Ergodic Theory: Numbers, Fractals, and Geometry
September 24-28, 2017
Abstracts of Talks

Nalini Anantharaman (Université de Strasbourg)

Title: Quantum ergodicity on graphs: spectral and spatial delocalization

Abstract: We discuss the notion of "quantum ergodicity" on large graphs, which is a form of delocalization of eigenfunctions. We have established it on large regular graphs with Etienne Le Masson, and more recently with Mostafa Sabri for some families of non-regular graphs, making a connection with spectral delocalization on infinite trees.

Tim Austin (University of California, Los Angeles)

Title: Measure concentration and the weak Pinsker property

Abstract: A measure-preserving system has the weak Pinsker property if it can be split into a direct product of a Bernoulli shift and a system of arbitrarily low entropy, up to measure-theoretic isomorphism. I will discuss the recent theorem that all measure-preserving systems have this property. This can be seen as a natural extension of classical work by Sinai, Ornstein, Thouvenot and others on the existence of equivariant maps or isomorphisms between systems of positive entropy.

It turns out that the weak Pinsker property is closely related to the phenomenon of measure concentration. I will aim to sketch this relationship, and explain a new theorem about concentration in discrete probability which lies at the heart of the proof of the weak Pinsker theorem.

Lewis Bowen (University of Texas at Austin)

Title: A counterexample to the Weak Pinsker conjecture for free group actions.

Abstract: The Weak Pinsker conjecture posits that any ergodic measure-preserving transformation decomposes as a direct product of a Bernoulli shift and a low-entropy transformation. There is a natural generalization to ergodic actions of groups. I'll explain a counterexample, which is an action of a nonabelian free group, that arises from the hardcore model on the d-regular tree. The proof is based on a new measure-conjugacy invariant that counts the number of clusters of pseudo-periodic orbits.

Emmanuel Breuillard (Université Paris Sud)

Title: Homogeneous dynamics and the subspace theorem.

Abstract: Metric diophantine approximation is concerned with the diophantine properties of a typical point on a manifold. Schmidt's subspace theorem on the other hand deals with diophantine properties of algebraic points. I will discuss a new extension of Schmidt's theorem to the setting of metric diophantine approximation, which can be used to compute the diophantine exponent of a typical point on a variety defined over an arbitrary number field. The methods are based in part on homogeneous dynamics using ideas first introduced in this setting by Kleinbock and Margulis in the 90's. Joint work with Nicolas de Saxce.

Giovanni Forni (University of Maryland)

Title: Effective equidistribution by scaling, and number theory'

Abstract: We discuss a ``spectral method" based on scaling to prove effective equidistributions results in two cases: higher step nilflows and twisted horocycles. From our results on higher step nilflows we derive polynomial bounds on Weyl sums (but only for "good" coefficients in a certain sense) with exponent analogous to the optimal one, which follows from Wooley [2012] and Bourgain, Demeter and Guth [2015] . From the results on twisted horocycle flows, we derive results on a sparse equidistribution problem proposed by Margulis and Shah, slightly improving on results of Venkatesh [2010], and bounds on Fourier coefficients of cusp forms (for general lattices) which match the best known results of Good [1981] and Bernstein and Reznikov [1999] up to logarithmic terms. This is joint work with L. Flaminio and J. Tanis.

Alexander Gorodnik (University of Bristol)

Title: Discrepancy in Diophantine problems

Abstract: We discuss some recent results describing the distribution of solutions of Diophantine inequalities.

Alex Kontorovich (Rutgers University)

Title: Geometry to arithmetic of crystallographic packings

Abstract: In joint work with Kei Nakamura, we formulate a precise conjecture (the SuperPAC) on the nature of sphere packings having all radii reciprocals of integers and arising as limit sets of hyperbolic reflection groups. A consequence of the conjecture is that there are only finitely many "maximal" such packings, in all dimensions. We prove the conjecture in several families.

Elon Lindenstrauss (Hebrew University of Jerusalem)

Title: Random walks on homegenous spaces

Abstract: There has been much progress in the study of random walks on homogenous spaces, and in particular Benoist and Quint made great strides in understanding such random walks in many cases.

I will talk about ongoing work with Alex Eskin, using ideas from his joint work with Mirzakhani, regarding such random walks, and more specifically regarding classification of stationary measures for a probability measure mu on the acting group G. This gives an alternative approach to some results of Benoist and Quint but apply in substantially greater generality.

Hee Oh (Yale University)

Title: Geometric prime number theorems and fractals.

Abstract: The prime number theorem states that the number of primes of size at most T grows like T/log T. Geometric analogues of this profound fact have been of great interest over the years. In my lecture, I will discuss refined versions of the prime number theorem for hyperbolic 3-manifolds and for hyperbolic rational maps.

Jens Marklof (University of Bristol

Title: Higher dimensional Steinhaus problems via homogeneous dynamics

Abstract: The three gap theorem, also known as Steinhaus conjecture or three distance theorem, states that the gaps in the fractional parts of $\alpha,2\alpha,\ldots, N\alpha$ take at most three distinct values. Motivated by a question of Erdos, Geelen and Simpson, we explore a higher-dimensional variant, which asks for the number of gaps between the fractional parts of a linear form. Using the ergodic properties of the diagonal action on the space of lattices, we prove that for almost all parameter values the number of distinct gaps in the higher dimensional problem is unbounded. This in particular improves earlier work by Boshernitzan, Dyson and Bleher et al. Joint work with Alan Haynes (Houston).

Jean-François Quint (Université Bordeaux)

Title: Limit theorems for the spectral radius

Abstract: In this talk, I will present limit theorems for the spectral radius of a product of iid random matrices: they follow the same as the norm. This is a joint work with Yves Benoist.

Pablo Shmerkin (Universidad Torcuato Di Tella)

Title: Furstenberg's intersection conjecture and self-similar measures

Abstract: I will present my recent solution to Furstenberg's conjecture on the dimension of the intersections of $\times 2$ and $\times 3$ invariant Cantor sets. The proof relies on methods from additive combinatorics, and also yields progress in other problems involving self-similarity, including the smoothness of Bernoulli convolutions, which I will also survey.

Corinna Ulcigrai (University of Bristol)

Title: On Birkhoff sums and Roth type conditions for interval exchange transformations

Abstract: Understanding growth and behaviour of Birkhoff sums is one of the central themes in the study of interval exchange transformations (IET), starting from the work of Zorich and Forni on deviations of ergodic averages, up to recent results on limit theorems by Bufetov and others. Marmi, Moussa and Yoccoz introduced an object called "limit shape" which can be used as a tool to study Birkhoff sums which display polynomial deviations. In joint work with Yoccoz and Marmi, we describe a limit object for Birkhoff sums of functions which correspond to relative homology classes and, as in the case of the circle, display slower growth. In connection, we discuss two variations of the Roth type Diophantine condition introduced by Marmi, Moussa and Yoccoz to solve the cohomological equation for IETs. The talk is based on joint work with Stefano Marmi and Jean-Christophe Yoccoz.

Péter Varjú (University of Cambridge)

Title: Full dimension of Bernoulli convolutions

Abstract: Fix a number 0 < lambda < 1 and denote by nu_lambda the stationary probability measure under the maps x -> lambda x +1 and x -> lambda x -1. This measure is called the Bernoulli convolution with parameter lambda. It is a long standing open problem to determine the set of parameters lambda for which nu_lambda is absolutely continuous. I will discuss recent progress on this problem focusing on a joint work with Emmanuel Breuillard, which proves that if Lehmer's conjecture holds, then there is a number a < 1 such that dim nu_lambda =1 for all lambda in [a,1). Unconditionally, we prove that dim nu_lambda = 1 for some explicit examples of transcendental parameters such as ln(2) and pi/4.