

When Topological Dynamics meets Model Theory

June 29 - July 3, 2015

Tentative Program

	Monday	Tuesday	Wednesday	Thursday	Friday
09:30-10:20	Ibarlucia (Tutorial)	Rosendal	Bartosova	Akin	Simon
10:30-11	Wesolek	Mbombo	Tent [10:30–11:20]	Zielinski	Panagiotopoulos
11:00-11:30	<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>	<i>coffee break</i>
11:40-12:30	Newelski	Zucker	Sabok	Megrelishvili	Kechris
12:40-14:00	<i>lunch</i>	<i>lunch</i>		<i>lunch</i>	<i>lunch</i>
14:00-14:50	Weiss	Pillay		Evans	
15–15:30	<i>coffee break</i>	<i>coffee break</i>		<i>coffee break</i>	
15h30-16h20	Glasner	Chernikov		Ibarlucia	

Abstracts

- **Ethan Akin**, *Complete Homogeneous Linearly Ordered Topological Spaces*. .

We call a linearly ordered topological space (LOTS) homogeneous when it is order isomorphic to any nonempty open convex subset of itself (HLOTS). Homogeneity is preserved by completion. Of special interest are the complete examples (CHLOTS). Any dense subset of the reals, \mathbb{R} , which is invariant under positive rational affine motions, e.g. \mathbb{Q} , is a HLOTS with completion the CHLOTS \mathbb{R} . At first glance it is hard to think of other examples of CHLOTS and indeed \mathbb{R} is the only separable CHLOTS. We construct topologically distinct examples organized according to a natural notion of size in a well-ordered tower of height ω_1 , the first uncountable ordinal. By using some results of Hart and van Mill we construct 2^c such towers. This is joint work with Karel Hrbacek.
- **Dana Bartošová**, *The group of linear isometries of the Gurarij space is extremely amenable* .

We show that the group of linear isometries of the separable Banach space that is universal and approximately homogeneous for finite dimensional Banach spaces and isometric embeddings has the fixed point on compacta property. In order to do so, we prove an approximate Ramsey property for finite dimensional normed spaces with isometric embeddings. We present an analogous result for finite dimensional simplexes with affine continuous surjections and compute the universal minimal flow of the group of affine homeomorphisms of the Poulsen simplex. This is a joint work with Jordi Lopez Abad (ICMAT) and Brice Mbombo (USP).
- **Artëm Chernikov**, *Ergodic measures and genericity in definably amenable NIP groups*.

We study the dynamics of the action of a definable NIP group G on its space of types. Examples of such groups are given by stable groups and definably compact groups in o-minimal theories and p -adics, and our setting may be viewed as a model-theoretic version of tame dynamics as studied by Glasner, Megrelishvili and others. We develop a theory of generics and demonstrate that regular ergodic measures are precisely the liftings of the Haar measure on the canonical compact quotient G/G^{00} via f -generic types. Our methods combine model-theoretic tools and Vapnik-Chervonenkis theory. Joint work with Pierre Simon.
- **David Evans** , *Reconstruction of omega-categorical structures from their endomorphism monoids*. .

It is well known that there are two countable, omega-categorical structures M_1, M_2 whose automorphism groups are isomorphic as abstract groups, but not as topological groups. Here, we look at the same question for endomorphism monoids. In joint work with Bodirsky, Kompatscher and Pinsker we give an example of a pair of countable, omega-categorical structures whose endomorphism monoids are isomorphic as monoids, but not as topological monoids. In fact, it is the same example as for the groups.
- **Eli Glasner**, *WAP Systems and labeled subshifts* .

I will present a powerful method of construction of subshifts which we use chiefly to produce countable WAP systems with various properties. Among many other applications of this so called labeled subshifts, we obtain examples of null as well as non-null WAP subshifts, WAP subshifts of arbitrary countable (Birkhoff) height, and completely scrambled WAP systems of arbitrary countable height. We also construct LE but not HAE subshifts, and recurrent non-tame subshifts. The auxiliary Polish space of labels \mathcal{LAB} comes with an action of the semigroup $FIN(\mathbb{N})$, the additive semigroup of nonnegative integer-valued functions with finite support defined on \mathbb{N} . Together with a choice of an *expanding function* $k : \mathbb{Z} \rightarrow \mathbb{Z}$ and the associated map $x[\cdot] : \mathcal{LAB} \rightarrow \{0, 1\}^{\mathbb{Z}}$, the triple $(\mathcal{LAB}, FIN(\mathbb{N}), x[\cdot])$ produces a kind of “Lie algebra” for the dynamical system $(\{0, 1\}^{\mathbb{Z}}, S)$ (S denoting the shift transformation) which enables a study of the fine structure of labeled subshifts. An additional powerful tool in this theory is the natural action of the Polish group $S_\infty(\mathbb{N})$ on \mathcal{LAB} .

This is a joint work with Ethan Akin.

- **Tomás Ibarlucia**, *Eberlein oligomorphic groups* .

A topological group G is Eberlein if every weakly almost periodic function on G can be approximated by matrix coefficients of unitary representations of G . We will give several topological and model-theoretic characterizations of the family of Eberlein oligomorphic groups. More generally, we shall describe the semitopological semigroup compactifications of such groups that can be embedded into the semigroup of contractions of a Hilbert space.

- **Alexander Kechris**, *Structurable equivalence relations* .

An important aspect of the theory of countable Borel equivalence relations on Polish spaces is an understanding of the kind of countable (first-order) structures that can be assigned in a uniform Borel way to each equivalence class of a given equivalence relation. I will discuss some recent results, in particular concerning the notion of smoothness (concrete classifiability) of equivalence relations, and open problems.

- **Brice Mbombo**, *TBA* .

- **Michael Megrelishvili**, *Order, tame systems and topological groups* .

We study order preserving dynamical systems. Among some applications we discuss:

- (a) tameness of some coding sequences and symbolic systems;
- (b) Rosenthal representable topological groups G and (WRN) G -spaces;
- (c) topological groups G the universal minimal G -system $M(G)$ of which is tame.

The talk is based on a joint work with E. Glasner.

- **Ludomir Newelski**, *Is Ellis group model-theoretic?* .

We consider definable G -flows within a model M with complete theory T . Related to these flows are various derived objects, like the Ellis semigroup $S_{G,ext}(M)$ (which is the model-theoretic counterpart of βG) and its Ellis subgroups. The Ellis subgroups of $S_{G,ext}(M)$ are related to the model-theoretic connected components of G . However it is not clear, to what extent their structure reflects some properties of T , and to what extent it depends on the accidental set-theoretic nature of M (reflected in $S_{ext}(M)$). In particular, in general it is not clear if the Ellis subgroups of $S_{G,ext}(M)$ are related algebraically for various models of T . I will present some results related to this problem.

- **Aristotelis Panagiotopoulos**, *Compact spaces as quotients of projective Fraïssé limits* .

Projective Fraïssé structures were introduced by T.Irwin and S.Solecki and they were used to provide a very useful construction of a certain compact space known as the pseudo-arc. We develop a theory of projective Fraïssé limits in the Irwin-Solecki spirit which moreover support a dual structure. Let K be a totally disconnected, second countable, compact space. We prove that a subgroup G of $\text{Homeo}(K)$ is closed in the compact-open topology if and only if it is the automorphism group of some dual topological Fraïssé limit \mathbf{K} on domain K . As an application we prove that every second countable, compact space is the the quotient of topological Fraïssé limit \mathbf{K} with a closed equivalence relation on K that is definable in \mathbf{K} .

- **Anand Pillay**, *Some interactions between model theory and topological dynamics*..

I will give a general outline of the model theoretic perspective on topological dynamics. Followed by a discussion of results and problems in one or more of the topics:

- definably amenable o-minimal groups
- new invariants of discrete groups,
- topological dynamics of the automorphism group of a saturated model, and
- compactifications of pseudofinite groups.

- **Christian Rosendal**, *Coarse geometry of topological groups*.

The large scale geometry of finitely or compactly generated groups has long been a central part of geometry, topology and group theory. An abstract approach to certain aspects of large scale geometry is given by the coarse spaces due to J. Roe of which finitely or compactly generated groups, metric spaces and Banach spaces are particular examples. By analogy with a classical description of the left-invariant uniformity, we define a canonical left-invariant coarse structure on every topological group. This coincides with the previously mentioned cases, but also identifies natural structure in more general topological groups such as homeomorphism groups and other topological transformation groups.

- **Marcin Sabok**, *Topological conjugacy of Toeplitz subshifts*.

We will discuss the the descriptive set theoretic complexity of the equivalence relation of conjugacy of Toeplitz subshifts of a residually finite group G . On the one hand, we will see that if G is the group of integers, then topological conjugacy on Toeplitz subshifts with separated holes is amenable. In contrast, if G is non-amenable, then conjugacy of Toeplitz G -subshifts is a non-amenable equivalence relation. The results are motivated by a general question, asked by Gao, Jackson and Seward, about the complexity of conjugacy for minimal, free subshifts of countable groups. This is joint work with Todor Tsankov.

- **Pierre Simon**, *Compact domination for NIP groups*. I will discuss the phenomenon of compact domination in NIP definably amenable groups, of which various versions exist. The analogue in topological dynamics is the property of being almost automorphic. The first compact domination result was proved by Hrushovski and Pillay for definably

compact groups in o-minimal theories. Then Chernikov and myself proved generic compact domination for the Baire ideal in the context of definably amenable NIP groups. This yields as an application a solution to the Ellis group conjecture of Newelski and Pillay. Lebesgue generic compact domination for the same class of groups was finally proved later using an additional purely geometric ingredient.

- **Katrin Tent**, *Ample geometries of finite Morley rank*.

- **Benjamin Weiss**, *Topological and smooth models for dynamical systems* .

Ergodic theory concerns itself with measure preserving actions of groups up to a natural notion of isomorphism. When the measure space has additional structure such as a topology, or a smooth structure this may impose restrictions on the isomorphism class. For example, one of the oldest open problems in smooth dynamics is the question as to what are the isomorphism classes of the smooth diffeomorphisms of compact manifolds that preserve a "Lebesgue" measure. I will survey some of the work that has been done around this general theme.

- **Phillip Wesolek**, *Automatic continuity notions and locally compact Polish groups* .

Joint with François Le Maître) We begin with a discussion of a hierarchy of automatic continuity notions. We then study these properties in various locally compact Polish groups. We first show certain profinite branch groups have the small index property, and as a corollary, we obtain the first example of a non-discrete compactly generated simple locally compact Polish group with the SIP. We next consider the special linear group over the p-adic integers. We show this group fails the small index property, but it does have the automatic continuity property into Polish groups with two sided invariant metrics. We conclude by mentioning a few open questions.

- **Joseph Zielinski**, *The complexity of the homeomorphism relation between compact metric spaces*.

For equivalence relations E and F on Polish spaces X and Y , respectively, E is Borel reducible to F when there is a Borel-measurable function from X to Y satisfying xEy iff $f(x)Ff(y)$. H. Becker and A.S. Kechris demonstrated that there are equivalence relations arising from Polish group actions that reduce all other such orbit equivalence relations. Moreover, J.D. Clemens, S. Gao, Kechris, J. Melleray, and M. Sabok, have variously shown that the natural relations of isometry between separable complete metric spaces, linear isometry between separable Banach spaces, and isomorphism of separable C^* -algebras share the same Borel-reducibility degree with these maximal orbit equivalence relations.

We outline a proof that the relation of homeomorphism between metrizable compact spaces is also Borel bireducible with the complete orbit equivalence relations of Polish group actions.

- **Andy Zucker**, *Permutation groups with metrizable universal minimal flow* .

In this talk, we will give a necessary and sufficient combinatorial condition for the automorphism group of a countable first order structure to have metrizable universal minimal flow. Along the way, we will construct the Samuel compactification of such a group and see how this universal object can be used to extract information about the dynamics of the original group.