Building’, 209 W. 18th Ave., which is connected to the Math Tower. The poster session will take place in the 7th floor lounge of the Math Tower. The conference dinner will take place at the Drake Events Center.

- 9:00-9:50am **Jana Rodriguez Hertz (IMERL, Uruguay)**
“Center-unstable foliations do not have compact leaves”
- 10:00-10:30am Refreshments
- 10:40-11:30am **Anush Tserunyan (University of Illinois)**
“Differentiation of subsets of semigroups, a Ramsey theorem and a van der Corput lemma”

Session in honor of the 70th birthday of Carl Simon:

- 11:40-12:30pm **Don Saari (UC-Irvine)**
“Dynamics and the dark matter mystery”
- 12:30-2:00pm Lunch
- 2:00-2:50pm **Jeff Xia (Northwestern University)** Title TBA
- 3:00-4:20pm **Poster Session with Refreshments (7th Floor Lounge, Math Tower)**
- 4:30-5:20pm **Charles Pugh (UC-Berkeley)**
“Unbound Hyperbolicity”
- 5:45-6:30pm Drinks (Drake Events Center, River Den Room)
- 6:30- 9:00pm **Conference Dinner (Drake Events Center, River Den Room)**

SUNDAY

All Sunday talks will take place in **EA0170**.

- 9:00-9:50am **Keith Burns (Northwestern University)**
“Unique equilibrium states for geodesic flows in nonpositive curvature”
- 10:00-10:30am Refreshments
- 10:40-11:30am **Zhiren Wang (Penn State)**
“Mobius disjointness for analytic skew products”
- 11:40-12:30pm **Jim Yorke (University of Maryland)**
“Chaos and Quasiperiodicity”

Talk Titles and Abstracts (Chronological Order)

Yakov Pesin (Penn State)

The essential coexistence phenomenon in dynamics.

I will discuss two different types of essential coexistence of regular (zero Lyapunov exponents and hence, zero entropy) dynamics and chaotic (non-zero Lyapunov exponents) dynamics in the setting of smooth dynamical systems, both with discrete and continuous time. I will review some recent results in this direction, discuss some open problems and describe some new examples of coexistence. In particular, I will outline a construction of a volume preserving topologically transitive diffeomorphism of a compact smooth Riemannian manifold which is ergodic (indeed is Bernoulli) on an open and dense subset of not full measure and which has zero Lyapunov exponent on the complement of this set. I will also discuss a continuous-time version of this example. These constructions demonstrate a “complete” KAM-type picture in the volume preserving category (in both discrete and continuous-time).

Jon Chaika (University of Utah)

There exists a mixing C^∞ area preserving flow on a surface with all fixed points non-degenerate.

We construct a C^∞ area preserving flow on a surface with all fixed points non-degenerate which is mixing with respect to the volume on the surface. Kocergin showed that this impossible for the torus. C. Ulcigrai showed this was exceptional for any genus. This is joint work with A. Wright.

Jana Rodriguez Hertz (IMERL, Uruguay)

Center-unstable foliations do not have compact leaves.

For a partially hyperbolic diffeomorphism on a 3-manifold, we show that any invariant foliation tangent to the center-unstable bundle has no compact leaves.

Anush Tserunyan (University of Illinois)

Differentiation of subsets of semigroups, a Ramsey theorem and a van der Corput lemma

What often lies at the heart of multiple recurrence results is that for measure-preserving actions of semigroups, mixing along a suitable filter on the semigroup amplifies itself to multiple mixing along the same filter. This amplification is usually proved using a so-called van der Corput difference lemma. Instances of this lemma for specific filters have been proven before by Furstenberg, BergelsonMcCutcheon, and others, with a somewhat different proof in each case. We define a notion of differentiation for subsets of semigroups and isolate a class of filters that respect this notion. The filters in this class (call them ∂ -filters) include all those, for which the van der Corput lemma was known, and our main result is a van der Corput lemma for ∂ -filters, which thus generalizes its previous instances. This is done via proving a Ramsey theorem for graphs on the semigroup.

Don Saari (UC-Irvine)

Dynamics and the dark matter mystery

One of the more compelling contemporary mysteries in science is that expected, but still undiscovered, dark matter that supposedly makes up most of the mass of a galaxy. While this issue appears to be one strictly for astrophysicists, in fact it is an issue for mathematicians and dynamical systems. It will be shown why this is so and why, if huge amounts of dark matter are eventually discovered, how it will create a problem for Newtonian mechanics.

Jeff Xia (Northwestern University)

TBA

Charles Pugh (UC-Berkeley)

Unbound Hyperbolicity

I'll discuss some ideas about invariant manifolds for an endomorphism of a Banach space where the linear part is unbounded.

Keith Burns (Northwestern University)

Unique equilibrium states for geodesic flows in nonpositive curvature

The geodesic flow for a compact Riemannian surface with negative curvature has a unique equilibrium state for every Hölder continuous potential function. This is no longer true if the curvature of the surface is only nonpositive, but there is a still large class of potentials with unique equilibrium states. These include multiples of the geometric potential. This is joint work with Vaughn Climenhaga, Todd Fisher and Dan Thompson.

Zhiren Wang (Penn State)

Mobius disjointness for analytic skew products

Sarnak's Mobius disjointness conjecture states that the Mobius function is disjoint to every topological dynamical system of zero entropy. In this talk, we will explain why this is true for every analytic skew product map on the two torus over a rotation of the circle of arbitrary rotation number.

Jim Yorke (University of Maryland)

Chaos and Quasiperiodicity

Chaos and quasiperiodicity are the two kinds of recurrent nonlinear dynamics that one is likely to have in generic dynamical systems. As part of our numerical studies we found a rather surprising (rigorous) result. The Birkhoff Ergodic Theorem concludes that time averages, i.e., Birkhoff averages, $\sum_{n=0}^{N-1} f(x_n)/N$ of a function f along a length N ergodic trajectory (x_n) of a function T converge to the space average $\int f d\mu$, where μ is the unique invariant probability measure. Convergence of the time average to the space average is slow, like $1/N$ or slower. We introduce a modified average of $f(x_n)$ by giving very small weights to the "end" terms when n is near 0 or $N-1$. When (x_n) is a trajectory on a quasiperiodic torus and f and T are C^∞ , we show that our weighted Birkhoff averages converge "super" fast to $\int f d\mu$ with respect to the number of iterates N , i.e. with error $|\sum_{n=0}^{N-1} f(x_n)/N - \int f d\mu|$ decaying faster than N^{-m} as $N \rightarrow \infty$ for every $m > 0$. We show that our weighted Birkhoff average is a powerful computational tool for computing rotation numbers and conjugacies. This is joint work with work with Suddhasattwa Das, Yoshitaka Saiki and Evelyn Sander.