

- Michael Aizenman
 Title:
 Probability Cascades and the Spin Glass Problem

- Alexandra Bellow
 Title:
 Another look at some questions in pointwise ergodic theory
 Abstract:
 A bit of history and some recent developments; the case when a.e. convergence fails.

- Vitaly Bergelson
 Title:
 Ergodic Ramsey theory: old and new results and conjectures
 Abstract:
 After briefly reviewing the ergodic approach (due to H.Furstenberg) to problems in Ramsey theory, we shall focus our attention on the recent developments. We shall conclude by formulating and discussing some open problems and conjectures.

- Shriskrishna Dani
 Title:
 Group-induced actions on homogeneous spaces: a review
 Abstract:
 The study of actions on homogeneous spaces, induced by subgroups and automorphisms of the ambient group, has broadly followed two streams according to whether there exists or not a measure invariant under the action of the ambient group. Furstenberg introduced novel ideas in both streams. The aim of this talk is to review the area with this perspective in mind.

- Eli Glasner
 Title:
 Classifying dynamical systems by their recurrence properties
 Abstract:
 In his seminal paper of 1967 on disjointness in topological dynamics and ergodic theory H. Furstenberg started a systematic study of topologically transitive dynamical systems. In recent years this work served as a basis for a broad classification of dynamical systems by their recurrence properties. I will describe some aspects of this new theory and its connections with combinatorics, harmonic analysis and the theory of topological groups.

- Rostislav Grigorchuk
 Title:
 Spectra of fractal groups and integrable maps.

- Yves Guivarch
 Title:
 Orbits of linear group actions and orbit closures of semi-groups of automorphisms of the d -dimensional torus

Abstract:

We consider the general linear group $GL(V)$ of a real vector space V , and a sub-semi-group S of $GL(V)$. We study the orbit-closures of S in V , if S is “large”. The results allow to describe the orbit-closures of “large” sub-semi-groups of the group of unimodular integer matrices acting on the d -dimensional torus.

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- Vadim Kaimanovich

Title:

A survey on boundaries: Answers and questions

- Teturo Kamae

Title:

Self-affine functions and self-similar processes

Abstract:

Let Ω be a compact metrizable space with an additive \mathbb{R} -action and a multiplicative \mathbb{R}_+ -action satisfying the distributive law, that is, there exist continuous mappings $\phi : \Omega \times \mathbb{R} \rightarrow \Omega$ and $\psi : \Omega \times \mathbb{R}_+ \rightarrow \Omega$ such that

$$(1) (\omega + s) + t = \omega + (s + t), \quad \omega + 0 = \omega$$

$$(2) \lambda(\eta\omega) = (\lambda\eta)\omega, \quad 1\omega = \omega$$

$$(3) \lambda(\omega + t) = \lambda\omega + \lambda t$$

for any $\omega \in \Omega$, $s, t \in \mathbb{R}$ and $\lambda, \eta \in \mathbb{R}_+$, where we denote $\omega + t := \phi(\omega, t)$ and $\lambda\omega := \psi(\omega, \lambda)$. Moreover, we assume that those actions are faithful, that is

$$(4) \omega + s \neq \omega + t \text{ for some } \omega \in \Omega \text{ if } s \neq t$$

$$(5) \lambda\omega \neq \eta\omega \text{ for some } \omega \in \Omega \text{ if } \lambda \neq \eta.$$

We also assume that

$$(6) \text{ the additive } \mathbb{R}\text{-action on } \Omega \text{ is strictly ergodic.}$$

Such an Ω equipped with the additive \mathbb{R} -action and the multiplicative \mathbb{R}_+ -action as above is called a *numeration system*.

Let Ω be a numeration system. A continuous function $F : \Omega \times \mathbb{R} \rightarrow \mathbb{R}$ is called an α -homogeneous cocycle ($0 < \alpha < 1$) on Ω if

$$(7) F(\omega, s + t) = F(\omega, s) + F(\omega + s, t)$$

$$(8) F(\lambda\omega, \lambda s) = \lambda^\alpha F(\omega, s)$$

for any $\omega \in \Omega$, $s, t \in \mathbb{R}$ and $\lambda \in \mathbb{R}_+$.

An α -homogeneous cocycle on a numeration system Ω is an extension of the notion of self-affine functions while it is considered as a self-similar random process with stationary and ergodic increments having 0 entropy with respect to the unique \mathbb{R} -invariant probability measure. We discuss the homogeneous cocycles related to weighted substitutions and develop a stochastic analysis based on such processes.

REFERENCES

- [1] Teturo Kamae, Linear expansions, strictly ergodic homogeneous cocycles and fractals, Israel J. Math. 106 (1998) pp.313-337.
 - [2] Teturo Kamae, Stochastic analysis based on deterministic Brownian motion, Israel J. Math. 125 (2001) pp.317-346.
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- Anatole Katok

Title:

Rigidity of Group actions and KAM method

Abstract:

Local differentiable rigidity for most algebraic hyperbolic actions of Z^k and R^k was proved in [KS]. In this proof topological conjugacy transversal to the orbit foliation is established first and then it is shown to be smooth using the nonstationary normal forms theory. This method is not sufficient for partially hyperbolic actions whose elements are far from being structurally stable. We introduce a new method where first rigidity of central foliations is established following hyperbolic methods and then perturbations along the central direction are tackled by a KAM type iterative scheme with a version of cocycle rigidity used to solve the linearized equation. We will also discuss a possibility of doing the whole proof of rigidity based on an iterative scheme without an a priori existence of a topological conjugacy.

This is work in progress, partly in collaboration with the Ph.D. student Danijela Damjanovic.

[KS] A. Katok and R.J. Spatzier, Differential rigidity of Anosov actions of higher rank abelian groups and algebraic lattice actions, Proc. Steklov Inst. Math. (1997), 287–314.

- David Kazhdan

Title:

The theory of representations and special functions

- Mike Keane

Title:

On spontaneous emergence of opinions:

“Towards a better understanding of stochastic processes with infinite memory”

- Harry Kesten

Title:

Some examples of near subadditivity

Abstract:

We shall discuss some examples of families of random variables which are nearly subadditive, but to which the subadditive ergodic theorem does not apply directly. We shall concentrate on a large deviation estimate (in the upwards direction) for the range of a random walk or volume of a Wiener sausage, and on a shape theorem for the infected set in a model for the spread of an infection.

- Bryna Kra

Title:

Non-conventional ergodic averages

Abstract:

Furstenberg developed the beautiful connections between combinatorics and ergodic theory, proving Szemerédi’s theorem on arithmetic progressions via a multiple ergodic theorem. In the proof, he showed that for a certain average, the liminf is positive and that this implies Szemerédi’s Theorem.

Analogous to other ergodic theorems, Furstenberg asked about the convergence of these averages. More generally, for bounded functions f_1, f_2, \dots, f_k , we consider the existence in $L^2(\mu)$ of the limit:

$$\lim_{N \rightarrow \infty} \frac{1}{N} \sum_{n=1}^N f_1(T^n x) f_2(T^{2n} x) \dots f_k(T^{kn} x) .$$

In joint work with B. Host, we show the existence in L^2 of this (and several other) “non-conventional” ergodic averages. I will focus on the geometric and algebraic motivation in the proofs of the existence of these averages.

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- Francois Ledrappier

Title:

Products of random matrices

- Mariusz Lemanczyk

Title:

On disjointness of special flows over irrational rotations from mixing and Gaussian flows

- Elon Lindenstrauss

Title:

Measure rigidity, quantum unique ergodicity, and the set of exceptions in Littlewood’s Conjecture

Abstract:

In 1967 Furstenberg discovered a very surprising phenomenon: while both $T : x \rightarrow 2x \bmod 1$ and $s : x \rightarrow 3x \bmod 1$ on \mathbb{R}/\mathbb{Z} have many closed invariant sets, closed sets which are invariant under both T and S are very rare (indeed, are either finite sets of rationals or \mathbb{R}/\mathbb{Z}). Furstenberg also conjectured that a similar result holds for invariant measures. This conjecture is of course still open.

As has been shown by several authors, including Katok-Spatzier and Margulis this phenomenon is not an isolated curiosity but rather a deep property of many natural \mathbb{Z}^d and \mathbb{R}^d actions ($d > 1$) with many applications. In the last year there has been substantial progress in the study of measure rigidity of \mathbb{R}^d and \mathbb{Z}^d -actions. In particular, in many cases of interest we have a full understanding of the invariant measures for which there is some element of the action which acts with positive entropy. This has previously been known only in the one-dimensional case and in some special \mathbb{Z}^d -actions by toral automorphisms. While this is still far from resolving the issue, these partial results already powerful enough to prove results in other fields, especially number theory, which to date have been unapproachable by other techniques.

In particular, our (partial) understanding of a variant of the classical measure rigidity question enables us to prove a special but important case of Rudnick and Sarnak’s Quantum Unique Ergodicity Conjecture. The same technique, which is based among other things on ideas introduced by Ratner in her proof of the Raghunathan conjectures, applies more generally.

In conjunction with techniques developed by Einsiedler and Katok one can classify the positive entropy measures on $SL(3, \mathbb{R})/\Gamma$ invariant under the full

diagonal group (this result, as well as the following application, will appear in a joint paper with Einsiedler and Katok). As a corollary, one gets the following partial result toward a long-standing conjecture of Littlewood: the set of $\alpha, \beta \in \mathbb{R}$ so that $\liminf n\|n\alpha\|\|n\beta\| > 0$ has Hausdorff dimension 0. The best result obtained by traditional techniques which I am aware of is due to Pollington and Velani and is significantly weaker.

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- Stanislav Molchanov
Title:
Dynamo Theorem

 - Shahar Mozes
Title:
Orbit closures, square complexes and simple groups

 - Amos Nevo
Title:
Between measure-preserving and amenable actions

 - Alex Lubotzky
Title:
From arithmetic progressions to congruence subgroups and back

 - Yuval Peres
Title:
Extra heads, invariant allocations, and finitary coding

 - Feliks Przytycki
Title:
Pressure and dimension of Julia sets
Abstract:
I will discuss the equalities between various notions of pressure function $P(t)$ for the potential $-t \log |f'|$ on Julia set of a rational function f and arising equalities of dimensions. In particular I will discuss conformal measures approach and also focus on a special class of non-uniformly hyperbolic maps, called Topological Collet-Eckmann maps. The talk will include results which I obtained in recent years jointly with Stefen Rohde, Juan Rivera-Letelier and Stas Smirnov.

 - Klaus Schmidt
Title:
Isomorphism rigidity of algebraic Z^d -actions

 - Ya. Sinai
Title:
Difficulties in the $(3x + 1)$ and similar problems

 - Alain-Sol Sznitman
Title:

On diffusive and ballistic random walks in random environment

Abstract:

Random walks in random environment constitute one of the basic models of stochastic motion in a disordered medium. They have been the object of much interest, but to this day still remain poorly understood. We will discuss in this talk some recent examples of multi-dimensional walks which exhibit a diffusive or a ballistic asymptotic behavior. Some of the results described during this talk have been obtained in collaboration with E. Bolthausen and O. Zeitouni.

- Robert Tichy

Title:

Metric results in diophantine approximation and uniform distribution.

Abstract:

Various distribution concepts for sequences of real numbers are introduced and discussed. We present metric bounds for the discrepancy as well as constructions of low discrepancy sequences. Furthermore, recent results and normal numbers are presented. In a second part digit expansions are discussed from a number theoretical and from a dynamical point of view.

- Anatoly Vershik

Title:

Polymorphisms: theory and applications

Abstract:

A Polymorphism is the measure theoretical analogue of manyvalued map, correspondence, Young measure and so on. There are many situations in which polymorphism is a more natural notion than automorphism. I will be giving a series of results on Polymorphisms and some problems about this notion in a popular manner.

- Benjamin Weiss

Prediction theory for Stationary Processes

- Ofer Zeitouni

Title:

Random matrices meet large deviations: asymptotics for matrix models and spherical integrals.

Abstract:

Matrix models describe the joint distribution of two (or more) random matrices, through a Hamiltonian linking them. A basic feature of these is that unlike the case of a single matrix, angular variables cannot be integrated out to give a concise description of the joint law of eigenvalues. Matrix models arose in physics, but also in statistics and, surprisingly, in communication theory.

A crucial element in the understanding of even the simplest matrix models is the evaluation of certain integrals over the orthogonal/unitary groups. In the unitary case, classical approaches rely on Harish-Chandra's formula. I will describe a different point of view, developed in collaboration with A. Guionnet, based on re-interpreting the required integrals dynamically and

using tools of large deviations and stochastic analysis. I will discuss recent rigorous results, links with free probability theory, and open questions.