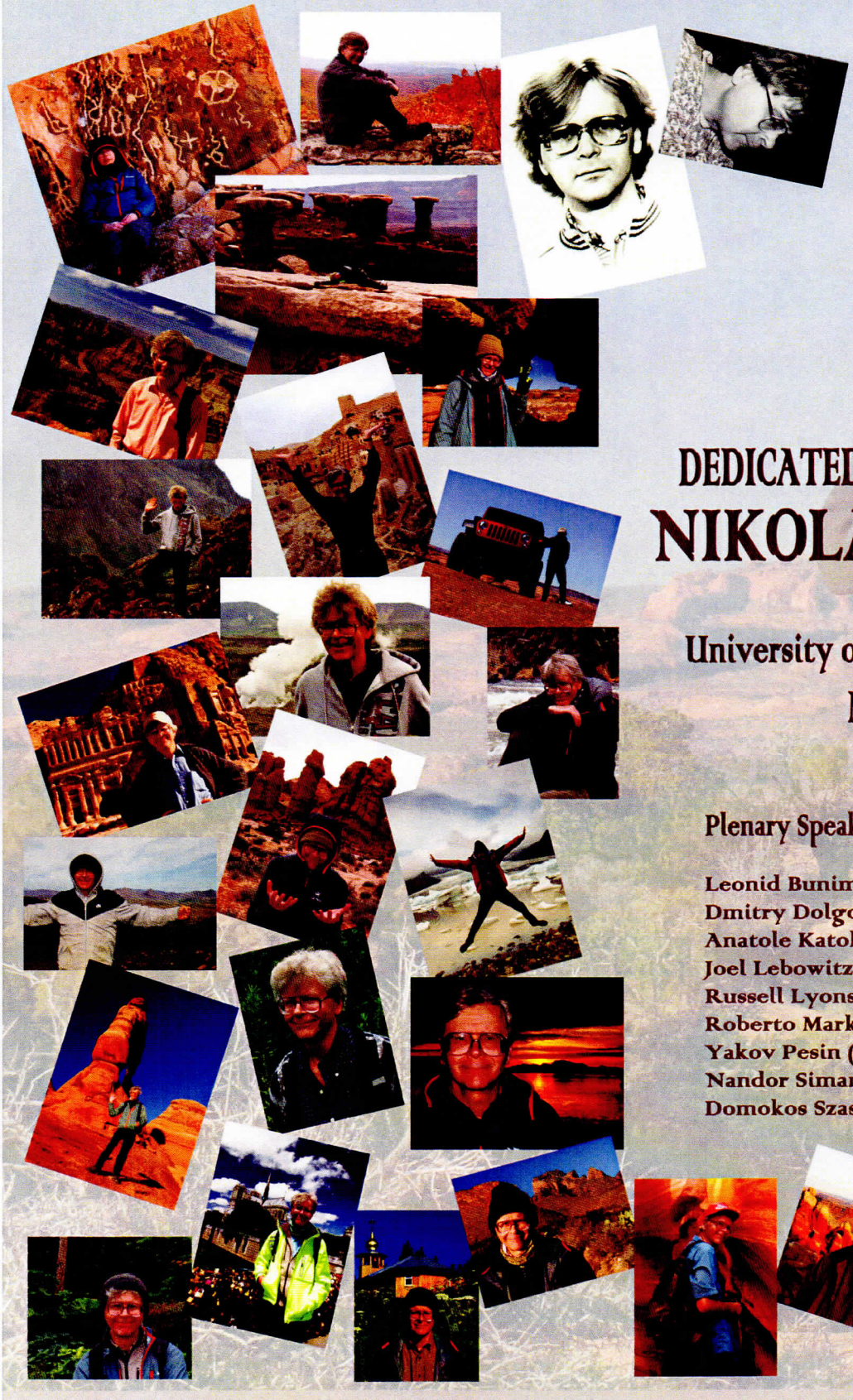
DYNAMICAL SYSTEMS & ERGODIC THEORY and PROBABILITY CONFERENCE



DEDICATED TO THE MEMORY OF NIKOLAI CHERNOV

University of Alabama at Birmingham

May 18-20, 2015

Plenary Speakers

Leonid Bunimovich (Georgia TECH)
Dmitry Dolgopyat (U of Maryland)
Anatole Katok (Penn State)
Joel Lebowitz (Rutgers)
Russell Lyons (Indiana U)
Roberto Markarian (IMERL, Uruguay)
Yakov Pesin (Penn State)
Nandor Simanyi (UAB)
Domokos Szasz (U of Technology & Economics, Hungary)

ABSTRACTS OF TALKS TO BE PRESENTED IN PARALLEL SESSIONS

A

Abdalla, Areeg, *Cairo University, Egypt*

TREATING UNCERTAINTY AND VAGUENESS IN DATA

Wednesday, May 20, 4:30-5:00, EB 146

In analyzing any collected data, uncertainty arises due to limitations of measurements, insufficient data, extrapolations and interpolations. Therefore, the management of uncertainty and/or vagueness is important whenever any real world information is to be represented. Human have remarkable capabilities - machines do not have- in performing measurements and computations. Probability is used to consider uncertainty. While, fuzzy set theory is used in treating vagueness. Whether individually or combined, both theories are need to treat uncertainty.

B

Balint, Peter, *Budapest University of Technology and Economics*

THE FLOW OF TWO FALLING BALLS MIXES RAPIDLY

Tuesday, May 19, 11:30-12:00, EB 145

The system of two falling balls describes the motion of two point masses moving along a vertical half-line, subject to constant gravity force and colliding elastically with each other and the floor. By results of Wojtkowski and Chernov, the dynamics are hyperbolic and ergodic iff the lower ball is heavier. Here we study the model in continuous time and establish rapid (superpolynomial) decay of correlations.This is joint work with Andras Nemedy Varga.

Van dem Bedem, Henry, *SCLA/Stanford University*

CHARACTERIZING SPATIOTEMPORAL ENSEMBLES OF BIOMOLECULES

Wednesday, May 20, 11:30-12:00, EB 133

Proteins operate and interact with their cellular partners by exchanging between conformational substates on a wide range of spatiotemporal scales. However, structurally characterizing this spatiotemporal ensemble is extremely challenging. We have developed a new geometric procedure to characterize the rigidity and flexibility of proteins, based on their resemblance to kinematic frameworks. In contrast to explicit constraint counting, our geometric analysis correctly identifies rigid substructures at singular configurations. Coupled with fast and efficient conformational sampling algorithms, our procedure can identify parsimonious ensembles of states from sparse experimental data. Understanding how different parts of biomolecules are conformationally coupled will allow us to modulate proteins by selectively stabilizing conformations that enhance or inhibit function with broad implications for human health.

Bonetto, Federico, *Georgia Tech*

KAC PARTICLES INTERACTING WITH A THERMAL BATH

Wednesday, May 20, 11:30-12:00, EB 145

We consider a system of particles interacting via random collisions. The system interact with a thermal bath that bring it to equilibrium at a given temperature. We consider different model for the thermostat, both finite and infinite, and discuss their relations.

C

Catsigeras, Eleonora, *Universidad de la Republica, Uruguay*

CONDITIONS FOR POSITIVE ENTROPY OF DIFFEOMORPHISMS WITH DOMINATED SPLITTING

Monday, May 18, 12:00-12:30, EB 133

We find several conditions that imply positive entropy for C^1 diffeomorphisms with dominated splitting. These conditions are related with Pesin's Formula of the Entropy which is satisfied by all the (always existing) SRB-like measures. This is a joint work with Xueting Tian.

Cellarosi, Francesco, *University of Illinois at Urbana-Champaign*

AUTOCORRELATIONS FOR QUATUM PARTICLES ON A NILMANIFOLD

Tuesday, May 19, 4:00-4:30, EB 146

The ergodic properties of Heisenberg nilflows are well understood, and the mixing properties of time-changes of such flows were recently described by Avila, Forni and Ulcigrai. Instead of classical flows, we consider quantum particles moving freely in a Heisenberg nilmanifold, and study their autocorrelation function. Our main result is a limiting theorem for the autocorrelation function (at random time) for particles that are a superposition of N eigenmodes, as N tends to infinity. Our methods use some recent results of J. Marklof and the speaker.

Chen, Jianyu, *Michigan State University*

EXPONENTIAL MIXING OF TORUS EXTENSION OVER EXPANDING MAPS

Wednesday, May 20, 12:00-12:30, EB 133

We study the mixing property for the skew product $F : T^d \times T^l \to T^d \times T^l$ given by $(x, y) \to (Tx, y + \tau(x))$, where $T : T^d \to T^d$ is a C^∞ uniformly expanding endomorphism, and the fiber map $\tau : T^d \to T^l$ is a C^∞ map. We apply the semiclassical approach to show the dichotomy: either F mixes exponentially fast or τ is an essential coboundary. This is a joint work with Huyi Hu.

Chumley, Timothy, *Iowa State University*

RANDOM MOTION OF A RIGID BODY WITH SURFACE TEMPERATURE

Wednesday, May 20, 3:30-4:00, EB 146

We present a Markov chain model for the motion of a rigid body with varying surface temperature while it interacts with an environment of point particles. We show that the as a result of the surface temperature the model shows an interesting multi-scale phenomenon. The main results we present are a law of large numbers and central limit theorem for the model. This is joint work with Scott Cook and Renato Feres.

Climenhaga, Vaughn, *University of Houston*

SPECIFICATION, STATISTICAL PROPERTIES, AND TOWERS

Monday, May 18, 4:30-5:00, EB 146

Given a dynamical system with some hyperbolicity, the equilibrium states associated to sufficiently regular potentials often display stochastic behaviour. Two important tools for studying these equilibrium states are specification properties and tower constructions. I will describe how both uniform and non-uniform specification properties can be used to deduce existence of a tower with exponential tails, and hence to establish various statistical properties.

Correia, Maria, *Universidade de Évora, Évora, Portugal*

THE ORBIT STABILITY AND ERGODICITY IN A NEW CLASS OF BILLIARDS

Tuesday, May 19, 4:00-4:30, EB 145

We study a two-parameter family of a billiard tables, with a convex and non-convex boundary arcs. We analytically study the stability of some periodic orbits and prove the hyperbolicity of this family of billiards. Some numerical observations of phase spaces of ergodic and mixed billiard tables are also provided.

D

Demers, Mark, *Fairfield University, CT*

DECAY OF CORRELATIONS FOR THE SINAI BILLIARD FLOW

Tuesday, May 19, 12:00-12:30, EB 145

We present recent progress in proving exponential decay of correlations for the billiard flow associated with a finite horizon Lorentz gas. This is joint work with V. Baladi and C. Liverani.

Dettmann, Carl, *University of Bristol, UK*

INFINITE HORIZON LORENTZ GASES

Monday, May 18, 3:30-4:00, EB 145

A particle moving though a periodic lattice of hard convex scatterers with "infinite horizon", that is, the existence of trajectories without collisions, exhibits a number of interesting features including a logarithmic increase of the rate of diffusion and an anomalous limiting second moment. Generalizations will be discussed, including higher dimensions and many-particle systems.

E

Erchenko, Alena, *Penn State University*

TOPOLOGICAL AND METRIC ENTROPIES FOR SURFACES OF NEGATIVE CURVATURE

Wednesday, May 20, 3:30-4:00, EB 133

This is a joint work with A. Katok. We consider a smooth closed surface with a Riemannian metric of negative curvature. A. Katok has shown that there are constraints on the topological entropy and metric entropy of geodesic flow. It is natural to ask if all values satisfying these constraints can be achieved. I will discuss examples with the necessary distribution of curvature to answer this question affirmatively and will formulate other questions around this topic.

Eslami, Peyman, *University of Roma Tor Vergata*

DECAY OF CORRELATIONS FOR SKEW PRODUCTS WITH SINGULARITIES

Wednesday, May 20, 4:00-4:30, EB 145

Rates of decay of correlations have been an important part of the statistical study of dynamical systems. They provide a quantitative estimate on how fast the system looses memory of its past and open the door to further statistical study of the system. In this talk I will consider the skew product map on the 2-torus given by $F(x, y) = (f(x), y+T(x))$, where f is a piecewise expanding map on a countable partition with a Hölder derivative and T is a piecewise C^1 map. I will show that F mixes at a stretched-exponential rate if T is not cohomologous to a piecewise constant function. The proof is mostly based on ideas of D. Dolgopyat and N. Chernov.

F

Feres, Renato, *Washington University*

DYNAMICS AND DIFFERENTIAL GEOMETRY OF NON-STANDARD BILLIARD MODELS

Monday, May 18, 4:00-4:30, EB 145

A billiard dynamical system, very broadly conceived, is a Hamiltonian system on a configuration manifold with boundary. Boundary conditions are defined by assigning a collision map on the tangent space at each boundary configuration, the standard example being mirror reflection. It is possible, in any dimension, to classify the collision maps compatible with physical conservation laws and this classification points to new models of deterministic, volume preserving billiard systems, with distinct dynamical properties. In this talk I report on joint work with Chris Cox on new billiard models with "rough collisions" that greatly extends related earlier work by Broomhead and Gutkin and indicate some first steps in understanding their dynamics.

G

Galperin, Grigoriy, *Eastern Illinois University*

BOUNCING IN GRAVITATIONAL FIELD

Monday, May 18, 3:30-4:00, EB 133

The behavior of certain "random" trajectories of a billiard ball bouncing in gravitational field off of a set of obstacles will be discussed in the talk. Hénon considered the motions of a ball in gravitational field in the plane, bouncing off of two circles, and studied the set of trajectories encoded by their itineraries. In my talk, the spatial case will be considered: the billiard particle, subject to gravity acting along the negative z–axis, undergoes repeated collisions with an array of 3D obstacles not all of which are convex. It will be shown that under mild assumptions **any prescribed itinerary is realizable**. Hyperbolic methods do not apply in that situation because the obstacles are non-convex; a variational approach is used instead. The result and its proof obtained in collaboration with Mark Levi.

Grigo, Alexander, *University of Oklahoma*

ON CERTAIN CLASSICAL MODELS IN STATISTICAL MECHANICS

Monday, May 18, 5:00-5:30, EB 145

In this talk we will consider a few different mathematical models of gas-like systems of particles, which interact through (binary) collisions that conserve momentum and mass. The aim of the talk will be to present how one can employ ideas from dynamical systems theory to derive macroscopic properties of such models.

H

Haydn, Nicolai, *University of Southern California*

EXPONENTIAL LAW FOR RANDOM MAPS ON COMPACT MANIFOLDS

Tuesday, May 19, 11:30-12:00, EB 146

We consider random maps on manifolds which have measures whose correlations decay at least polynomially. We show that the first hitting time is in the limit exponentially distributed almost surely. This is a quenched limit which applies to almost all realizations of the random maps. The measure is required to satisfy an invariance-like property and be of product type form with respect to the local unstable leaves of the random maps.

Hu, Huyi, *Michigan State University*

POLYNOMIAL DECAY OF CORRELATIONS FOR SOME ALMOST ANOSOV DIFFEOMORPHISMS

Monday, May 18, 3:30-4:00, EB 146

A smooth dynamical system is called an almost Anosov system if it is hyperbolic everywhere except for a finite set. We consider an almost Anosov diffeomorphism of the two dimensional torus with an indifferent fixed point at which the differential of the map is identity. We show that under some nondegeneracy conditions at the fixed point, the system has polynomial decay of correlation with respect to its SRB measure. We give both upper and lower bound estimates.

J

Jiang, Yunping, *City University of New York-Graduate Center and Queens College*

Introduction to Geometric Gibbs Theory

Monday, May 18, 4:00-4:30, EB 133

One of the most important equilibrium states is the Gibbs state. In the study of the Gibbs state, the deformation theory of a Gibbs measure becomes an important topic. To study the deformation theory, one needs to have an appropriate metric on the space of underlying dynamical systems. The Teichmuller metric becomes a natural choice. The Teichmuller metric, just like the hyperbolic metric on the open unit disk, makes the space of underlying dynamical systems a complete space. The Teichmuller metric precisely measures the change of the eigenvalues at all periodic points which are essential data to obtain the Gibbs measure for a given dynamical system. In this talk, I will introduce the Teichmuller metric on the space of symmetric equivalence classes of uniformly symmetric circle endomorphism and show that it is the completion of the space of smooth equivalence classes of smooth expanding circle endomorphisms under this Teichmuller space. And, subsequently, I will introduce a generalization of Gibbs theory which we called a geometric Gibbs theory.

K

Kleinbock, Dmitry, *Brandeis University*

Kolya Chernov and shrinking targets

Monday, May 18, 4:30-5:00, EB 145

I will talk about Kolya's work on so-called "dynamical Borel-Cantelli lemmas", which for many dynamical systems allow to control rates with which trajectories of generic points enter a family of shrinking targets. After surveying our joint paper with Kolya (Israel Math. J. 2001) I will mention more recent developments of this theme.

Kocic, Sasa, *University of Mississippi*

GENERIC RIGIDITY OF CIRCLE DIFFEOMORPHISMS WITH A BREAK

Monday, May 18, 5:30-6:00, EB 133

Rigidity theory of circle diffeomorphisms is a classic topic in dynamical systems which started with the work of Arnold and was further developed by Herman, Yoccoz and others. Rigidity, in this context, refers to a phenomenon that every two maps, within a given topological equivalence class, are smoothly conjugate to each other. We prove that C^r-smooth ($r > 2$) circle diffeomorphisms with a break, i.e., circle diffeomorphisms with a single singular point where the derivative has a jump discontinuity, are generically, i.e., for almost all irrational rotation numbers, not $C^{1+\varepsilon}$-rigid, for any $\varepsilon > 0$. This result complements our recent proof, joint with K. Khanin, that such maps are generically C^1-rigid. It stands in remarkable contrast to the result of J.-C. Yoccoz that C^r-smooth circle diffeomorphisms are generically $C^{r-1-\varkappa}$-rigid, for any $\varkappa > 0$.

Korepanov, Alexey, *Warwick University, England*

AVERAGING FOR PERTURBED FAST-SLOW SYSTEMS

Monday, May 18, 5:30-6:00, EB 145

We consider a family of non-uniformly hyperbolic skew product fast-slow systems. We provide a general and easy to check condition for existence of macroscopic averaging limit, with explicit bounds on convergence speed. Applications include Henon and logistics maps for Benedicks-Carleson parameters. This is a joint work with Zemer Kosloff and Ian Melbourne.

L

Lenci, Marco, *Universita di Bologna, Italy*

Infinite mixing for one-dimensional maps

Monday, May 18, 12:00-12:30, EB 145

I will present some applications of the definitions of mixing that I have recently introduced for dynamical systems preserving an infinite measure to the cases of uniformly and non-uniformly expanding maps of the real line. The latter case covers popular examples of maps with an indifferent fixed point on the unit interval.

M

Mavinga, Nsoki, *Swarthmore College*

BIFURCATION FROM INFINITY FOR REACTION-DIFFUSION EQUATIONS SUBJECT TO NONLINEAR BOUNDARY CONDITIONS

Wednesday, May 20, 4:00-4:30, EB 146

We consider a reaction-diffusion equation under nonlinear boundary conditions where the nonlinearities are asymptotically linear at infinity, and depend on a parameter. We prove that as the parameter crosses some critical values a resonance type phenomenon provides solutions that bifurcate from infinity. This is a joint work with Rosa Pardo.

N

Nandori, Peter, *Courant Institute, NYU*

NON-EQUILIBRIUM DENSITY PROFILES IN LORENTZ TUBES WITH THERMOSTATED BOUNDARIES

Wednesday, May 20, 12:00-12:30, EB 145

Let's consider a long Lorentz tube with absorbing boundaries and inject particles from the left end. We show that the evolution of the density profile is well described by the heat equation. In the proof, we use new local limit theorems for Lorentz particles having a prescribed behavior in the past. An important ingredient to our argument is a coupling lemma borrowed from a paper of Chernov. This is a joint work with Dmitry Dolgopyat.

Nicol, Matthew, *University of Houston*

ALMOST SURE INVARIANCE PRINCIPLE FOR NON-STATIONARY DYNAMICAL SYSTEMS

Monday, May 18, 12:00-12:30, EB 146

We establish almost sure invariance principles, a strong form of approximation by Brownian motion, for non-stationary time-series arising as observations on dynamical systems. Our examples include observations on sequential expanding maps, perturbed dynamical systems, non-stationary sequences of functions on hyperbolic systems as well as applications to the shrinking target problem in expanding systems. This is joint work with Nicolai Haydn, Andrew Torok and Sandro Vaienti.

O

Ott, William, *University of Houston*

SEARCHING FOR SRB MEASURES

Monday, May 18, 5:00-5:30, EB 146

SRB measures play a central role in the theory of nonuniform hyperbolicity. Although this theory is reasonably well-developed, the search for SRB measures in concrete systems continues.
Here we identify dynamical mechanisms that suggest the emergence of SRB measures and we prove that SRB measures exist for certain concrete finite-dimensional systems. In particular, SRB measures may emerge when flows with homoclinic loops or heteroclinic cycles are gently forced. We conclude by discussing the possibility of proving the existence of SRB measures for evolution partial differential equations.

Ouyang, Cheng, *University of Illinois at Chicago*

FRACTAL PROPERTIES OF ROUGH DIFFERENTIAL EQUATIONS DRIVEN BY FRACTIONAL BROWNIAN MOTIONS

Tuesday, May 19, 12:00-12:30, EB 146

We study fractal properties of rough differential equations driven by fractional Brownian motions with Hurst parameter $H > 1/4$. In particular, we show that the Hausdorff dimension of the sample paths of the solution is $\min\{d, 1/H\}$ almost surely and that the Hausdorff dimension of the level sets is $1 - dH$ with positive probability when $d < 1/H$.

R

Raines, Brian, *Baylor University*

SHADOWING ON DENDRITES

Monday, May 18, 11:30-12:00, EB 133

We show that shadowing is generic for maps of dendrites.

Rosenblatt, Joseph, *IUPUI*

COBOUNDARIES IN DYNAMICAL SYSTEMS

Tuesday, May 19, 4:00-4:30, EB 133

A coboundary is a difference $H - H \circ \tau$. The function H is the transfer function. It is well-known that for ergodic transformations τ, a mean-zero function in $L_r(X), 1 \leq r < \infty$ can be approximated by coboundaries with transfer functions in $L_r(X)$, and that the subspace of coboundaries is first category. As a dual to this, if one can ask how often we can write a given mean-zero $F \in L_r(X)$ as a coboundary, with a transfer function in $L_r(X)$ too, if vary τ. The answer is the class of maps τ for which one can do this is first category. Nonetheless, there is good evidence that every $F \in L_r(X)$ is a coboundary with transfer function $H \in L_r(X)$ for some τ. These types of questions, and related ones connected with coboundaries where f, H, and τ all vary are the subject of this talk.

Rousseau, Jerome, *Universidade Federal da Bahia/University of Illinois at Urbana-Champaign*

CONCENTRATION INEQUALITIES FOR SEQUENTIAL DYNAMICAL SYSTEMS OF THE UNIT INTERVAL

Monday, May 18, 11:30-12:00, EB 146

We prove a concentration inequality for sequential dynamical systems of the unit interval enjoying an exponential loss of memory in the BV norm, and we investigate several of its consequences. In particular, this covers compositions of β-transformations, with all β lying in a neighborhood of a fixed $\beta_\star > 1$ and systems satisfying a covering type assumption.

Roychowdhury, Mrinal Kanti, *University of Texas-Pan American*

QUANTIZATION DIMENSION AND OTHER DIMENSIONS OF PROBABILITY MEASURES

Wednesday, May 20, 12:00-12:30, EB 146

Quantization dimension measures the speed at which some specified measure of the error, when a continuous probability measure is approximated by a probability measure with finite support, tends to zero as n tends to infinity. Recently, it has been shown that quantization dimension of a fractal probability measure has a relationship with some other dimensions of the measure that arise in fractal geometry. My talk will be about it.

S

Selinger, Nikita, *Stony Brook University*

DECIDABILITY OF COMBINATORIAL EQUIVALENCE OF THURSTON MAPS

Wednesday, May 20, 4:00-4:30, EB 133

In a joint work with M. Yampolsky, we give a classification of Thurston maps with parabolic orbifolds based on our previous results on characterization of canonical Thurston obstructions. The obtained results yield a partial solution to the problem of algorithmically checking combinatorial equivalence of two Thurston maps.

De Simoi, Jacopo, *University of Toronto*

DISPERSING FERMI-ULAM MODELS

Wednesday, May 20, 3:30-4:00, EB 145

Fermi-Ulam models describe the dynamics of a point mass bouncing elastically between two oscillating walls. If the motion of the walls is sufficiently smooth, KAM theory guarantees that every trajectory has bounded energy. This conclusion may fail quite spectacularly if the motion is only piecewise smooth. In this talk we introduce a class of piecewise smooth Fermi-Ulam models and prove that their ergodicity: in particular the energy of almost every trajectory will oscillate between arbitrarily large and arbitrarily small values.

Slijepcevic, Sinisa, *University of Zagreb, Croatia*

INVARIANT MEASURES OF EXTENDED SCALAR DISSIPATIVE SYSTEMS

Monday, May 18, 5:00-5:30, EB 133

We consider extended scalar dissipative systems in both discrete-space case (driven Frenkel-Kontorova models) and continuous-space case (scalar reaction diffusion equations on R without decay of infinity). We prove that the union of supports of all space-time invariant measures is at most two dimensional. In the discrete case space, we then partially explain various numerically observed phenomena in the physics literature (asymptotics, synchronization, phase transitions). In the continuous space case, we consider generalizations of known results for the Burgers equation, and for reaction-diffusion equations on bounded domains.

Starr, Shannon, *University of Alabama at Birmingham*

COARSE BOUNDS IN RANDOM MATRICES

Tuesday, May 19, 3:30-4:00, EB 146

At the level of a weak limit law for the moments, random matrices represents a problem in mean-field statistical mechanics. As such, it provides a simpler toy model of harder problems such as spin glasses. But for non-symmetric matrices, moments do not relate just to the eigenvalue empirical spectral distribution function. The moments also depend on the left and right eigenvectors through their inner-products. I will describe this. This is joint work with Meg Walters at the University of Rochester.

T

Thompson, Dan, *Ohio State University*

UNIQUENESS OF EQUILIBRIUM STATES FOR GEODESIC FLOWS IN MANIFOLDS OF NON-POSITIVE CURVATURE

Monday, May 18, 4:30-5:00, EB 133

We establish results on uniqueness of equilibrium states for geodesic flows on rank 1 manifolds. This is an application of machinery developed by Vaughn Climenhaga and myself, which applies when systems satisfy suitably weakened versions of expansivity and the specification property. The geodesic flow on a rank 1 manifold is a canonical example of a non-uniformly hyperbolic flow and I'll explain why it satisfies our hypotheses. Our methods are completely different from those used by Knieper in his seminal proof that there is a unique measure of maximal entropy in this setting. This is a preliminary report of joint work with Keith Burns (Northwestern), Vaughn Climenhaga (Houston) and Todd Fisher (Brigham Young).

Torok, Andrew, *University of Houston*

ALMOST SURE INVARIANCE PRINCIPLES FOR SEQUENTIAL AND NON-STATIONARY DYNAMICAL SYSTEMS

Monday, May 18, 4:00-4:30, EB 146

We establish almost sure invariance principles, a strong form of approximation by Brownian motion, for non-stationary time-series arising as observations on dynamical systems. Our examples include observations on sequential expanding maps, perturbed dynamical systems, non-stationary sequences of functions on hyperbolic systems as well as applications to the shrinking target problem in expanding systems.

Tsiflakos, Michael, *University of Vienna, Austria*

GLOBAL ERGODICITY OF N FALLING BALLS

Tuesday, May 19, 12:00-12:30, EB 133

The system of falling balls is a hyperbolic system with singularities, which was introduced by Wojtkowski in 1990. The main, long standing conjecture is whether that sytem is ergodic or not. Sinai and Chernov developed, in 1987, a powerful mechanism for hyperbolic systems with singularities that gives ergodicity of such systems, by checking, if the dynamical system is 'locally' and 'globally' ergodic. We make a first step towards the solution of this challenging task by proving that the system of N falling balls is globally ergodic and briefly elaborate on details regarding local ergodicity.

Turkington, Bruce, *University of Massachusetts, Amherst*

A STATISTICAL REDUCTION METHOD FOR HIGH-DIMENSIONAL HAMILTONIAN DYNAMICS

Tuesday, May 19, 3:30-4:00, EB 145

A general method of deriving reduced dynamical models of Hamiltonian systems with many degrees of freedom is derived from an optimization principle. For any statistical model associated with a given set of resolved variables, paths of probability densities on phase space are tested against the Liouville equation. The ensemble-averaged, squared Liouville residual is minimized over such paths, yielding the best-fit reduced dynamics. In this way an optimal nonequilibrium evolution is deduced, and it is shown to have generic thermodynamic structure and properties. The method has been implemented on prototypical turbulent dynamics, including the spectrally-truncated Burgers equation and inviscid two-dimensional flow, where it defines systematic closures in terms of coarse-grained quantities.

W

Webb, Ben, *Brigham Young University*

SELF-AVOIDING MODES OF MOTION IN A DETERMINISTIC LORENTZ LATTICE GAS

Wednesday, May 20, 11:30-12:00, EB 146

We consider the motion of a particle on the two-dimensional honeycomb lattice whose sites are occupied by flipping rotators, which scatter the particle according to a deterministic rule. What we find is that the particle's trajectory is a self-avoiding walk between returns to its initial position. We show that this behavior is a consequence of the deterministic scattering rule and the particular class of initial scatterer configurations we consider. Since self-avoiding walks are one of the main tools used to model the growth of crystals and polymers, the particle's motion in this class of systems is potentially important for the study of these processes.

Wilson, Chad, *Casualty Actuarial Society*

PRACTICAL APPLICATIONS OF PROBABILITY IN A CHANGING BUSINESS ENVIRONMENT

Monday, May 18, 5:30-6:00, EB 146

Students sometimes wonder how probability theory is applied in business. This talk touches on practical methods used by actuaries in the insurance industry. Modeling an insurance claim as a random event helps actuaries predict the future claim activity of a portfolio of customers. This is especially important in this era of rapid technological change. Using examples including telematics, solar panels, Uber, and more, see how actuaries reveal insights that improve company results.

X

Xue, Jinxin, *University of Chicago*

Noncollision singularities in a planar four-body problem

Tuesday, May 19, 3:30-4:00, EB 133

We show that there is a Cantor set of initial conditions in a planar four-body problem such that all the four bodies escape to infinity in finite time avoiding collisions. This proves the Painlevé conjecture for the four-body case. The work is based on an ideal model of Gerver and a joint work with D. Dolgopyat.

Y

Yakobson, Michael, *University of Maryland*

ATTRACTORS IN FOLKLORE-TYPE THEOREMS

Tuesday, May 19, 11:30-12:00, EB 133

We consider ergodic properties of attractors appearing in folklore-type theorems.

Yang, Fan, *University of Southern California*

Hitting times distribution for dynamical balls

Wednesday, May 20, 4:30-5:00, EB 145

For measure preserving systems with alpha mixing property, we prove that the hitting times of Bowen-balls have approximately exponential law if the measure has certain regularity. We also look at higher order return times of Bowen-balls and prove that the limiting distribution is Poissonian under proper mixing conditions. Finally, we show that the Poincare return time of a typical n-Bowen-ball is at least n. This is a joint work with Nicolai Haydn.

Z

Zhang, Hongkun, *University of Massachusetts, Amherst*

OPTIMAL BOUNDS ON CORRELATION DECAY RATES FOR NONUNIFORM HYPERBOLIC SYSTEMS

Monday, May 18, 11:30-12:00, EB 145

We investigate the decay rate of correlations for nonuniformly hyperbolic systems with singularities, on piecewise Hölder observables. By constructing a new scheme of coupling according to certain stopping times we obtain optimal bounds for the decay rate of correlations. Our results are applied to certain classes of billiards. This was joint work with N. Chernov and S. Vaienti.

Zhang, Pengfei, *University of Houston*

HOMOCLINIC INTERSECTIONS FOR THE GEODESIC FLOW ON 2-SPHERES

Wednesday, May 20, 4:30-5:00, EB 133

Let g be a Riemannian metric on the 2-sphere with positive Gauss curvature, and ϕ_g^t be the induced geodesic flow on the unit tangent bundle of S^2. We prove that, generically, the stable and unstable manifolds of each hyperbolic periodic orbit admits transversal homoclinic intersections.