ABSTRACTS

Friday, April 1

- 3:00 Federico Rodriguez-Hertz, Penn State University (Department of Mathematics Colloquium), *Global Rigidity for certain actions of higher rank lattices on the torus*

  Abstract. In this talk we will give an approach to the following theorem:
  Let Γ be an irreducible lattice in a connected semi-simple Lie group with finite center, no non-trivial compact factor and of rank bigger than one. Let $\alpha : \Gamma \to Diff(T^N)$ be a real analytic action on the torus preserving an ergodic large measure (large means essentially that its support is non trivial in homotopy). α induces a representation $a_0 : \Gamma \to SL(N, Z)$. Assume further that Γ has no zero weight and no rank one factor. Then a and a_0 are conjugated by a real analytic map outside a finite a_0 invariant set.

- 7:00 Party (welcome to the conference), Chez Treviño

Saturday, April 2 - Special day in honor of Mike Boyle's birthday

- 9:00 Douglas Lind, University of Washington, *Periodic points and entropy*

  Abstract. There is a general principle for algebraic dynamical systems that the limiting growth rate of periodic points should exist and be the entropy. I will formulate a conjecture for which there are no known counterexamples. For a single toral automorphism this is equivalent to a deep result by Gelfond in diophantine analysis. For several commuting group automorphisms the corresponding diophantine result is not known, but I will describe recent work with Schmidt and Verbitskiy using homoclinic points which provides an alternative approach in many cases. Surprisingly, this involves logic and real algebraic geometry, and can be used to obtain new diophantine information.

- 10:15 Karl Petersen, University of North Carolina at Chapel Hill, *Invariant measures and combinatorics of some nonstationary adic systems*

  Abstract. We review recent work (much of it joint with Frick or Varchenko) on adic (Bratteli-Vershik) dynamical systems which come from walks or reinforced walks on finite graphs. Identification of the ergodic invariant measures depends on knowing path counts between vertices in the associated diagram, and this leads to interesting combinatorial problems and formulas involving binomial coefficients as well as Eulerian, Stirling,and Delannoy numbers. Among dynamical properties that can be determined are lack of point spectrum, faithful coding by subshifts, topological weak mixing, loosely Bernoulli, and complexity.

- 11:30 Todd Fisher, Brigham Young University, *Symbolic extensions for partially hyperbolic diffeomorphisms*

Date: March 30, 2011.

Abstract. We will discuss the motivation for studying symbolic extensions. We will then discuss results involving existence and nonexistence of symbolic extensions for partially hyperbolic diffeomorphisms and relate what this implies about the dynamics of the system.

- 2:00 Tomasz Downarowicz, Wroclaw University of Technology (Poland), *Origins of symbolic extensions*

  Abstract. I will discribe the first examples, by Mike Boyle, of finite entropy systems with positive residual entropy (i.e., roughly, admitting no symbolic extension with equal entropy) or with infinite residual entropy (i.e. without symbolic extensions at all). Mike was inspired by Joe Auslander's question. Although entropy structures or invariant measures are not used, without these examples there would be no theory of symbolic extensions.

- 3:15 Alejandro Maass, University of Chile, Santiago (Chile), *Combinatorics of orbits in nilsystems and independence*

  Abstract. The notion of dynamical cubes was introduced in topological dynamics inspired in the proofs of non-conventional ergodic averages by Host and Kra. Among other properties, these cubes allow to define the regionally proximal relations of higher order which characterize the maximal nilfactors of a system. In this talk we will recall these notions and use them to study systems whose "local complexity" (meaning the way orbits visit a given open cover, as in the local entropy theory) has the same combinatorics of the dynamical cubes.

- 4:30 Dmitry Dolgopyat, University of Maryland, *On dynamical point of view on random walks in random environment*

  Abstract. We discuss some questions in symbolic dynamics motivated by the study of random walks in random environment.

- Banquet: 7:30 pm

Sunday, April 3

- 9:00 Amie Wilkinson, Northwestern University, *The cohomological equation for partially hyperbolic diffeomorphisms*

  Abstract. Many natural problems in the study of rigidity and stability phenomena in dynamics reduce to the question of solving a dynamical cohomological equation. When the underying dynamics are hyperbolic, the solution to this problem is commonly known as "Livsic theory." For partially hyperbolic dynamics, the same questions are significantly more delicate. I will discuss a fairly general solution to the problem for accessible partially hyperbolic systems.

- 10:15 Omri Sarig, Weizmann Institute (Israel) and Penn State University, *Symbolic dynamics for $C^{1+\epsilon}$ surface diffeomorphisms with positive topological entropy*

  Abstract. Suppose $f : M \to M$ is a $C^{1+\epsilon}$ diffeomorphism of a compact smooth manifold of dimension two with topological entropy $h > 0$. For every $0 < \delta < h$, we construct a "δ-large" invariant set E such that f

restricted to E has a countable Markov partition. It follows that $f|_E$ is a finite-to-one factor of a countable Markov shift. "δ-large" means that E has full measure for every ergodic invariant measure with entropy bigger than delta. There are many consequences, for example – every ergodic measure of maximal entropy is a finite-to-one factor of a stationary countable state Markov measure, and is therefore isomorphic to the product of a Bernoulli scheme and a finite rotation.

- 11:30 Hee Oh, Brown University, *Apollonian circle packings, Hausdorff measures, and Conformal metrics*

  Abstract. Beginning with the construction of Apollonian circle packings, we will discuss recent work on the asymptotic counting and distribution of circles in Apollonian circle packings with respect to different conformal metrics. We will also discuss various generalizations to other circle packings as well as to higher dimensional sphere packings and relate them with dynamics on hyperbolic manifolds.

- 2:00 Nimish Shah, Ohio State University, *Limit distributions of sequences of measures on homogeneous spaces of Lie groups and orbital counting*

  Abstract. Many counting and Diophantine approximation problems in number theory involve two large groups of direct or indirect symmetries. The interaction between these groups can be studied in terms of ergodic properties of group actions on homogeneous spaces of Lie groups. Algebraic descriptions of orbit closures or limiting distributions of sequences of measures provide deep number theoretic or geometric insights in to these problems. We have developed various techniques for applying deep theorems on algebraic behavior of unipotent and hyperbolic dynamics to resolve a large class of such problems. In this lecture we will highlight some of the earlier and the recent developments.

- 3:15 Danijela Damjanovic , Rice University, *Non-trivial cohomology and local rigidity of group actions*

  Abstract. The talk will be about a general KAM-type result which describes local structure of smooth group actions in case of non-trivial cohomology. I will speak of several applications to algebraic actions on homogeneous spaces, and couple of potential applications.

- 4:30 Bryna Kra, Northwestern University,*Multiple correlation sequences*

  Abstract. Correlation sequences are classical objects in harmonic analysis and are well understood via Fourier analysis. Higher order versions play a role in recent developments in ergodic theory and in additive combinatorics, and can be studied using algebraic objects (nilsequences). I will give an overview of how these algebraic objects play a role in various settings and discuss open questions.

Monday, April 4

- 9:00 Alexander Bufetov, Rice University and Steklov Institute of Mathematics, Moscow, *On the Vershik-Kerov Conjecture Concerning the Shannon-Macmillan-Breiman Theorem for the Plancherel Family of Measures on the Space of Young Diagrams*

Abstract. Vershik and Kerov conjectured in 1985 that dimensions of irreducible representations of finite symmetric groups, after appropriate normalization, converge to a constant with respect to the Plancherel family of measures on the space of Young diagrams. The statement of the Vershik-Kerov conjecture can be seen as an analogue of the Shannon-McMillan-Breiman Theorem for the non-stationary Markov process of the growth of a Young diagram. The limiting constant is then interpreted as the entropy of the Plancherel measure. The talk is devoted to the proof of the Vershik-Kerov conjecture. The argument is based on the methods of Borodin, Okounkov and Olshanski.

- 10:15 Corinna Ulcigrai, University of Bristol (UK), *Ergodic properties of infinite extensions of area-preserving flows*

  Abstract. We consider infinite volume preserving flows that are obtained as extensions of flows on surfaces. Consider a smooth area-preserving flow on a surface S given by a vector field X and consider a real valued function f on X. The (skew-product) extension of the flow on S given by f is the flow on $S \times R$ given by the solutions to the differential equations $dx/dt = X, dy/dt = f$, where (x, y) are coordinates on $S \times R$ and R is the real line. While the ergodic properties of surface flows that preserve a smooth area form are now well understood, very little is known for these infinite measure preserving extensions, which were previously studied only when S is a torus. We prove ergodicity of the infinite extension when the surface flow is of periodic type and f belong to a suitable subspace of smooth functions. In the proof we develop renormalization techniques for cocycles with logarithmic singularities over interval exchange transformations. This is joint work with K. Fraczek.

- 11:30 Pascal Hubert, Universite' Paul Cezanne, Marseille (France), *On the Ehrenfest Model*

  Abstract. In this talk, I will describe the Ehrenfest model. This is an old model of gas. A point moves in the plane and collides with rectangular scatterers with the usual law of reflexion. The scatterers are identical rectangular obstacles located periodically along a square lattice on the plane, one obstacle centered at each point of Z^2. I will explain how this model is related to a linear flow on a non compact translation surface. I will discuss some properties of this dynamical system: periodic orbits,recurrence, rate of diffusion.

- 2:00 Jon Chaika, University of Chicago, *Cylinders, saddle connections, the Siegel-Veech transform and applications*

  Abstract. This talk will focus on joint work with J. Athreya on the gaps between saddle connection and cylinder directions. We will motivate the study of saddle connections and periodic cylinders and discuss how the Siegel-Veech transform helps us study them.

- 3:15 Dan Thompson, Penn State University, *Uniqueness of equilibrium states: Beta-shifts, the Bowen property and Beyond*

  Abstract. This joint work with Vaughn Climenhaga (Maryland) establishes uniqueness of equilibrium states for

(1) a large class of shift spaces which includes every beta-shift;
(2) a large class of potential functions which strictly includes those with the Bowen property.

As an application, our method yields new results in the theory of thermodynamic formalism for piecewise monotonic interval maps. Our method allows us to handle a variety of systems without a Markov structure, and it covers a class of potentials that are well behaved away from a 'small' set; for example, an indifferent fixed point or a point of discontinuity. This work extends the techniques which we developed in a recent preprint, available at http://arxiv.org/abs/1011.2780, which gave a positive answer to the question 'Is every subshift factor of a beta-shift intrinsically ergodic?'. This question was included in Mike Boyle's article 'Open problems in symbolic dynamics', and was the original motivation for the development of these techniques.

- 4:00 Anthony Quas, University of Victoria (Canada), *Piecewise Isometries, Uniform Distribution and* $3\log(2) - \pi^2/8$

  Abstract. We study a simple family of piecewise isometries of the plane and look at their dynamical properties. We prove the abundance of "periodic islands" and study their density in the plane using uniform distribution methods. (This is joint work with Yitwah Cheung and Arek Goetz)

Tuesday, April 5

- 9:00 Jose' Alves, University of Porto (Portugal), *Interplays between large deviations, decay of correlations and recurrence times*

  Abstract. A classic approach in dynamical systems is to use particular geometric structures to deduce statistical properties, for example the existence of invariant measures with stochastic-like behaviour, large deviations or decay of correlations. Such geometric structures are generally highly non-trivial and thus a natural question is the extent to which this approach can be applied. We show that in many cases stochastic-like behaviour itself implies that the system has certain geometric properties, which are therefore necessary as well as sufficient conditions for the occurrence of the statistical properties under consideration.

- 10:30 Sevak Mkrtchyan, Rice University, *Asymptotic properties of Schur-Weyl duality*

  Abstract. Vershik and Kerov in 1985 gave asymptotic bounds for the maximal and typical dimensions of the irreducible representations of the symmetric group. It was conjectured by Grigori Olshanski that the maximal and typical dimensions of the isotypic components of the representations in Schur-Weyl duality accept similar asymptotic bounds. The isotypic components of this representation are parametrized by certain Young diagrams, and the relative dimensions of these components give rise to a measure on Young diagrams. Philippe Biane in 2001 found the limit shape of a typical Young diagram with respect to this measure. We will discuss a proof of the conjecture which is based on showing that the limit shape found by Biane is the minimizer of a certain functional.

- 11: 30 Vadim Kaloshin, Penn State University, *Diffusion along mean motion resonance for the restricted planar three body problem (joint with J. Fejoz, M. Giardia, P. Roldan)*

  Abstract. Abstract: We consider a planar 3 body problem so that one body is large (the Sun), one small (Jupiter), and the other is tiny (Asteroid). In the regime when period of Jupiter and of Asteroid are in resonance (called mean motion resonance) 1:7 we show that orbit of Asteroid can substantially change its shape. This resonance is close to mean motion resonance between Jupiter and Uranus. The proof is computer assisted with fundamental role played by apriori unstable structure of the underlying Hamiltonian system.