INVITED TALKS

DIETMAR BISCH

Subfactors with infinite representation theory

A subfactor has infinite representation theory, or infinite depth, if its standard representation generates infinitely many non-equivalent irreducibles. Such subfactors are hard to construct, and only very few methods are known to produce examples with non-integer Jones index. We will highlight one such procedure, which involves a notion of free product for the associated planar algebras (joint work with Vaughan Jones).

BERNDT BRENKEN

C-algebras of *-semigroups and the C*-algebra of a partial isometry*

Various C*-algebras associated with *-semigroups, a class containing both groups and inverse semigroups, are introduced. These C*-algebras are universal for contractive *-representations, order, and complete order structures occurring on *-semigroups. An illustrative example occurs when describing the C*-algebra of a partial isometry, which has the structure of a Cuntz-Pimsner C*- algebra associated with a C*-correspondence over a completely ordered *-semigroup. This decomposition may be viewed as a crossed product C*-algebra for an action given by a completely positive map.

NATHANIAL P. BROWN

The structure of simple operator algebras

Over the last five years, several surprising and exciting analogies have emerged, suggesting deep commonalities between the structure of simple C*- and W*-algebras. The main technical ingredient is to replace inclusions (in the W*-category) with so-called order-zero maps (in the C*- category). In this talk I'll explain some of these developments and where it may all lead.

MARIUS DADARLAT

Group C-algebras, quasidiagonality and almost flat bundles*

We will revisit the question of quasidiagonality of group C*-algebras in view of our recent work with Jose Carrion and Caleb Eckhardt. Then, we will use quasidiagonality to produce interesting finite dimensional quasi-representations and to give conditions for a discrete group G under which the K-theory of the classifying space BG consists entirely of almost flat classes.

SøREN EILERS

Geometric classification of graph C-algebras*

While the Cuntz-Krieger algebras of real rank zero were classified by Restorff in 2006, the classification problem for more general real rank zero C*-algebras with finitely many ideals remains wide open in spite of substantial progress in many special cases. We will show how Restorff's result generalizes to graph C*-algebras over finite graphs in a way also allowing one to describe in geometric terms when two graphs give the same stabilized graph algebra. In fact, the result does not require real rank zero and thus affords classification of the quantum lens spaces of Szymanski and Hong. This is joint work with Ruiz and Sorensen.

DAVID EVANS

The search for the exotic - subfactors and conformal field theories

Subfactor theory provides a framework for studying modular invariant partition functions in conformal field theory, and candidates for exotic modular tensor categories. I will describe recent work with Terry Gannon, which is also motivated by links with twisted equivariant K-theory through the K-theoretic realisation of Freed-Hopkins- Teleman of the Verlinde ring of primary fields.

FARZAD FATHIZADEH

Curved Noncommutative Four-Tori and Extremums of the Einstein-Hilbert Action

I will report on a recent joint work with M. Khalkhali (arXiv:1301.6135), in which we consider noncommutative four- tori $\mathbb{T}^4_\theta$ whose flat geometry is perturbed by means of a Weyl conformal factor. We compute the scalar curvature of these noncommutative spaces and consider the analogue of the Einstein-Hilbert action. A purely noncommutative feature is the appearance of the modular automorphism of the KMS state implementing the conformal perturbation of the metric in the computations and in the final formulas which describe the local geometry of these noncommutative curved tori. We show that metrics with constant curvature are critical points of the Einstein- Hilbert action for $\mathbb{T}^4_\theta$. I shall also indicate the construction of a noncommutative residue on Connes' pseudodifferential symbols on noncommutative tori, and will explain the analogue of Connes' trace theorem for these spaces.

DAVID HANDELMAN

Realizing dimension groups, good measures, and Toeplitz actions

A well-known result of George's, that there exist dimension groups (with unique trace) of rank two but that cannot be realized by a sequence of 2×2 nonnegative integer matrices, but can be with size three. We show that this is a general property of dimension groups with unique trace, that they can always be realized with a Bratteli diagram of size one more than the underlying group rank (parts of this have been known for decades), and the construction is (relatively, at least for me) explicit.

Akin introduced the notion of good measure on a Cantor set; this was translated to the dimension group situation, via [GPS], by Sergey Bezuglyi and me. A rational-valued trace on an arbitrary dimension group can be realized with a Bratteli diagram with the matrices having equal column sums (and the trace the obvious one on such a diagram) iff the trace is good.

In answer to a question of Chris Skau, we give explicit realizations of dimension groups with unique trace for which the matrices have constant row sums (when that is possible); it turns out, we can use the transposes of the matrices obtained in the first paragraph. These correspond to Toeplitz systems. Particularly weird are the criteria for realizations via matrices that have both equal column sums and equal row sums, wherein a rank condition sometimes intervenes.

All the results concern dimension group realizations, and are intimately related to each other.

BRADD HART

The model theory of R

A model theoretic study of operator algebras begins with the correct choice of logic. In order to study the model theory of R, the hyperfinite II_1 factor, one needs to understand its continuous model theory. I will explain how this is done and discuss issues of axiomatizability, decidability and their relationship with the Connes embedding problem. This is joint work variously with Ilijas Farah, David Sherman, Isaac Goldbring and Thomas Sinclair.

MATTHEW KENNEDY

The Choquet boundary of an operator system

In 1969, Arveson conjectured the existence of a noncommutative analogue of the classical Choquet boundary. This is an intrinsic invariant of an operator system that plays a fundamental role in Arveson's approach to the study of non-commutative dilation theory and non-self-adjoint operator algebras. In this talk, I will give a brief overview of these ideas and discuss our recent solution of this conjecture. (This is joint work with Ken Davidson.)

DAVID KRIBS

Quantum information via subsystems

In this talk, I'll give an overview of some of my work over the past few years on the underlying mathematics for quantum information. Specifically I'll focus on the use and development of "operator techniques" in fields such as quantum error correction and quantum cryptography. This typically involves viewing qubits as encoded into quantum subsystems; an approach that naturally lends itself to connections with operator theory and operator algebras.

MARCELO LACA

Equilibrium states and self similar actions

The bimodule C*-algebras associated to self-similar group actions have natural time evolutions and we study their KMS equilibrium states. For inverse temperatures above a critical value, the Toepitz extension of the bimodule C*-algebra has its KMS states indexed by the simplex of normalised traces on the self similar group. At the critical inverse temperature, and under a further finiteness asumption on the self similar action, which include the contractive case, we show that there is a unique equilibrium state. This state factors through the Pimsner algebra, and reveals a special trace on the self similar group. This is joint work with I. Raeburn, J. Ramagge, and M. Whittaker.

JAMIE MINGO

Random Matrices and Symmetry

The first ensembles of random matrices for which asymptotic freeness was domonstrated posessed a high degree of symmetry; later work showed that asymptotic freeness could be achieved with only a little bit of symmetry. The connection between symmetry and freeness is not too surprising as Voiculescu discovered free probability in his work on the free group factors. I will give examples which demonstrate the effect of different symmetry groups on the freeness of random matrix ensembles, both at the higher order level but, quite surpisingly even at the first order level. This is joint work with Mihai Popa.

PING WONG NG

The corona algebra of the stabilized Jiang–Su algebra

Let Z be the Jiang–Su algebra and K the C*-algebra of compact operators on an infinite dimensional separable Hilbert space. We prove that the corona algebra $M(Z \otimes K)/Z \otimes K$ has real rank zero. We actually prove a more general result.

Joint work with H. Lin.

ZHUANG NIU

A classification of approximate subhomogeneous C-algebras*

Elliott-Thomsen building blocks are certain unital sub-C*- algebras of interval algebras. Considering the class of C*- algebras which can be tracially approximated by Elliott-Thomsen building blocks, then it turns out that this class of C*-algebras exhausts all possible weakly unperforated Elliott invariants rationally. In this talk, I will show a classification theorem for C*-algebras which are in this class rationally, that is, the C*-algebras which can be tracially approximated by Elliott-Thomsen building blocks after tensoring with a UHF-algebra. This is a joint work with Guihua Gong and Huaxin Lin.

DAVE PENNEYS

Subfactors at index $3 + \sqrt{5}$

A planar algebra is a mathematical object which encodes quantum symmetries. Particularly nice planar algebras, called "factor" or "fantastic" planar algebras, give unitary 2 categories, and generalize the representation categories coming from (quantum) groups. We will discuss some examples and non-examples of such planar algebras at index $3 + \sqrt{5}$ which are important in the classification of subfactors.

MIKAEL PICHOT

Sofic invariants of orbit equivalence

I will explain how to define orbit equivalence invariants in a purely combinatorial way by "counting" the number of sofic approximations of a given probability measure preserving dynamical system. This is joint work with Ken Dykema and David Kerr.

SARAH REZNIKOFF

A new uniqueness theorem for k-graphs

The graph algebras of Cuntz and Krieger have been generalized in myriad ways to provide combinatorial tools to study a broad range of C*-algebras. In particular, Kumjian and Pask developed k-graphs to facilitate examination of the higher rank graphs of Robertson and Steger. We prove a new uniqueness theorem for k-graph algebras that relates the injectivity of a representation to its injectivity on a special abelian subalgebra, M. Our proof generalizes the proof of Szymanski's uniqueness theorem for directed graphs. This is joint work with Jonathan Brown and Gabriel Nagy.

LEONEL ROBERT

C-algebras of finite nuclear dimension*

The nuclear dimension of a C*-algebra, introduced by Winter and Zacharias, is a natural generalization to the non- commutative setting of the covering dimension of a topological space. I will discuss several structural properties enjoyed by the C*-algebras of finite nuclear dimension (some holding under additional assumptions). These properties are roughly characterized by the following terms: tracial comparison, cancellation, stability, global Glimm halving property, tensorial absorption of the Jiang-Su algebra, small sums of commutators

ZHONG-JIN RUAN

Multipliers of Locally Compact Quantum Groups

In this talk, we will discuss some recent results on Schur multipliers and Herz-Schur multipliers of locally compact quantum groups. We will also discuss some interesting applications.

LUIS SANTIAGO

The Equivariant Cuntz Semigroup

The Cuntz semigroup is an isomorphism invariant for C*- algebras. It is an analog for positive elements of the Murray-von Neumann semigroup of projections of a C*- algebra. The Cuntz semigroup has been used to classify C*- algebras as well as to study their structure. In this talk, I will introduce an equivariant version of this semigroup. I will then discuss some of its properties. I will show that if G is a compact group then the equivariant Cuntz semigroup of a G-C*-algebra is naturally isomorphic to the Cuntz semigroup of the associated crossed product C*- algebra. I will also explain how this semigroup can be used to classify actions of finite abelian groups on AI-algebras with the Rokhlin property. This is a joint work with Eusebio Gardella.

AARON TIKUISIS

Dimension and tensorial absorption in C- algebras*

Much recent activity in the classification of C*-algebras has centred on forming a satisfactory notion of low-dimensional C*- algebras. Jiang-Su algebra (Z)-absorption and finite nuclear dimension are two properties which each have the potential to be exactly the right notion. The two properties have strikingly different flavours, yet surprisingly are conjectured to be equivalent for a very large class of C*-algebras (perhaps for all C*-algebras where obvious obstructions do not exist).

In this talk, I will introduce the two notions. We will discuss the relationships between these properties themselves and the classification programme. Finally, I will mention the close analogies between this circle of ideas and corresponding notions in the theory of von Neumann algebras.

ANDREW TOMS

Regularity properties for nuclear C-algebras*

I will give a survey of recent progress on the conjectural equivalence of strict comparison, Z-stability, and finite nuclear dimension for simple separable nuclear C*-algebras, and discuss possible strategies for moving past the case of algebras with finite-dimensional extreme tracial boundary.

DILIAN YANG

The Hopf structure of some dual operator algebras

We study the Hopf structure of a class of dual operator algebras corresponding to certain semigroups. This class of algebras includes the noncommutative analytic Toeplitz algebra and the multiplier algebra of the Drury- Arveson space, which correspond to the free semigroup and the free commutative semigroup respectively. The preduals of the algebras in this class naturally form Hopf (convolution) algebras. The original algebras and their preduals form (non-self-adjoint) dual Hopf algebras in the sense of Effros and Ruan. We study these algebras from this perspective, and obtain a number of results about their structure. This is joint work with Matt Kennedy.

SUBMITTED TALKS

SARA ARKLINT

Closure properties for the class of Cuntz- Krieger algebras

We examine closure properties — such as being closed under corners or unital extensions — for the class of Cuntz-Krieger algebras. For this we introduce the notion of phantom Cuntz-Krieger algebras, and apply classification of purely infinite Cuntz-Krieger algebras.

RASMUS BENTMANN

Kirchberg X-algebras with real rank zero and intermediate cancellation

A universal coefficient theorem is proved for C*-algebras over an arbitrary finite T_0-space X which have vanishing boundary maps. Under bootstrap assumptions, this leads to a complete classification of unital/stable real- rank-zero Kirchberg X-algebras with intermediate cancellation. Range results are obtained for (unital) purely infinite graph C*-algebras with intermediate cancellation and Cuntz-Krieger algebras with intermediate cancellation. Permanence results for extensions of these classes follow.

RAPHAEL CLOUATRE

On the unilateral shift as a Hilbert module over the disc algebra

We study the unilateral shift (of arbitrary countable multiplicity) as a Hilbert module over the disc algebra and the associated extension groups. In relation with the problem of determining whether this module is projective, we consider a special class of extensions, which we call "polynomial". We show that the subgroup of polynomial extensions of a contractive module by the adjoint of the unilateral shift is trivial. The main tool is a function theoretic decomposition of the Sz.-Nagy-Foias model space for completely non-unitary contractions.

ADAM FULLER

Non-self-adjoint 2-graph algebras

We consider the weakly-closed non-self-adjoint operator algebras generated by representations of single-vertex 2- graphs. This is precisely the study of algebras generated by 2 row-isometries, satisfying certain commutation relations. We show that these algebras all have a lower 3x3 triangular form, with the left-hand column being an ideal of the enveloping von Neumann algebra and the (3,3) position being isomorphic to a higher-rank noncommutative Toeplitz algebra. This is joint work with Dilian Yang.

KOUSHIK GHOSH

Corona theorem and its ramifications

I will discuss the various forms of corona theorem and operator theoretic versions.

CRISTIAN IVANESCU
Coauthors: G. A. Elliott

A Krein-Milman type theorem for non-unital dimension drop C-algebras*

If V is a certain real subspace of C[0, 1] of codimension one, then any positive linear map of norm one defined on V with values in C[0, 1] can be approximated, in the strong topology, by an average of eigenvalues maps.

EVGENIOS KAKARIADIS

Isomorphism Invariants for Multivariable C- dynamics*

Apart from the strong interest of the operator algebra community on C*-dynamics, additional motivation comes from the recent papers of Cornelissen and Marcolli in number theory and graph theory. In these papers Cornelissen and Marcolli make essential use of the work of Davidson and Katsoulis on tensor algebras and piecewise conjugacy of multivariable classical systems. In our recent work with Katsoulis, we are able to examine piecewise conjugacy in the non-commutative setting. Nevertheless, in the course of proving this we were able to do more. We show that tensor algebras are a complete isomorphic invariant for unitary equivalence of a large class of systems, e.g., classical systems (even more, for systems by stably finite C*- algebras), and systems by *-epimorphisms.

ZHIQIANG LI
Coauthors: George A. Elliott

A remark on the lifting problem for KK- elements between dimension drop algebras

We investigate the lifting problem for KK-elements between dimension drop algebras. To do so, we determine the action of KK-elements on both the ordered K-groups with coefficients in Z/nZ and the ordered K-homology groups of two such algebras. It turns out that when the dimension drops at the two endpoints are different, there exist KK-elements which preserve the Dadarlat-Loring order on the K-groups with coefficients in Z/nZ, but cannot be lifted to a *-homomorphism between two such dimension drop algebras.

RORY LUCYSHYN-WRIGHT

Riesz-Schwartz distributions and vector integration in closed categories

We develop aspects of functional analysis in an abstract axiomatic setting, through monoidal and enriched category theory. We work in a given closed category, whose objects we call spaces, and we study R-module objects therein, which we call linear spaces; for certain choices of ambient category, the latter include topological vector spaces. Building on ideas of F. William Lawvere and Anders Kock, we study operators between spaces of scalar-valued maps, including compactly-supported Radon measures and Schwartz distributions. We develop an abstract theory of vector- valued integration with respect to such scalar functionals and their relatives. We study three axiomatic approaches to vector integration, including an abstract Pettis-type integral, showing that all are encompassed by an axiomatization via monads and that all coincide in suitable contexts. We study the relation of this vector integration to novel relative notions of completeness in linear

spaces. One such notion of completeness, defined via enriched orthogonality, characterizes exactly those separated linear spaces that support the vector integral. We prove Fubini-type theorems for the vector integral. The requisite category theory will be introduced during the talk.

EMILY REDELMEIER

Quaternionic Second-Order Freeness

Many large random matrices, including unitarily and orthogonally invariant distributions, satisfy the noncommutative independence condition freeness. This allows us to study the moments of these matrices using the tools of free probability. The behaviour of the second-order statistics or fluctuations of these ensembles, however, depends on whether the matrices are real or complex. The natural definition of second-order freeness is significantly different in these two cases. We discuss this problem in the context of quaternionic random matrices.

PAUL SKOUFRANIS

Closed Unitary and Similarity Orbits of Normal Operators in Purely Infinite C-Algebras*

In the past there was significant interest in examining the unitary and similarity orbits of bounded operators on Hilbert spaces. This led to examining analogous problems inside the Calkin algebra. As the Calkin algebra is a unital, simple, purely infinite C*-algebra, it is natural to ask whether the results for the Calkin algebra generalize to a larger setting.

We will investigate the norm closure of the unitary and similarity orbits of normal operators in unital, simple, purely infinite C*-algebras. We will examine bounds for the distance between unitary orbits of normal operators and determine when one normal operator is the closed similarity orbit of another operator in said algebras.

ADAM SøRENSEN

Almost commuting unitary matrices

A famous theorem by Lin shows that any two almost commuting self-adjoint matrices will be close to two exactly commuting self-adjoint matrices. Voiculescu has shown that this fails for pairs of unitary matrices.

Using Real C*-algebra techniques we will explain what happens if we pick two almost commuting unitaries that satisfy additional symmetry relations and ask to find exactly commuting unitaries that also satisfies these additional conditions.

FRANCISZEK HUGON SZAFRANIEC

Looking for the target space of a would-be Hankel operator

I intend to discuss the question of how to define Hankel operators in unbounded domain. It is interesting if a measure traditionally involved is not determinate or, even worse, when it is absent.

HAOXIN WANG

The Russo-Dye Theorem in Nest Subalgebras of Factors

We introduce the concept of the admissible nest for a factor and prove that the weak operator topology closure of the convex hull of all the unitary elements in the nest subalgebra of the factor is the whole unit ball if and only if the nest is an admissible nest in the factor.

MICHAEL WHITTAKER
Coauthors: Marcelo Laca, Iain Raeburn, and Jacqui Ramagge

KMS states for self-similar group actions

A self-similar action (G, X) consists of a group G along with a self-similar action of the group on a rooted tree. Self-similarity is displayed by the action of the group acting on all levels of the tree. Self-similar actions give rise to Cuntz-Pimsner algebras, first constructed by Nekrashevych, as well as a Toeplitz algebra. We describe KMS states on these algebras. The presentation will focus on three key examples.