Symbolic Dynamics
Dynamique Symbolique
(Org: **Bryna Kra** (Northwestern University), **Yuri Lima** (Université Paris-Sud 11) and/et **Alejandro Maass** (Universidad de Chile))

JON CHAIKA, University of Utah
Almost every 3-interval exchange transformation is not simple

This talk will present that almost every 3-IET is not simple. That is, it has ergodic self joinings that are neither the product measure nor "supported on a graph." This answers a question of Veech. Moreover, the ergodic self joinings are (weak-*) dense in the self-joinings. Relevant terminology will be defined. This is joint work with Alex Eskin.

MARÍA ISABEL CORTEZ, Universidad de Santiago de Chile, Chile
Invariant measures, monotilable groups and orbit equivalence

The set of invariant probability measures of a continuous action of an amenable group on a compact metric space is a (non empty) metrizable Choquet simplex. A natural question is to know if the converse is true, i.e, if given a metrizable Choquet simplex K and an amenable group G, it is possible to realize K as the set of invariant probability measures of a continuous action of G on a compact metric space. In 1991, Downarowicz answered for the first time this question in the case $G = \mathbb{Z}$, showing that every metrizable Choquet simplex can be realized as the set of invariant probability measures of a Toeplitz $\mathbb{Z}$-subshift. In this talk we show the extension of this result to any amenable residually finite group (C, Petite 2014) and to some larger class of monotilable groups (Cecchi, C.). We will also explain the connection of this result with problems related to topological orbit equivalence.

SEBASTIÁN DONOSO, Center for Mathematical Modeling
Automorphism groups of Toeplitz subshifts

In this talk I will show recent results in the description of automorphism groups of Toeplitz subshifts. Among other results, we show that such groups are abelian and finitely generated subgroups have a cyclic torsion. Indeed, every finitely generated abelian group with cyclic torsion can be realized as the automorphism group of a Toeplitz subshift. When we restrict to "low complexity" situations, such automorphism groups are spanned by the roots of the shift map. Also, for any $\epsilon > 0$ we construct Toeplitz subshifts with word complexity smaller than $Cn^{1+\epsilon}$ whose automorphism groups are not finitely generated.

This is a joint work with Fabien Durand, Alejandro Maass and Samuel Petite.

ALBERT FISHER, University of Sao Paulo
Finite and infinite measures for adic transformations

We classify the invariant Borel measures for adic transformations of finite rank which are finite on the path space of some sub-Bratteli diagram. Key ingredients of the proof include an appropriate definition of distinguished eigenvector sequence, a nonstationary Frobenius–Victory theorem, and the notions of adic tower and canonical cover: the measure may be locally infinite on the original space but is always locally finite on the cover space. This extends theorems of Bezuglyi, Kwiatkowski, Medynets and Solomyak, and Karpel. An application is given to nested circle rotations, where our necessary and sufficient condition for the measure to be infinite is expressed in terms of continued fractions.

(Joint work with Marina Talet)

YAIR HARTMAN, Northwestern University
Thompson's group F is not strongly amenable

We show that Thompson's group F has a topological action on a compact space that is proximal and has no fixed points. By definition, it says that this group is not strongly amenable. I'll explain all the notions and will present the construction which is a twist of a symbolic space over a Schrier graph of the group.

Joint work with Kate Juscheno, Omer Tamuz and Pooya Vahidi Ferdowsi

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GODOFREDO IOMMI, Pontificia Universidad Catolica de Chile
Thermodynamic properties of the Jacobi Perron algorithm

The Jacobi-Perron algorithm provides simultaneous rational approximations to vectors in $(0,1)^N$. The quality of the approximation can be estimated by means of the Lyapunov exponents associated to some product of matrices related to the algorithm. In this talk I will describe some dynamical properties of the level sets determined by the speed of convergence of simultaneous rational approximations to irrational vectors. I will explain how a non-additive thermodynamic formalism on non-compact spaces developed jointly with Yuki Yayama will serve that purpose. Part of this work is joint with Jairo Bochi and Pablo Shmerkin.

ZEMER KOSLOFF, Hebrew University of Jerusalem
The Krieger types of Bernoulli and Markov shifts

This talk will focus on some results on the Krieger types of inhomogenous Bernoulli shifts and inhomogenous Markov shifts and a few of their consequences. Namely the existence of ergodic Anosov diffeomorphisms of $\mathbb{T}^n$ for all $n = 2, 4, 5, 6, ...$ which are stable type III_1.

SAMUEL PETITE, Université de Picardie Jules Verne
Restrictions on the group of automorphisms preserving a subshift

A subshift is a closed shift invariant set of sequences over a finite alphabet. An automorphism is an homeomorphism of the space commuting with the shift map. The set of automorphism is a countable group generally hard to describe. We will present in this talk a survey of various restrictions on these groups for zero entropy subshifts.

CARLOS MATHEUS SILVA SANTOS, CNRS - Université Paris 13
On problem 17 in Bowen's notebook

In his notebook, Bowen left a list of 157 mathematical problems. Among them, problem 17 asks for "symbolic dynamics for billiards".

In this talk, we discuss a joint work with Yuri Lima extending Sarig's theory of symbolic models for smooth surface diffeomorphisms to the case of surface maps with discontinuities, which includes Sinai and Bunimovich billiards.

OMRI SARIG, Weizmann Institute of Science
Symbolic dynamics for surface diffeomorphisms: updates

Smooth surface diffeomorphisms with positive topological entropy can be coded by countable state Markov shifts, but the transitivity of the diffeomorphism does not seem to imply the transitivity of the symbolic space. I will report on joint work with J. Buzzi and S. Crovisier which shows how to break "most" of the surface into "basic pieces" which admit transitive coding.

WENBO SUN, the Ohio State University
Symbolic counter-examples for quantitative multiple recurrence problems

Furstenberg multiple convergence theorem states that for every set A with positive measure in a measure preserving system, there are infinitely many n such that the set $A \cap T^{-n}A \cap \cdots \cap T^{-dn}A$ is of positive measure. In stead of asking the positivity

of the measure of the set $A \cap T^{-n}A \cap \cdots \cap T^{-dn}A$, quantitative multiple recurrence problems studies how far (and how often) is this measure away from 0. In this talk, I will introduce recent advances of this topic as well as its connection to the symbolic dynamics and combinatorics. This is joint work with Sebastian Donoso.

DAN THOMPSON, The Ohio State University
Symbolic dynamics and specification for geodesic flow on CAT(-1) spaces

Locally CAT(-1) spaces are geodesic metric spaces satisfying a metric notion of negative curvature. These spaces are not necessarily manifolds, covering examples such as graphs equipped with an interior metric, yet they still have a geodesic flow defined on them. We discuss recent advances in understanding the dynamical properties of these geodesic flows via symbolic dynamics. We obtain results which extend the analogy with the negative curvature Riemannian setting. This is joint work with Dave Constantine and Jean-Francois Lafont.

EDGARDO UGALDE, Universidad Autónoma de San Luis Potosí
Projective convergence of random substitutions towards a Gibbs measures

This work is devoted to the study of processes generated by random substitutions over a finite alphabet. We prove, under mild conditions on the substitution's rule, the existence a unique process, which remains invariant under the substitution. Under stronger assumptions we prove that the invariant process is precisely a Gibbs measure. To this end we use the fact that under those conditions, a random substitution is contraction in the projective distance, and a result ensuring that a sequence of Markovian measures with sufficiently fast convergence rate, have a Gibbsian limit. By using some examples, we explore the tightness of our conditions.

VAN CYR, Bucknell University
Automorphisms of zero entropy symbolic systems

The symmetries of a symbolic dynamical system X form an interesting and often complicated group called its automorphism group. Although this group is always countable, it is frequently extremely complex for positive entropy subshifts (containing free subgroups, the fundamental group of every 2-manifold, and every finite group). By contrast, the group of automorphisms of a zero entropy subshift is often considerably more tame and it has been possible to prove a number of strong algebraic results. In this talk I will discuss some of these results and open problems.

KELLY YANCEY, Institute for Defense Analyses - Center for Computing Sciences
Structure of Rigidity Sequences for Substitution Dynamical Systems

A special class of dynamical systems that we will focus on are substitutions. This class of systems provides a variety of ergodic theoretic behavior and is connected to self-similar interval exchange transformations. During this talk we will explore rigidity sequences for these systems. A sequence (n_m) is a rigidity sequence for the dynamical system (X, T, μ) if $\mu(T^{n_m}A \cap A) \to \mu(A)$ for all positive measure sets A. We will discuss the structure of rigidity sequences for substitutions that are rank-one and substitutions that have constant length. This is joint work with Jon Fickenscher.

REEM YASSAWI, IRIF Université Paris Diderot - Paris 7
Recognizability for sequences of morphisms

We investigate different notions of recognizability for a free monoid morphism $\sigma : \mathcal{A}^* \to \mathcal{B}^*$. Full recognizability occurs when each (aperiodic) point in $\mathcal{B}^{\mathbb{Z}}$ admits at most one tiling with words $\sigma(a)$, $a \in \mathcal{A}$. This is stronger than the classical notion of recognizability of a substitution $\sigma : \mathcal{A}^* \to \mathcal{A}^*$, where the tiling must be compatible with the language of the substitution. We show that if $|\mathcal{A}| = 2$, or if σ's incidence matrix has rank $|\mathcal{A}|$, or if σ is permutative, then σ is fully recognizable.

Next we define recognizability and also eventual recognizability for sequences of morphisms (σ_n) which define an S-adic shift. We prove that a sequence of morphisms on alphabets of bounded size, such that compositions of consecutive morphisms are growing on all letters, is eventually recognizable for aperiodic points. In particular if each σ_n is fully recognizable, then the S-adic shift is recognizable. We provide examples of eventually recognizable, but not recognizable, sequences of morphisms, and sequences of morphisms which are not eventually recognizable. As an application, for a recognizable sequence of morphisms, we obtain an almost everywhere bijective correspondence between the S-adic shift it generates, and the measurable Bratteli-Vershik dynamical system that it defines. This is joint work with Valérie Berthé, Wolfgang Steiner and Jörg Thuswaldner.