

Daily Schedule

Applications of Model Theory to Operator Algebras

TIME	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
10:00 AM		Intro to Logic and Model Theory	Nik Weaver	Eusebio Gardella	Ping Wong Ng	Søren Eilers	
10:30 AM		by Greg Oman					
11:00 AM		Break	Break	Break	Break	Break	
11:30 AM		Ilijas Farah Talk #1	Ilijas Farah Talk #2	Ilijas Farah Talk #3	Ilijas Farah Talk #4	Ilijas Farah Talk #5	
12:00 PM							
12:30 PM		Lunch	Lunch	Lunch	Free Afternoon	Lunch	
1:00 PM		Lunch	Lunch	Lunch		Lunch	
1:30 PM		Lunch	Lunch	Lunch		Lunch	
2:00 PM		Astrid an Huef	Piotr Koszmider	Martino Lupini		Stephen Hardy	
2:30 PM							
3:00 PM		Reception (chance to meet other	Break	Break		David Blecher	
3:30 PM		participants, talk math, and socialize)	Efren Ruiz	Marcin Sabok			
4:00 PM							
4:30 PM					Conference Dinner at 7PM. Held at		
5:00 PM					Calhoun's Rooftop		

MONDAY

Speaker: Greg Oman (University of Colorado, Colorado Springs)

Title: Introduction to Model Theory with Applications to Algebra

Abstract: We will begin by discussing the syntax and semantics of first-order languages (this talk does not assume any background in logic). We will then discuss some fundamentals of model theory including completeness of theories, compactness, Lowenheim-Skolem Theorems, axiomatizability, and elementary submodels. We will illustrate these ideas through examples taken from some recent papers. In particular, we will work in groups, rings, and fields. Only basic graduate algebra will be required to understand the results presented in this talk.

Note: This talk will provide background on topics from logic, set theory, and model theory that will be useful for Ilijas Farah's series of talks. This introduction is aimed at graduate students and researchers who do not work primarily in these topics.

Ilijas Farah's Talk #1, delivered by Martino Lupini (Caltech)

Title: Model theory of metric structures

Topics: Introduction to model theory for metric structures, with an emphasis on its applications to C^* -algebras.

Speaker: Astrid an Huef (Victoria University of Wellington, New Zealand)

Title: Stable finiteness and pure infiniteness of the C^* -algebras of higher-rank graphs

Abstract: The C^* -algebras of higher-rank graphs have proved to be a tractable and useful class of examples which can be used to solve major problems. For example, they were used by Ruiz, Sims and Sørensen to show that all UCT-Kirchberg algebras, regardless of their K-theory, have nuclear dimension one.

For simple C^* -algebras of directed graphs, there is a dichotomy: they are either AF or purely infinite. This dichotomy does not extend to higher-rank graphs. For example, the rank-2 Bratteli diagrams, constructed by Pask, Raeburn, Rørdam and Sims, give $\mathcal{AT}$ algebras, which are neither AF nor purely infinite. It has been conjectured that there may instead be a stable finiteness/purely infiniteness dichotomy for the C^* -algebras of higher-rank graphs. I will survey recent results.

TUESDAY

Speaker: Nik Weaver

Title: Ideas about the general Stone-Weierstrass problem

Abstract: The general Stone-Weierstrass problem asks: if a unital C^* -subalgebra B of a unital C^* -algebra A separates the pure states of A , does this imply that $B = A$? This question is unsettled in the separable case, but the diamond principle offers a possible route to a nonseparable counterexample.

Ilijas Farah's Talk #2, delivered by Martino Lupini (Caltech)

Title: Axiomatizability and definability

Topics: Axiomatizable classes of C^* -algebras. Definable sets and definable properties.

Speaker: Piotr Koszmider (Mathematical Institute of the Polish Academy of Sciences)

Title: Locally finite-dimensional operator algebras and some transfinite combinatorial structures

Abstract: A C^* -algebra A is said to be locally finite-dimensional if finite subsets of A can be approximated from finite-dimensional subalgebras. We survey our recent joint results with T. Bice, S. Ghasemi and C. Hida concerning some locally finite-dimensional nonseparable operator algebras in $\mathcal{B}(\ell_2)$. They fall into topics like:

- (1) Scattered C^* -algebras, their structure, stability, extensions and coronas,
- (2) Nonseparable C^* -algebras with no nonseparable abelian subalgebras,
- (3) Various versions of “approximately finite” for nonseparable C^* -algebras,
- (4) The existence of $\ll$ -increasing approximate units.

The methods are inspired by commutative combinatorial set theory (trees, almost disjoint families, gaps, Q -sets) and often mix with logic, in particular some of the results depend on extra combinatorics and are undecidable.

Speaker: Efren Ruiz (University of Hawai'i at Hilo)

Title: Groupoid C^* -algebras and their canonical diagonal subalgebras

Abstract: Recent amazing results of Matsumoto-Matui and Carlsen-Eilers-Ortega-Restorff show that two shift spaces of finite type are flow equivalent if and only if there is a stable isomorphism between the associated Cuntz-Krieger algebras that preserves the canonical diagonal subalgebras. One of the key component in obtaining these results is the realization that the groupoid associated to the shift space of finite type can be reconstructed from the Cuntz-Krieger algebra and its canonical diagonal subalgebra. In this talk, I will be reporting on preliminary work with Toke Carlsen, Aidan Sims, and Mark Tomforde. Building on the results of Kumjian, Renault, and Brownlowe-Carlsen-Whittaker, we show that for a second-countable locally compact étale groupoid G whose interior of the isotropy subgroupoid is abelian and torsion free, G may be recovered from the associated reduced groupoid C^* -algebra and its canonical diagonal. Consequently, two groupoids satisfying the above assumptions are isomorphic if and only if there is an isomorphism between the reduced groupoid C^* -algebras preserving the canonical diagonal subalgebras.

WEDNESDAY

Speaker: Eusebio Gardella (University of Münster)

Title: Amenability and actions on strongly self-absorbing C^* -algebras

Abstract: Amenability for discrete groups admits a surprisingly long list of equivalent formulations. Some of them are purely group-theoretic (like the Følner condition), some are measure-theoretic (existence of a left invariant mean), and some are phrased in terms of operator algebras (hyperfiniteness of the group von Neumann algebra, or nuclearity of the reduced group C^* -algebra). Here, we are interested in certain characterizations of amenability that are related to actions of the group. These characterizations usually come in the form of a dichotomy: roughly speaking, they assert that there is an object in the relevant category (like the standard probability space, the hyperfinite II_1 -factor, etc), on which every amenable group acts in an essentially unique way, while every nonamenable group admits a continuum of non-equivalent actions (and the equivalence relation of such actions is not even Borel).

In this talk, we will discuss the possibility of characterizing of amenability in terms of actions on strongly self-absorbing C^* -algebras, with focus on the non-amenable part of the dichotomy. Our main result asserts that any group with property (T), which is a strong form of nonamenability, admits uncountably many non-cocycle equivalent actions on any UHF-algebra (of infinite type), and that this relation is not Borel.

This is joint work with Martino Lupini.

Ilijas Farah's Talk #3, delivered by Martino Lupini (Caltech)

Title: Massive C^* -algebras

Topics: Ultraproducts and central sequence algebras. Algebras with approximately inner flip, strongly self-absorbing C^* -algebras, and their ultrapowers.

Speaker: Martino Lupini (Caltech)

Title: A notion of dimension for inclusion of C^* -algebras, and applications

Abstract: I will present a notion of dimension for equivariant inclusions of C^* -algebras endowed with a G -action for a given compact (quantum) group G . I will explain how this notion allows one to 1) give a unified conceptual approach to several preservation results for actions with finite Rokhlin dimension, and 2) generalize them to the setting of compact quantum group actions. This is joint work with Eusebio Gardella and Mehrdad Kalantar.

Speaker: Marcin Sabok (McGill University)

Title: Hyperfiniteness of boundary actions of cubulated hyperbolic groups

Abstract: An old result of Dougherty, Jackson, and KeCHRIS implies that the boundary action of the free group F_2 induces a hyperfinite equivalence relation. During the talk, I will discuss generalizations of this theorem to the class of hyperbolic groups. The examples discussed will include groups acting properly and cocompactly on $\text{CAT}(0)$ cube complexes. This is joint work with Jingyin Huang and Forte Shinko.

THURSDAY

Speaker: Ping Wong Ng (University of Louisiana at Lafayette)

Title: Purely infinite corona algebras, extensions, and double commutants

Abstract: TBA.

Ilijas Farah's Talk #4, delivered by Martino Lupini (Caltech)

Title: The effect of the Continuum Hypothesis

Topics: The number of nonisomorphic ultrapowers of a C^* -algebra. An abstract characterization of the ultrapower of a C^* -algebra associated with a nonprincipal ultrafilter.

Thursday afternoon will be a free afternoon during which you can explore Houston or spend some time on your own. All museums in the Houston Museum District have free general admission on Thursdays (although special exhibits may still cost a fee). There are some suggestions of things to do in Houston on the Conference Website.

The Banquet is scheduled for Thursday evening at 7PM.

FRIDAY

Speaker: Søren Eilers (University of Copenhagen)

Title: Decidability questions for Cuntz-Krieger algebras and their underlying dynamics

Abstract: In recent years, driven in large part by ideas of Kengo Matsumoto, it has become clear that the isomorphism classes of Cuntz-Krieger algebras retain substantial information of the underlying dynamics provided one requires the isomorphisms to respect certain additional structure. I will discuss some consequences for the question of whether or not these concepts of isomorphisms are decidable, and to which extent the phenomena observed can be generalized to graph C^* -algebras.

Ilijas Farah's Talk #5, delivered by Martino Lupini (Caltech)

Title: Omitting types and model-theoretic forcing

Topics: Model theory and the Elliott classification programme. Model-theoretic description of regularity properties of C^* -algebras, and applications. Construction of generic C^* -algebras.

Speaker: Stephen Hardy (Washington & Lee University)

Title: Pseudocompact C^* -algebras

Abstract: Historically, C^* -algebras which are built from finite-dimensional C^* -algebras in nice ways have been tractable. For instance, the algebra of compact operators (norm limits of finite rank operators), and the AF C^* -algebras (inductive limits of finite-dimensional C^* -algebras) are well understood. Instead of norm limits or inductive limits, we study the logical limits of finite-dimensional C^* -algebras. These logical limits of matrix algebras are called the pseudocompact C^* -algebras. This idea was first used by Ax to study the logical limits of finite fields. The analogous metric objects were introduced by Goldbring and Lopes, using the continuous logic due to Ben Yaacov, Berenstein, Henson, and Usvyatsov. We will explore the finiteness properties and K -theory of pseudocompact C^* -algebras.

Speaker: David Blecher (University of Houston)

Title: Noncommutative peak sets and operator algebras

Abstract: We begin with the classical theory of peak sets, and their applications. Then we turn to the noncommutative variant in operator algebras (Hay, and the author with Hay, Read, Neal, and others). We describe recent work with Labuschagne on noncommutative peak sets in subalgebras of sigma-finite von Neumann algebras, and with Weaver in more general von Neumann algebras (relating a theorem of Ueda to the set theory of 'regular states'). In the last part we discuss some work in progress on noncommutative peak sets and states in more general algebras.