ICM Operator Algebras Satellite Conference - ICMOA - 6th Florianópolis-Münster-Ottawa meeting

This conference is dedicated to the
60th birthday of Prof. Ruy Exel

July 26-30, 2018 in Florianópolis, Santa Catarina, Brazil

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CAPES


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Contents

Subject of the conference

Operator Algebras originated in the work of von Neumann, in his search for a mathematical framework for quantum mechanics, and of Gelfand and Naimark. They are the noncommutative versions of measure theory, topology and differential geometry and have deep ties with operator theory, ergodic theory, harmonic analysis, representation theory and quantum physics. In recent years the connections with other fields have guaranteed to Operator Algebras a central role in Mathematics, as it is seen from the work of A. Connes in noncommutative geometry and V. Jones in polynomial invariants. One of the many ramifications of these developments is the fruitful interaction with Dynamical Systems. The deep connections between Ergodic Theory and von Neumann algebras, established in the 70's by A. Connes, W. Krieger, J. Feldman, C. Moore and others, has recently found its counterpart in equally deep connections linking Topological Dynamics and C*-algebras. For example, for the class of symbolic dynamical systems there exists a correspondence with the theory of C*-algebras (through the notion of crossed products and their K-theory groups). For Markov shifts, for example, the corresponding C*-algebra is the well known Cuntz-Krieger algebra and its K0-group is the known invariant introduced by Bowen and Franks in 1977. The theory of operator algebras is undoubtedly one of the domains in Mathematics most notable for the depth of its problems, the richness of its new ideas, its connections to so many different fields, and its great potential as a unifying language and source of illumination.

Abstracts

Morita enveloping Fell bundles

07/28, 10:00 - 10:30

Fernando Abadie
Universidad de la República

We introduce notions of weak and strong equivalence for non- saturated Fell bundles over locally compact groups and show that every Fell bundle is strongly (resp. weakly) equivalent to a semidirect product Fell bundle for a partial (resp. global) action.

A new class of ample étale groupoids

07/29, 8:40 - 9:10

Pere Ara
Universitat Autònoma de Barcelona

For an ample étale groupoid $\mathcal{G}$, one may define a certain *type semigroup* $\mathrm{Typ}(\mathcal{G})$, which generalizes the type semigroup associated to an action of a discrete group on a totally disconnected topological space. This type semigroup is always a refinement monoid, i.e., it satisfies the Riesz refinement property. For each finitely generated conical refinement monoid M we build an ample Hausdorff étale topological groupoid $\mathcal{G}_M$ such that the type semigroup of $\mathcal{G}_M$ is canonically isomorphic to M. We can understand this groupoid as a categorification of M. The construction uses a classification result for such monoids in terms of combinatorial data, due to E. Pardo and the presenter, which allows us to represent them as monoids associated to certain separated graphs. We then are able to associate to each of these separated graphs a certain well-behaved inverse semigroup. Using this inverse semigroup, we follow standard techniques to build an ample étale Hausdorff groupoid $\mathcal{G}_M$ with the desired property that $\mathrm{Typ}(\mathcal{G}_M) \cong M$. Extending early constructions of Brustenga and the presenter, we aim to show that, for any field K, a suitable universal localization $\Sigma^{-1}A_K(\mathcal{G}_M)$ of the Steinberg algebra $A_K(\mathcal{G}_M)$ is von

Neumann regular, and satisfies that its monoid of finitely generated projective modules is isomorphic to M. We also raise the question of whether the natural map $M \cong \mathrm{Typ}(\mathcal{G}_M) \to \mathcal{V}(C^*(\mathcal{G}_M))$ is injective.

This is joint work in progress with J. Bosa, E. Pardo and A. Sims

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07/29, 10:00 - 10:30

Quantitative E-theory

Sarah Browne
Penn State University

Quantitative E-theory is an ongoing project joint with Nate Brown which aims to create a new approach to tackling results like the Universal Coefficient Theorem for new classes of C*-algebras. In recent years, many people have been working on classifying C*-algebras and these results assume the UCT, which requires further understanding. The inspiration is work by Oyono-Oyono-Yu, who used a quantitative approach of K-theory to prove the KÃ$\frac{1}{4}$nneth Theorem for new classes of C*-algebras. An ongoing project of Willett-Yu extends the quantitative approach to the KK-context. Quantitative E-theory is a generalisation of E-theory and so I will begin my talk by defining the notion of E-theory and talk about how we get the definition of Quantitative E-theory. Then I will state results connecting this definition to E-theory.

07/30, 11:40 - 12:10

The smallest exact crossed-product functor

Alcides Buss
Universidade Federal de Santa Catarina

The original Baum-Connes conjecture with coefficients predicted that a certain assembly map

$$\mu_A : K_*^G(\mathcal{E}(G), A) \to K_*(A \rtimes_r G)$$

from the topological K-theory of G with coefficient A in the K-theory of the reduced crossed product $A \rtimes_r G$ should always be an isomorphism. This turned out to be wrong due to the existence of groups G, for which the reduced crossed-product functor is not exact in the sense that it maps short exact sequences of G-C*-algebras into short exact sequences of C*-algebras.

Recently, Baum, Guentner and Willett proposed to replace the reduced crossed-product functor by the smallest *Morita compatible exact* crossed-product functor which dominates the reduced crossed product.

In this lecture we report on recent joint work with Siegfried Echterhoff and Rufus Willett on concrete constructions and properties of the smallest exact crossed product. Among other results we show that the smallest exact crossed product is automatically Morita compatible and that the corresponding group C*-algebra always coincides with the reduced group C*-algebra, thus showing that the new formulation of the Baum-Connes conjecture coincides with the classical one in the case of trivial coefficients.

Simplicity of algebras associated to non-Hausdorff groupoids

07/26, 9:20 - 9:50

Lisa Orloff Clark

Victoria University of Wellington

In this talk, we investigate the simplicity of both Steinberg algebras and C^*-algebras associated to non-Hausdorff groupoids. First, we discuss the obstructions when moving from the Hausdorff to the non-Hausdorff case. Then we present a uniqueness theorem and characterisation of simplicity.

This is joint work with Ruy Exel, Enrique Pardo, Aidan Sims and Charles Starling.

Norm attainment under finite-dimensional representations

07/26, 11:00 - 11:30

Kristin Courtney

University of Virginia

A residually finite-dimensional (RFD) C^*-algebra is one for which the norm of every element equals the supremum of its norms under finite-dimensional representations. Inspired by recent results of Fritz, Netzer, and Thom for the full group C^*-algebra of a free group, we consider the set of elements for which this supremum is a maximum: when is it dense, when is it an algebra, and when is it equal to the whole algebra? To answer the latter two questions, we develop a technique using AF mapping telescopes, which has since found application in a number of other results. This is joint work with Tatiana Shulman.

07/27, 16:30 - 17:00

C*-algebras associated to toric varieties (the higher dimensional case)

Joachim Cuntz
Universität Münster

The coordinate ring of a toric variety is, by definition, the group ring of a finitely generated subsemigroup of Z^n. In a previous paper we had considered the two-dimensional case and computed the K-theory for the semigroup C*-algebra of a subsemigroup of Z^2. In this talk we describe a new completely different method that permits the computation of the K-theory of the C*-algebra for higher dimensional toric semigroup. The method is based on a new phenomenon in K-theory.

07/27, 15:20 - 15:50

Recovering the boundary path space of a topological graph using pointless topology

Gilles de Castro
Universidade Federal de Santa Catarina

From a topological graph E, Katsura built two C*-algebras, $\mathcal{T}(E)$ and $\mathcal{O}(E)$, which are sometimes called the Toeplitz C*-algebra and Cuntz-Krieger algebra associated to E, respectively, by considering a C* - correspondence. Yeend showed that these algebras can be seen as groupoid C*-algebras, and the passage from $\mathcal{T}(E)$ to $\mathcal{O}(E)$ corresponds to reducing a groupoid by restricting its unit space, which is the set of all finite and infinite paths on the graph, to the boundary path space.

When the graphs are discrete, going from the set all paths to the boundary path space can also be seen from the point of view of inverse semigroups and their idempotents semilattice. In this case, we restrict the characters on the idempotents to the tight characters defined by Exel. The framework developed by Exel does not work well in the case of topological graphs, because the spaces he finds are all totally disconnected, whereas the path space of a topological graph does not need to be. In order to circumvent this problem, we propose another approach to look at this reduction, namely using pointless topology. This theory allows us to find a subspace of a topological space by considering some relations on its open sets. We show how the relations defining a graph C*-algebra in the discrete case can be used to define relations on the open sets of the space of all paths, and then generalize to arbitrary topological graphs. The subspace given by these relations is exactly the boundary path space.

Partial cohomology and partial projective representations

07/26, 14:40 - 15:10

Mikhailo Dokuchaev
Universidade de São Paulo

Influenced by developments around partial actions and partial representations, the concept of a partial projective group representation was introduced in [2] together with the notion of the corresponding Schur multiplier. A better understanding of the Schur multiplier was achieved in [3]. On the other hand, motivated by the desire to give a cohomological basis for the concept of a twisted partial group action defined by Ruy Exel in [4], group cohomology based on partial action was worked out in [1], also relating it to the partial Schur multiplier. Notice that partial group cohomology and, in a certain sense, partial projective group representations, naturally appeared also in the study of ideals of reduced C^*-crossed product [5].

Now, in a joint work with Nicola Sambonet, we introduce relative partial group cohomology (for $n = 2$) and use it to refine a structural result from [3] on the partial Schur multiplier. The relative partial cohomology is consistent with the cohomology theory in [1], and we improve the relation between the partial cohomology and the Schur multiplier given in [1].

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07/29, 11:40 - 12:10

Matricial stability of discrete groups

Søren Eilers
University of Copenhagen

The famous Voiculescu matrices show that the group C^*-algebra of $\mathbb{Z}^2$ fails to be matricially weakly semiprojective, or – which is the same – that it is not possible to perturb an almost representation of this group into a matrix algebra $M_n(\mathbb{C})$ to obtain an exact representation uniformly in all n.

We consider this classical fact in the context of crystallographic groups, and find that of the 17 such groups at dimension two (the so-called wallpaper groups), exactly 12 are matricially stable. This somewhat surprising fact can be explained via K-theory because of early work of Exel and Loring.

Further results on semiprojectivity properties of group C^*-algebras will also be presented. This is joint work with Shulman and Sørensen.

07/29, 16:30 - 17:00

Recent progress in the classification of non-unital simple C*-algebras

George Elliott
University of Toronto

Recent results with Gong, Lin, and Niu concerning the classification of non-unital simple separable C*-algebras with finite nuclear dimension and satisfying the UCT will be discussed.

07/29, 9:20 - 9:50

Covariance algebra of a product system

Camila Fabre Sehnem
University of Göttingen

Let P be a unital subsemigroup of a group G. Given a product system $\mathcal{E} = (\mathcal{E}_p)_{p\in P}$, we consider a certain gauge-invariant ideal of the Toeplitz algebra of $\mathcal{E}$. We define the covariance algebra of $\mathcal{E}$, denoted by $A \times_{\mathcal{E}} P$, to be the corresponding quotient C^*-algebra. A representation of $A \times_{\mathcal{E}} P$ is injective on the fixed-point algebra for the canonical coaction of G if and only if it is injective on the coefficient C^*h-algebra A. In particular, our construction contains Cuntz–Pimsner algebras of single correspondences and a class of Cuntz–Nica–Pimsner algebras of compactly aligned product systems. Under the appropriate assumptions, we may describe

Fowler's Cuntz–Pimsner algebras, semigroup C^*-algebras of Xin Li and Exel's crossed products by interaction groups as covariance algebras of product systems.

Rigidity for uniform Roe algebras and coronas

07/27, 14:00 - 14:30

Ilijas Farah
York University

When does isomorphism of uniform Roe algebras associated imply coarse equivalence of the underlying coarse spaces? A recent result of Spakula and Willett gives sufficient conditions in the case of coarse metric spaces. These conditions are uniform discreteness and property A (the 'coarse' analogue of amenability). IÕll discuss recent progress on weakening these conditions. Very recently, these rigidity results were extended to Roe coronas (quotients of uniform Roe algebras modulo the compact operators). No previous knowledge of coarse spaces, Roe algebras, or logic is required. (This is a joint work with Bruno De Mendoca Braga and Alessandro Vignati.)

Cubical versus categorical (co-)homology for k-graphs

07/27, 9:20 - 9:50

Elizabeth Gillaspy
University of Montana

Higher-rank graphs (k-graphs) are category theoretic objects which can also be viewed as generalizations of directed graphs. In order to better understand the C*-algebras associated to k-graphs, Kumjian, Pask, and Sims introduced two cohomology theories for k-graphs. Using ad hoc methods, Kumjian, Pask, and Sims showed that the ith categorical and cubical cohomology groups of a k-graph are isomorphic for $i \leq 2$ This talk presents recent joint work with Jianchao Wu, in which we show that for all $i \in \mathbb{Z}$ the ith cubical and categorical homology and cohomology groups of any k-graph are isomorphic. This proves a conjecture posed by Kumjian, Pask, and Sims in 2015, and also uncovers more structural information about the categorical (co-)homology groups.

Our first proof of this result relies on the topological realization of a k-graph (as defined by Kaliszewski, Kumjian, Quigg, and Sims) and the reformulation of categorical cohomology using Λ -modules, as introduced by Gillaspy and Kumjian. Time permitting, we will also present our more computational second proof, which gives an explicit formula for passing between cubical and categorical (co-)cycles.

07/30, 8:40 - 9:10

A relative bi-commutant theorem: a partial answer to a question raised by G. Pedersen

Thierry Giordano

University of Ottawa

In his seminal paper in 1976, D. Voiculescu proved that any separable unital C*-subalgebras of the Calkin algebra is equal to its relative bi-commutant. In 1988, G. Pedersen asked if Voiculescu's theorem can be extended to the case of simple corona algebras. In this talk, I will present a partial answer to this result, obtained in a joint work with Ping W. Ng.

07/26, 16:30 - 17:00

Certain unitary representations of Thompson's groups F and T

Vaughan F. R. Jones

Vanderbilt University

Physical considerations led to the construction of unitary representations of Thompson groups. We guess that certain specific subrepresentations are all irreducible and can prove it in some cases of interest. A categorical approach allows one to extend this family of representations considerably and we show that a certain "easy" family of them actually factor through a known representation in the Cuntz algebra. This is due to a category-theoretic construction of Anna-Marie Bohman.

07/27, 14:40 - 15:10

Graded K-theory and graph algebras

Alexander Kumjian

University of Nevada, Reno

Graph algebras carry natural $\mathbb{Z}/2$-gradings. My coauthors David Pask, Aidan Sims and I compute the K-theory of graded graph C^*-algebras and derive a graded version of the Pimsner-Voiculescu six-term exact sequence. We compute the graded K-theory of a number of examples.

Equilibrium states an growth of quasi-lattice ordered monoids

07/28, 8:40 - 9:10

Marcelo Laca
University of Victoria

Each multiplicative real-valued homomorphism on a quasi-lattice ordered monoid gives rise to a quasi-periodic dynamics on the associated Toeplitz C*-algebra and we study the KMS equilibrium states of the resulting C*-dynamical system. We show that there is unique equilibrium above a critical inverse temperature that is the largest real pole of the partition function of the system. Motivated by this, we give a proof of the inversion formula for the growth series of a quasi-lattice ordered monoid in terms of the clique polynomial for the finitely generated case, and of the skew-growth series for the infinitely generated case as in recent work of Albenque-Nadeau, McMullen, and Saito.

Diagonal dimension for C*-pairs

07/30, 10:00 - 10:30

Kang Li
Polish Academy of Sciences (IMPAN)

We will introduce the notion of diagonal dimension for diagonal pairs of C*-algebras and compare it with usual nuclear dimension for C*-algebras. We show that the diagonal dimension of a uniform Roe algebra with respect to the standard diagonal is equal to the asymptotic dimension of its underlying metric space. Finally, we will discuss its relation to dynamic asymptotic dimension of groupoids introduced by Guentner, Willett and Yu and (fine) tower dimension of topological dynamical systems introduced by Kerr.

This is joint work with Hung-Chang Liao and Wilhelm Winter.

Constructing Cartan subalgebras in classifiable C*-algebras

07/29, 11:00 - 11:30

Xin Li
Queen Mary University of London

I will explain how to construct Cartan subalgebras in classifiable C*-algebras.

07/29, 15:20 - 15:50

Quasi-invariant probabilities for continuous groupoids on the simbolic space and spectral triplets

Artur Oscar Lopes

Universidade Federal do Rio Grande do Sul

We will consider a certain family of Haar systems and the associated Von Neumann Algebra. For a family of Holder cocycles we will describe the quasi-invariant probability associated to the corresponding KMS as an eigenprobability for the dual of the Ruelle operator. Another result will relate this probability in a naturally way to a Dirac operator and to Dixmier trace representation. We will present some examples of the theory. All this can be generalized to a large class of groupoids by considering another operator called the Haar-Ruelle operator which is associated to iterated function systems.

07/30, 14:00 - 14:30

Groupoid models for diagrams of Ètale topological groupoids

Ralf Meyer

Universität Göttingen

I introduce a bicategory of Ètale topological groupoids that unifies topological graphs and self-similarities of groups or graphs. Diagrams in this bicategory generalise many types of dynamical systems, including higher-rank topological graphs or complexes of groups. The groupoid model of such a diagram encodes it in a single groupoid. It always exists and is described more concretely in many cases. In particular, the groupoids associated to self-similar groups or actions of Ore monoids by topological correspondences are such groupoid models, and the fundamental group of a complex of groups is equivalent to a groupoid model. For a proper diagram over an Ore monoid, the C*-algebra of the groupoid model is isomorphic to the Cuntz-Pimsner algebra of the product system built from the diagram. In general, both C*-algebras may differ, as in the case of a separated graph C*-algebra and its tame variant.

On the K-theory of C^*-algebras for substitution tilings

07/28, 11:00 - 11:30

Maria Nørgård-Solano

University of Southern Denmark

Under suitable conditions, a substitution tiling gives rise to a Smale space, from which three equivalence relations can be constructed, namely the stable, unstable, and asymptotic equivalence relations. I denote with S, U, and A their corresponding C^*-algebras in the sense of Renault. In this talk I will show that the K-theories of S and U can be computed from the cohomology and homology of a single cochain complex with connecting maps for tilings of the line and of the plane. Moreover, I provide formulas to compute the K-theory for these three C^*-algebras. Furthermore, I show that the K-theory groups for tilings of dimension 1 are always torsion free. For tilings of dimension 2, only $K_0(U)$ and $K_1(S)$ can contain torsion.

The classification of simple separable nuclear C*-algebras

07/29, 14:40 - 15:10

Zhuang Niu

University of Wyoming

I will talk about the classification of simple separable amenable C*-algebras with finite nuclear dimensions. In particular, I will talk about stable uniqueness theorems and tracial approximations, for both unital C*-algebras and non-unital C*-algebras.

The talk is based on joint works with George Elliott, Guihua Gong, and Huaxin Lin.

07/28, 9:20 - 9:50

A Generalised uniqueness theorem and the graded ideal structure of Steinberg algebras

Enrique Pardo
Universidad de Cádiz

Given an ample, Hausdorff groupoid $\mathcal{G}$, and a unital commutative ring R, we consider the Steinberg algebra $A_R(\mathcal{G})$. First we prove a uniqueness theorem for this algebra and then, when $\mathcal{G}$ is graded by a cocycle, we study graded ideals in $A_R(\mathcal{G})$. Applications are given for two classes of ample groupoids, namely those coming from actions of groups on graphs, and also to groupoids defined in terms of Boolean dynamical systems.

This is a joint work with Lisa Orloff Clark (Victoria University, Wellington, New Zealand) and Ruy Exel (Universidade Federal de Santa Catarina, Florianópolis, Brazil), that will appear in Forum Mathematicum (DOI: https://doi.org/10.1515/forum-2016-0197).

07/29, 14:00 - 14:30

Tracial Z-stability in the nonunital case

Chris Phillips
University of Oregon

We give a nonunital version of Hirshberg and Orovitz's tracial Z-stability, and we give some clarification of its role even in the unital case.

Joint work with Massoud Amini, Nasser Golestani, and Saeid Jamali.

07/30, 15:20 - 15:50

Twists For Regular Inclusions From UCP Maps

David Pitts
University of Nebraska–Lincoln

Generalizing work of Kumjian, Renault has shown that isomorphism classes of Cartan pairs are in bijective correspondence with isomorphism classes of certain types of twisted groupoid extensions.

Given a Cartan pair $(\mathcal{C}, \mathcal{D})$, the Kumjian-Renault methods heavily use the faithful conditional expectation $E : \mathcal{C} \to \mathcal{D}$ in the construction of the twist. However, there are natural examples of regular MASA inclusions $\mathcal{D} \subseteq \mathcal{C}$ where there is no conditional expectation of $\mathcal{C}$ onto $\mathcal{D}$, and given the success of the Kumjian-Renault theory, it is desirable to seek twists associated to such pairs.

Given any regular inclusion $\mathcal{D} \subseteq \mathcal{C}$ with $\mathcal{D}$ abelian, it is always possible to find an abelian C^*-algebra $\mathcal{D}_1 \supseteq \mathcal{D}$ and a UCP map $\Delta : \mathcal{C} \to \mathcal{D}_1$ such that $\Delta|_{\mathcal{D}} = \mathrm{Id}|_D$; in general there are many such choices. In this talk I will discuss conditions on Δ which ensure that a construction analagous to that used by Kumjian and Renault but using Δ instead of a conditional expectation yields a twist $(\Sigma, G)_\Delta$ associated to the pair $(\mathcal{C}, \mathcal{D})$ and Δ. In addition, there is a map $\theta : \mathcal{C} \to C_r^*((\Sigma, G)_\Delta)$ which, while possibly not onto, has dense range in an appropriate locally convex topology. Further, $\ker \theta = (0)$ when Δ is faithful. When $\mathcal{D} \subseteq \mathcal{C}$ is a regular MASA, there is a unique "minimal" choice for Δ and $C(\Sigma^\circ)$ is a Cartan subalgebra of $C_r^*((\Sigma, G)_\Delta)$.

If time permits, I will discuss the minimal and other choices for Δ for an example similar to the following. Let $\mathcal{A}_\lambda$ be the irrational rotation algebra generated by unitaries $U_\pm$ with $\lambda U_- U_+ = U_+ U_-$. Put $\mathcal{C} := C([-1, 1], \mathcal{A}_\lambda)$ and $\mathcal{D} = \{f \in \mathcal{C} : f(t) \in C^*(U_{\mathrm{sign}(t)})$ for $t \neq 0$; $f(0) \in \mathbb{C}I\}$. Here $\mathcal{D} \subseteq \mathcal{C}$ is a regular MASA yet there is no conditional expectation of $\mathcal{C}$ onto $\mathcal{D}$.

Bratteli diagrams and flat surfaces

7/27, 8:40 - 9:10

Ian Putnam
University of Victoria

A flat surface is really a pair of transverse foliations on a 2-dimensional (non-compact) manifold. Recently, Lindsey and Trevino have given a new construction of such objects from a bi-infinite ordered Bratteli diagram. We will give a short introduction to flat surfaces, discuss the Lindsey-Trevino construction and describe a rather surprising relation between the AF-algebra of the Bratteli diagram and the foliation C*-algebras of the flat surface. This is joint work, in progress, with Rodrigo Trevino.

Limits of proper G-spaces

07/26, 10:00 - 10:30

Jean Renault
Unversité d'Orléans

Cho-Ho Chu and Xin Li have recently shown that amenable measured groupoids have the Liouville property. Using their construction, it will be shown that every amenable G-space, where G is a locally compact groupoid with Haar system, is in a suitable sense the limit of a sequence of proper G-spaces.

07/27, 11:00 - 11:30

Further twisted groupoid C^*-algebras

Sarah Reznikoff

Kansas State University

We generalize Renault's results on Cartan subalgebras by showing that when a C^*-algebra $\mathcal{A}$ is acted upon by a compact abelian group, and D is a Cartan subalgebra of the fixed point algebra of this action, then $\mathcal{A}$ is the reduced C^*-algebra of a groupoid twist, and moreover the inclusion $D \subset \mathcal{A}$ is uniquely determined by this twist.

This is joint work with Jonathan Brown, Adam Fuller, and David Pitts.

07/26, 8:40 - 9:10

Dirac operators for "Matrix algebras converge to the sphere"

Marc Rieffel

University of California, Berkeley

In the high-energy quantum-physics literature one finds statements such as "matrix algebras converge to the sphere". Earlier I provided a general setting for understanding such statements, in which the matrix algebras are viewed as compact quantum metric spaces, and convergence is with respect to a quantum Gromov-Hausdorff-type distance. More recently I have dealt with corresponding statements in the literature about vector bundles on spheres and matrix algebras. I will very briefly indicate how some of this works. But physicists want, even more, to treat structures on spheres (and other spaces) such as Dirac operators, Yang-Mills functionals, etc., and they want to approximate these by corresponding structures on matrix algebras. I am currently exploring how to make precise the situation for Dirac operators. This is confusing because in the physics literature there are at least 3 inequivalent suggestions as to what the Dirac operators on the matrix algebras should be. This is work in progress. I will report on what I have found by the time of the meeting.

Equivariant concentration in topological groups

07/27, 10:00 - 10:30

Martin Schneider
Universidade Federal de Santa Catarina

In their groundbreaking 1983 work on topological applications of the isoperimetric inequality, Gromov and Milman linked the phenomenon of measure concentration with dynamics of large topological groups: they showed that any metrizable topological group G containing an increasing sequence of compact subgroups whose union is dense in G and whose normalized Haar measures have the Lévy concentration property with respect to some right-invariant compatible metric on G is extremely amenable, i.e., admits a fixed point whenever it acts continuously on a (non-void) compact Hausdorff space. In the late 1990s, Gromov offered a far-reaching extension of the measure concentration phenomenon, the concentration topology, defined on the set of isomorphism classes of metric measure spaces. This topology captures the classical phenomenon of measure concentration in a very natural way: a sequence of metric measure spaces has the Lévy property if and only if it converges to a singleton space with respect Gromov's concentration topology. However, the concentration topology allows for non-trivial limit objects. Inspired by striking applications of measure concentration in topological dynamics, in 2006 Pestov suggested to study manifestations of Gromov's concentration in the context of topological groups.

In the talk I will report on recent progress in that direction and answer two questions by Pestov. Among other things, I will present a generalization of the Gromov-Milman result suited for Gromov's concentration topology, and discuss some examples and related problems.

Decomposability of Leavitt path algebras

07/26, 15:20 - 15:50

Mercedes Siles Molina
Universidad de Málaga

The aim of this talk is to characterize whether or not the Leavitt path algebra of an arbitrary graph is decomposable, i.e., can be written as the direct sum of some of its ideals. There is a wide range of LPA which cannot be decomposed, for example, the simple or the graded simple ones; or such that their decompositions are known, for example the locally artinian or the locally noetherian. Decomposability can be expressed in terms of central idempotents of the algebra and key tools to prove our results will be the Steinberg algebras, as well as the structure

of the center of a Leavitt path algebra. We also give a characterization of undecomposable Leavitt path algebras in terms of their underlying graph. This is a joint work with Lisa O. Clark, Dolores Martin Barquero and Candido Martin Gonzalez.

07/27, 11:40 - 12:10

Non-Hausdorff groupoids arising from self-similar actions and simplicity of their algebras

Charles Starling
Carleton University

Work of Nekrashevych, Katsura, and Exel-Pardo describe a class of C*-algebras arising from the action of a group on a finite alphabet (or more generally, a finite graph). The above authors described these as groupoid C*-algebras and gave conditions which guaranteed their simplicity, usually starting from assumptions which imply the groupoid is Hausdorff. These groupoids need not be Hausdorff, notably for the self-similar action associated to the Grigorchuk group, so it was an open question whether the C*-algebra of the Grigorchuk group action was simple or not. We answer this question in the affirmative. We also show that the complex Steinberg algebra associated to the Grigorchuk group action is simple, while the Steinberg algebra over $\mathbb{Z}_2$ is (surprisingly) not. This is joint work with Lisa Orloff Clark, Ruy Exel, Enrique Pardo, and Aidan Sims.

07/26, 14:00 - 14:30

Diagonal preserving isomorphisms of etale groupoid algebras

Benjamin Steinberg
The City University of New York

Jean Renault, in his study of Cartan subalgeras, proved that a diagonal preserving isomorphism of C*-algebras of topologically principal etale groupoids implies the existence of an isomorphism of groupoids. Recently, people have considered the corresponding question for algebras of ample groupoids over rings. In this talk we present some of the strongest results on this subject to date, emphasizing the connection with the isomorphism problem for group rings. A key innovation in our approach is that ample groupoids satisfying our conditions are determined up to isomorphism by their algebra/diagonal subalgebra pair within the entire class of ample groupoids.

C^*-algebras of minimal dynamical systems and related groupoids with prescribed K-theory

07/30, 9:20 - 9:50

Karen Strung

Radboud University

Now that the classification of infinite dimensional simple separable unital C^*-algebras with finite nuclear dimension and which satisfy the UCT is complete, it becomes an interesting question to determine the range of the invariant for certain naturally-occurring subclasses. I will discuss joint work in progress with Robin Deeley and Ian Putnam that considers this question for the C^*-algebras arising from groupoids associated to minimal dynamical systems. In particular, I will discuss dynamical constructions which realize certain prescribed Elliott invariants.

Asymptotics of Cheeger constants and unitarisability of groups

07/30, 11:00 - 11:30

Andreas Thom

TU Dresden

Given a group Γ, we establish a connection between the unitarisability of its uniformly bounded representations and the asymptotic behaviour of the isoperimetric constants of Cayley graphs of Γ for increasingly large generating sets. The connection hinges on an analytic invariant $\mathrm{Lit}(\Gamma) \in [0, \infty]$ which we call the *Littlewood exponent*. Finiteness, amenability, unitarisability and the existence of free subgroups are related respectively to the thresholds $0, 1, 2$ and ∞ for $\mathrm{Lit}(\Gamma)$. Using graphical small cancellation theory, we prove that there exist groups Γ for which $1 < \mathrm{Lit}(\Gamma) < \infty$. Further applications, examples and problems are discussed.

07/26, 11:40 - 12:10

The orbit space of groupoids whose C^*-algebras are GCR or CCR

Danie van Wyk

Universidade Federal de Santa Catarina

We remove an amenability assumption in CCR and GCR characterizations of groupoid C^*-algebras by Lisa Clark. A C^*-algebra is GCR if its image under any irreducible representation contains the compact operators. It is CCR if its image under any irreducible representation is precisely the compact operators.

For a second-countable locally compact Hausdorff groupoid with amenable stabilizers, Clark gives necessary and sufficient conditions for the full groupoid C^*-algebra to be GCR or CCR. We will show that the assumption of amenability on the stabilizers of the groupoid is unnecessary. We will discuss the techniques used to remove this assumption, as they differ in the GCR and CCR cases.

07/30, 16:30 - 17:00

Dimension reduction phenomena for C*-algebras

Wilhelm Winter

WWU Münster

Topological dimension keeps track of how many colours are required to approximate a space by families of pairwise disjoint open subsets. One can also define noncommutative versions for C*-algebras, and when there is enough noncommutative space available one can often package these colours more efficiently. I will describe some old and some new instances of such dimension reduction phenomena. In particular, the Toeplitz algebra has nuclear dimension one (joint work with Brake), and simple Z-stable C*-algebras have nuclear dimension either zero or one, no matter what their trace spaces look like (joint work with Castillejos, Evington, Tikuisis, and White).

Injective crossed products and amenable actions

07/30, 14:40 - 15:10

Rufus Willett
University of Hawaii at Manoa

Amenability of an action of a discrete group on a C*-algebra is an approximation property that has good consequences, such as that taking the crossed product preserves nuclearity. There are several reasonable notions of amenable action due for example to Anantharaman-Delaroche, to Brown-Ozawa, and to Exel (the last called the 'approximation property'). I'll discuss how ideas of injectivity interact with some of this theory, in particular answering some questions of Exel. This is based on joint work with Alcides Buss and Siegfried Echterhoff.

Haar Systems on Equivalent Groupoids

07/28, 11:40 - 12:10

Dana Williams
Dartmouth College

An important way to construct examples of C*-algebras is to form a groupoid C*-algebra from a locally compact groupoid in analogy to the classical group C*-algebra construction. To do this, we need an analogue of a Haar measure called a Haar system. In contrast to the group case, there are a number of interesting open questions surrounding the existence and uniqueness of Haar systems. I'll briefly discuss these and focus on the relation to the important notion of groupoid equivalence. In particular, I'll talk about a recent result showing that if a groupoid is equivalent to a groupoid with a Haar system, then that groupoid also possesses a Haar system.

Poster Session

Cuntz-Pimsner algebras associated to vector bundles

Julio Caceres

UFSC

In this work we develop techniques to calculate the K-theory associated to the CuntzPimsner algebra $\mathcal{O}(M)$ of a Hilbert B-module M with finite Parseval frame. We apply this to the Hilbert modules naturally arising from the continuous sections of a vector bundle over a compact Hausdorff space X. In order to do this we present a slight generalization of a result by Exel, an Huef and Raeburn that gives us a six-term exact sequence with rather concrete morphisms that permit the calculation of the K-theory of said Cuntz-Pimsner algebras.

Recovering locally compact spaces from classes of continuous functions

Luiz Cordeiro

University of Ottawa

Since Stone's work on the representation theory of Boolean algebras, several recovery theorems for compact spaces from different algebraic structures on spaces of continuous functions have been proven. We study a natural notion of disjointness for (supports of) continuous functions which allow us to recover and generalize several of these results. New applications for groupoid convolution algebras and groups of circle-valued functions are obtained as well.

C*-simplicity and representations of topological of groupoids

Eduardo Scarparo
UFSC

Many interesting groups arise from topological full groups of groupoids. For instance, Thompson's group V (observed by H. Matui) and the first examples of infinite, finitely generated, simple, amenable groups (proven by K. Juschenko and N. Monod). Given an ample groupoid G with compact unit space, we study the canonical representation of the topological full group $[[G]]$ in the full and reduced groupoid C^*-algebras. As an application, we provide sufficient conditions for C^*-simplicity of certain topological full groups, including those associated with topologically free and minimal actions of non-amenable and countable groups on the Cantor set.

Sylvester matrix rank functions on $\mathbb{Z}$-crossed product algebras

Joan Claramunt Carós
Universitat Autònoma de Barcelona

We explain a technique of approximating $\mathbb{Z}$-crossed product algebras $\mathcal{A}$ by subalgebras $\mathcal{A}_n$ which are embeddable into infinite matrix products R_n. This leads us to an embedding $A \hookrightarrow R$ being R a regular rank ring constructed from the R_n, so $\mathcal{A}$ inherits a natural Sylvester matrix rank function $rk_{\mathcal{A}}$ from the rank rk_R of R.

Von Neumann Algebras and the Limit Multiplicity Property

Lauren Ruth

We apply the limit multiplicity property (including results from DeGeorge–Wallach 1978 and Finis–Lapid–Mueller 2013) to represent von Neumann algebras arising from lattices in Lie groups on Hilbert spaces that could be useful for posing questions about Connes' correspondences in certain settings.

C*-Algebras Bieberbach Group

Ellen Weld
Purdue University

Bieberbach groups are finitely generated, virtually abelian, torsion-free, and interesting in their own right as the fundamental groups of compact Riemannian flat manifolds. We discuss some properties of Bieberbach groups that relate to C^*-algebras, specifically connectivity, as defined by M. Dadarlat and U. Pennig. Very roughly speaking, connectivity of a C^*-algebra A is the "connectedness" of the representations of A if we allowed asymptotic homomorphisms. Connective separable nuclear C^*-algebras are exactly those which we can unsuspend the E-theory of Connes and Higson. As a motivating set of examples, we focus most heavily on dimension 3 Bieberbach groups.

Li-Yorke chaos for ultragraphshift spaces

Bruno Uggioni

Recently, in connection with C^*-algebra theory, the first author and Danilo Royer introduced ultragraph shift spaces. In this paper we define a family of metrics for the topology in such spaces, and use these metrics to study the existence of chaos in the shift. In particular we characterize all ultragraph shift spaces that have Li-Yorke chaos (an uncountable scrambled set), and prove that such property implies the existence of a perfect and scrambled set in the ultragraph shift space. Furthermore, this scrambled set can be chosen compact, what is not the case for a labelled edge shift (with the product topology) of an infinite graph.

Equilibrium states from Cayley graphs

Johannes Christensen
University of Aarhus

If G is a group and $Y \subseteq G$ is a finite set generating G we can define a directed graph $\Gamma = \Gamma(G, Y)$ whose vertexes are the elements of G and with an edge from $g \in G$ to $h \in G$ iff $g^{-1}h \in Y$. This is the Cayley graph, and we will present a general framework for the study of KMS states of generalised gauge-actions on the C^*-algebra of a (pointed) Cayley graph. We use this framework to give a concrete description of what we call abelian KMS states and abelian KMS_∞ states. When G is nilpotent all KMS states are abelian, so we get the full picture.

The dynamics of partial inverse semigroup actions

Viviane Beuter
UFSC

Given an inverse semigroup S and a partial action of S on a locally compact, Hausdorff, zero-dimensional space X, we show that the Steinberg algebra of the groupoid of germs $S \ltimes X$ is isomorphic to the partial skew inverse semigroup ring $\mathcal{L}_c(X) \rtimes S$, where $\mathcal{L}_c(X)$ is the Steinberg algebra of X. We also prove that, under natural hypotheses, the converse holds. Introduce a new notion of topological principal of a partial action, corresponding to topological principality of the groupoid of germs, and study orbit equivalence for these actions in terms of isomorphisms of the corresponding groupoids of germs.

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