

Extended symmetries in symbolic dynamics

18–19 October 2021

Faculty of Mathematics
Bielefeld University

This workshop is part of the DFG-funded CRC 1283
*Taming uncertainty and profiting from randomness and low regularity
in analysis, stochastics and their applications*
at Bielefeld University

Organisers: Álvaro Bustos, Neil Mañibo

www.math.uni-bielefeld.de/baake/extsym/

Schedule: Monday October 18th, 2021

Lecture Room: **V2-210**

10:30 – 11:00 **Opening and settling down**

11:00 – 11:45 **Reem Yassawi** Open University, UK
Using the Maximal Equicontinuous Factor to spot automorphisms and extended symmetries

11:45 – 12:30 **Robbert Fokkink** TU Delft, Netherlands
On Krebs' more reasonable proof of Cobham's theorem

12:30 – 14:00 **Lunch break**

14:00 – 14:45 **Daniel Luz** Bielefeld University, Germany
Extended symmetries for bijective substitutions

14:45 – 15:30 **Christopher Cabezas** Université Jules Verne, France
Homomorphisms between multidimensional constant-shape substitutions

15:30 – 16:00 **Coffee break**

16:00 – 18:00 **Individual discussions**

18:00 – 20:00 **Dinner at Wirtshaus 1802**
(Kurt-Schumacher-Straße 17a, near tram station Bültmannshof)

Schedule: Tuesday October 19th, 2021

Lecture Room: **V2-210**

- 09:30 – 10:15 **Sebastián Donoso** Universidad de Chile, Chile
Dimension groups, invariant measures, and complexity
- 10:15 – 11:00 **Coffee break**
- 11:00 – 11:45 **Dan Rust** Open University, UK
Automorphism groups of random substitution subshifts
- 11:45 – 14:00 **Lunch break**
- 14:00 – 14:45 **Samuel Petite** Université Jules Verne, France
On the centralizers of minimal subshifts
- 14:45 – 15:30 **Michael Baake** Bielefeld University, Germany
Weak model sets and dynamical systems of number-theoretic origin

Abstracts

Michael Baake (Bielefeld University)

Weak model sets and dynamical systems of number-theoretic origin

Point sets such as the visible lattice points or the k -free integers in algebraic number fields have many properties in common, yet result in rather different dynamical systems. This talk introduces and summarises some recent results, including spectra, symmetries and conjugacy.

Christopher Cabezas (Université Jules Verne)

Homomorphisms between multidimensional constant-shape substitutions

Constant-shape substitutions are a multidimensional generalization of constant-length substitutions which have been extensively studied in the past years (criteria of ergodicity, entropy, mixing and spectral properties). In this talk we will present some recent results about the normalizer group of substitutional dynamical systems generated by constant-shape substitutions, which is a group extension of the automorphism group of a topological dynamical system, and some other related results such as rigidity properties of these homomorphisms.

Sebastián Donoso (Universidad de Chile)

Dimension groups, invariant measures, and complexity

A theorem of T. Downarowicz asserts that any Choquet simplex can be realized as the set of invariant measures of a minimal subshift. On the other hand, by a result of Boshernitzan, a system with a non-superlinear complexity function has finitely many ergodic measures. Here the complexity function of a subshift is the function that counts the number of non-empty cylinders of length n . I will present a result that establishes that in terms of complexity, non-superlinearity is the only restriction to realize a Choquet simplex as the set of invariant measures of a minimal subshift. (*Joint work with Paulina Cecchi-Bernales*)

Robbert Fokkink (TU Delft)

On Krebs' more reasonable proof of Cobham's theorem

The set of powers of 2 in binary notation has prefix 1 followed by zeroes. In ternary notation, using base 3, it is much more complex (see Lagarias, 2005). In 1969 Alan Cobham proved that if a finite state automaton recognizes a set in base a , then it does not recognize it in b (unless the set is trivial, or unless base a and b are equivalent). In his 1974 textbook on automata, Eilenberg asked for a “more reasonable” proof of Cobham’s theorem. In this talk I will discuss a recent new proof by Thijmen Krebs and how it can be applied on more general number systems.

Daniel Luz (Bielefeld University)

Extended symmetries for bijective substitutions

Symmetries are a natural and important property when analysing a dynamical system. Viewing the columns of a substitution as a permutation on the alphabet we provide criteria, which can be checked by algorithms, to determine the extended symmetry group of a given substitution. Given both a symmetry and an extended symmetry group we provide constructions for a corresponding bijective substitution with said symmetric properties.

Samuel Petite (Université Jules Verne)

On the centralizers of minimal subshifts

Symbolic systems given by subshifts form a rich class of dynamical systems with very diverse behavior. A homeomorphism of a subshift commuting with the shift is a cellular automaton and the study of the group generated by these transformations, i.e. the centralizer, is a classical dynamical system problem. We will present an overview of recent results obtained in this context. We will see how topological properties (complexity, minimality, ...) of the system give algebraic constraints on this group.

Dan Rust (Open University)

Automorphism groups of random substitution subshifts

Random substitutions are a natural generalisation of substitutions on finite alphabets, but where letters are mapped to sets of words, rather than a single word. Consequently, their subshifts have a hierarchical structure very reminiscent of a substitutive subshift, however they are more wild: they are highly non-minimal, far from uniquely ergodic and have positive topological entropy. These properties arise from the local randomness that the random substitution allows for. As such, their subshift also shares many properties with shifts of finite type. In this talk, I'll follow this path and describe some of the structure of the automorphism groups of recognisable random substitution subshifts. For instance, they contain all free groups and all countable sums of finite groups. When recognisability fails, we need different techniques, and so if I have time, I'll describe some of the techniques needed to understand the automorphism group of the random period doubling substitution. (*Joint work with Robbert Fokkink and Ville Salo*)

Reem Yassawi (Open University)

Using the Maximal Equicontinuous Factor to spot automorphisms and extended symmetries

Let (X, σ) be a topological dynamical system, where X is a compact metric space and $\sigma: X \rightarrow X$ is a homeomorphism. In this talk I will discuss how we can use the maximal equicontinuous factor of (X, σ) to gain insight into the structure of either the automorphism group, extended symmetry group or the Ellis semigroup, which is the compactification of the group action generated by σ in the topology of pointwise convergence on the space X^X . Through some concrete (substitutive) examples, I will show how the automorphism group sometimes coincides with the *virtual automorphism group*, as defined originally by Ellis. (*Joint work with Johannes Kellendonk*)

Participant List

Michael Baake	(Bielefeld University)
Álvaro Bustos	(Universidad de Chile)
Christopher Cabezas	(Université Jules Verne)
Sebastián Donoso	(Universidad de Chile)
Robbert Fokkink	(TU Delft)
Franz Gähler	(Bielefeld University)
Philipp Gohlke	(Bielefeld University)
Anna Klick	(Bielefeld University)
Daniel Luz	(Bielefeld University)
Neil Manibo	(Bielefeld University)
Jan Mazáč	(Bielefeld University)
Andreas Nickel	(Duisburg-Essen University)
Samuel Petite	(Université Jules Verne)
Dan Rust	(Open University)
Timo Spindeler	(Bielefeld University)
Reem Yassawi	(Open University)

Tram map



Campus map

