ABSTRACTS

Jonathan Brown

Title: Cartan Subalgebras of etale groupoid C*-algebras

Abstract: In a 2008 paper, Renault studied a special class of maximal abelian subalgebras of a C*-algebra which he called Cartan. He showed that if G is a groupoid, $C_0(G^{(0)})$ includes into $C_r^*(G)$ is Cartan if G is topologically principal. If G is not topologically principal, then $C_0(G^{(0)})$ is not maximal abelian. In this talk we consider a larger subalgebra M of $C_r^*(G)$ which can be constructed using the interior of the isotropy of G. We characterize exactly when M is Cartan using properties of G and show that the set of pure states on M with unique extension to $C_r^*(G)$ is dense and deduce a Cuntz-Krieger type uniqueness theorem. This work is joint with G. Nagy, S. Reznikoff, A. Sims and D. Williams.

Raphael Clouatre

Title: The Kadison property for representations of amenable operator algebras

Abstract: An operator algebra is said to have the *Kadison property* if all its bounded representations are completely bounded. It is a long-standing open problem to determine whether this is satisfied by every C^*-algebra. On the other hand, due to work of Haagerup and Gifford, it is known that the Kadison property for C^*-algebras is equivalent to a weaker version of amenability, called the *total reduction property.*

In this talk, we investigate whether non self-adjoint operator algebras with the total reduction property necessarily have the Kadison property. We obtain positive results in the case where either the domain or codomain of the representation is residually finite dimensional. We also explain why these facts are meaningful with regards to the general problem. Finally, we exhibit connections to the harder question of determining whether operator algebras with the total reduction property are necessarily similar to C^*-algebras.

This is joint work with Laurent Marcoux.

Kenneth Davidson

Title: Choquet order and hyperrigidity for function systems

Abstract: The Choquet order on measures is used to establish that states on a function system always have a representing measure supported on the set of extreme points of the state space (in a technical sense). We introduce a new operator-theoretic order on measures, and prove that it is equivalent to the Choquet order. This leads to some improvements in the classical theory, but more importantly it leads to some new operator-theoretic consequences. In particular, we establish Arveson's hyperrigidity conjecture for function systems. This yields a significant strengthening of the classical approximation theorems of Korovkin and Šaškin.

This is joint work with Matthew Kennedy.

Mario Diaz

Title: On the Fluctuations of Block Gaussian Matrices

Abstract: It is known that for every non-commutative polynomial evaluated in Gaussian matrices there exists a block Gaussian matrix that encodes its spectral behaviour. This talk focuses on the fluctuations of the moments of block Gaussian matrices. Specifically, we derive a semi-explicit formula for a matricial version of the second-order Cauchy transform. The derivation of this formula depends on three types of pairings and the Cauchy transforms associated to them: single-line, double-line, and annular.

This is joint work with Serban Belinschi and James Mingo.

George Elliott

Title: Recent progress in the classification of simple C*-algebras

Abstract: In the last year, the classification of unital simple C*-algebras with finite nuclear dimension has begun to be extended to the non-unital case. Surprisingly, perhaps, much of the proof has to be completely rebooted. (This is joint work with Guihua Gong, Huaxin Lin, and Zhuang Niu.)

Ilijas Farah

Title: Approximately matricial algebras

Abstract: A C*-algebra is approximately matricial (AM) if it is an inductive limit of full matrix algebras. The separable AM algebras form arguably the simplest nontrivial class of C*-algebras. In this talk I will discuss the nonseparable AM algebras. This is a joint work with Ilan Hirshberg.

Cristian Ivanescu

Title: The Cuntz semigroup of the tensor product of C*-algebras

Abstract: We calculate the Cuntz semigroup of the tensor product C*-algebra $A \otimes A$. We restrict our attention to unital, simple, separable, nuclear, stably finite, Z-stable, satisfy the UCT, with finitely generated K_0 group and have trivial K_1 group. This joint work with Dan Kucerovsky.

Matthew Kennedy

Title: Noncommutative boundaries and the ideal structure of reduced crossed products

Abstract: I will introduce the notion of a noncommutative topological boundary for a C*-dynamical system. This is a natural generalization of the notion of a topological boundary for a group introduced by Furstenberg. A C*-dynamical system is said to have the intersection property if the ideals of the corresponding reduced crossed product can be described in terms of the G-invariant ideals of the underlying C*-algebra. For commutative C*-dynamical systems, a characterization of the intersection property was recently obtained by Kawabe. I will discuss a characterization of the intersection property for arbitrary C*-dynamical systems in terms of noncommutative boundaries. This is joint work with Christopher Schafhauser.

Marcelo Laca

Title: C*-algebraic invariants for number fields from the action of units on integers.

Abstract: In joint work with Joachim Cuntz and Christopher Deninger [Math. Ann. 2013] we showed that the KMS equilibrium states of the Toeplitz C*-algebras we associated to number fields are parametrized by the tracial states of a finite direct sum of certain group C*-algebras. Soon afterwards the same direct sum of group C*-algebras re-emerged, independently, in K-theory computations of Joachim Cuntz, Siegfried Echterhoff and Xin Li [Q.J.M. 2013].

I will discuss these results and also current joint work with Jacqueline M. Warren, in which we write those group C*-algebras as (linear toral) transformation group C*-algebras, to which we then apply Sergey Neshveyevs characterization of traces of transformation group C*-algebras [J.O.T 2013]. The extremal traces of our algebras turn out to be parametrized by the ergodic invariant measures of groups of toral automorphisms arising from each number field, together with characters of the associated isotropy groups. The original problem then reveals itself as a version of Furstenberg's celebrated x2 - x3 question, generalized to higher-rank actions on higher-dimensional tori, which is still open. The topological analogue of this problem, namely whether infinite orbits of the action of units are dense, is tractable thanks to a theorem of Daniel Berend [T.A.M.S. 1983], and this allows us to compute the primitive ideals of the classifying C*-algebra in most cases. Our work leads to a classification of number fields into four cases for which the computation of extremal KMS equilibrium states is, variously, boring, hopeless, intriguing, and conjecturally at hand.

Boyu Li

Title: Regular Dilation on Graph Products of $\mathbb{N}$

Abstract: We extended the definition of regular dilation to graph products of $\mathbb{N}$, which is an important class of quasi-lattice ordered semigroups. Two important results in dilation theory are unified under our result: namely, Brehmer's regular dilation on $\mathbb{N}^k$ and Frazho-Bunce-Popescu's dilation of row contractions. We further show that a representation of a graph product has an isometric Nica-covariant dilation if and only if it is *-regular. A special case of our result was considered by Popescu, and we studied the connection with Popescu's work.

Hui Li

Title: Products of Odometers and Topological Higher-Rank Graphs

Abstract: Given k odometers one can form a unital semigroup called the standard product of odometers. Then the boundary quotient C*-algebra of the standard product of odometers is isomorphic to the C*-algebra of a topological k-graph. In this talk, I will sketch the proof of this result. This is joint work with Dilian Yang.

Martin Mathieu

Title: A sheaf cohomology theory for C*-algebras

Abstract: I will report on joint work in progress with Pere Ara (Barcelona) in which we aim to develop a full sheaf cohomology theory for C*-algebras on the basis of our sheaf theory for C*-algebras. Supported by EPSRC Grant No. EP/M02461X/1.

James Mingo

Title: Freeness and the partial transpose of block matrices

Abstract: Mihai Popa and I showed that for a unitarily invariant ensemble, the original matrix and its transpose are asymptotically free. By breaking such a matrix up into blocks one can apply a partial transpose, on the left or on the right, and get still more asymptotic freeness. In this regime both the number of blocks as well as the size of the blocks tends to infinity. In this talk I will review these earlier results and explain what happens in the regime where the number of blocks is fixed.

Soumyashant Nayak

Title: The Hadamard Determinant Inequality

Abstract: The classical Hadamard determinant inequality in essence says that an n-parallelopiped with prescribed lengths of sides has maximum volume iff the sides are mutually orthogonal. It is useful in proving convergence results in the classical Fredholm theory of integral equations. Further, Fischer's generalization of the inequality has seen many applications in statistics. Our goal is to view these results in the setting of finite von Neumann algebras. We will briefly discuss the notion of a determinant, due to B. Fuglede and R. Kadison, for finite von Neumann algebras and review some basic results on conditional expectations on von Neumann algebras. In this setting, we will see a proof of a generalized form of the Hadamard inequality and a simple characterization of the equality condition. We further extend this inequality in the context of operator monotone functions on $[0, \infty)$ still retaining the simple form of the equality condition. Finally we will see some applications to obtain estimates for determinants of perturbed positive-definite matrices.

Zhuang Niu

Title: The classification of simple separable nuclear KK-contractible C*-algebras

Abstract: I will report the recent progress on the classification of stably projectionless C*-algebras, in particular on the classification of KK-contractible C*-algebras. This is a joint work with George Elliott, Guihua Gong, and Huaxin Lin.

Satish Pandey

Title: Universally Symmetrically Norming Operators are Compact.

Abstract: The class of *norming operators* on complex Hilbert spaces have been extensively studied. The class of *absolutely norming operators*, however was introduced recently by Carvajal and Neves.

In this talk we extend the concept of absolutely norming operators to various symmetric norms. We present a few spectral characterization theorems for operators on complex Hilbert spaces that are absolutely norming with respect to various symmetric norms and we prove the existence of a symmetric norm on the algebra $B(H)$ with respect to which even the identity operator does not attain its norm.

We introduce and study the concepts of *universally symmetrically norming operators* and *universally absolutely symmetrically norming operators* on a separable Hilbert space. These refer to the operators that are, respectively, norming and absolutely norming, with respect to every symmetric norm on $B(H)$. We establish

a characterization theorem for such operators and prove that these classes are identical and that they coincide with the class of compact operators. In particular, we provide an alternative characterization of compact operators on a separable Hilbert space.

Vern Paulsen

Title: Embezzling Entanglement, Tsirelson, and Connes

Abstract: Haydon and van Dam proved that it was impossible for two separate quantum experiments to produce entangled states in the usual tensor product model using local operations and a catalytic vector. They then showed that up to any small error one could appear to achieve this outcome. They referred to this as "embezzlement" since one could fool an observer into thinking that something that was impossible had occurred.

In this talk I will recall Brown's C*-algebra of a non-commuting unitary and show that Haydon and van Dam were really studying states on the tensor product of this C*-algebra with itself. Recently, Sam Harris has shown that Connes' embedding conjecture is equivalent to proving that the minimal and maximal tensor product of these algebras are equal.

Harris' work provides a link between these embezzlement constructions and Connes' embedding conjecture, especially the forms of this conjecture that are related to the conjectures of Tsirelson about "quantum conditional probabilities".

This talk is based on joint papers with R. Cleve and L. Liu and with S. Harris. This work was supported by NSERC.

Jitendra Prakash

Title: The Projective Rank Game for the 3-Cycle

Abstract: Non-local games are important in the study of quantum information as they help in distinguishing among different correlation sets. We shall analyze a synchronous non-local game, called the projective rank game for 3-cycle, by computing its winning probability under some constraints, and see if it sheds any light on disambiguation of correlation sets.

This is a joint work with Ken Dykema and Vern Paulsen.

Ian Putnam

Title: Groupoid C*-algebras in the Elliott classification program

Abstract: We describe a construction, via etale equivalence relations on a Cantor set, for a class of C*-algebras which fall into the Elliott classification program.

Artur Płaneta

Title: Weighted shifts on directed trees. Their multiplier algebras, reflexivity and decompositions

Abstract: Let $\mathscr{T} = (V, E)$ be a directed tree (V and E stand for the sets of vertices and directed edges of $\mathscr{T}$, respectively). Set $\mathsf{Chi}(u) = \{v \in V : (u, v) \in E\}$ for $u \in V$. Denote by par the partial function from V to V which assigns to a vertex $u \in V$ its parent $\mathsf{par}(u)$ (i.e. a unique $v \in V$ such that $(v, u) \in E$). A vertex $u \in V$ is called

a root of $\mathscr{T}$ if u has no parent. A root is unique (provided it exists); we denote it by root. The tree $\mathscr{T}$ is rooted if the root exists. We set $V^\circ = V \setminus \{\mathsf{root}\}$. Let $\boldsymbol{\lambda} = \{\lambda_v\}_{v\in V^\circ} \subseteq \mathbb{C}$ be such that

$$\sup_{v\in V} \sum_{u\in \mathsf{Chi}(v)} |\lambda_v|^2 < \infty.$$

Then the following formula

$$(S_{\boldsymbol{\lambda}} f)(v) = \begin{cases} \lambda_v \cdot f\big(\mathsf{par}(v)\big) & \text{if } v \in V^\circ, \\ 0 & \text{if } v = \mathsf{root}, \end{cases} \qquad f \in \ell^2(V),$$

defines a bounded operator $S_{\boldsymbol{\lambda}}$ on $\ell^2(V)$, which is called the weighted shift on $\mathscr{T}$ with weights $\boldsymbol{\lambda}$.

The class of weighted shifts on directed trees contains all classical weighed shifts and it is related to that of weighted composition operators in L^2-spaces.

We show that the set of multiplication operators associated with an injective weighted shift on a rooted directed tree coincides with the WOT/SOT closure of the set of polynomials of the weighted shift. From this fact we deduce sufficient condition for reflexivity of weighted shifts on rooted directed trees. We show that weighted shifts with positive weights on rooted directed trees admit a Wold-type decomposition. We introduce the notion of balanced weighted shift and we prove that the pairwise orthogonality of the factors in the decomposition is equivalent to the weighted shift being balanced.

The talk is based on the joint work with P. Budzyński, P. Dymek and M. Ptak.

Chris Ramsey

Title: Faithfulness of bi-free product states

Abstract: Bi-free probability was introduced by Voiculescu in 2014 as an extension of free probability. Dykema proved that the reduced free product of C*-algebras with faithful states has a faithful free product state. In the bi-free setting things are more complicated, the faithfulness of the bi-free product state on the reduced bi-free product implies that each pair of faces arises as a tensor product. I will discuss this problem and its converse.

Luis Santiago

Title: Actions of compact groups on C*-algebras with finite Rokhlin dimension.

Abstract: In this talk I will discuss several properties of actions of compact groups on C*-algebras with finite Rokhlin dimension, particularly in relation to crossed products. I will show how taking crossed products by such actions preserves a number of relevant classes of C*-algebras, including: D-absorbing C*-algebras (where D is strongly self-absorbing), stable rank, C*-algebras with finite nuclear dimension or decomposition rank, C*-algebras that are nuclear and satisfy the UCT, among others. I will also introduce a representability dimension for actions of discrete groups on C*-algebras and show that in the abelian setting the dual action of an action of a compact group with finite Rokhlin dimension has finite representability

dimension. I will then discuss how to use the finite representability dimension of the dual action to determine the ideal structure of the crossed product.

This a joint work with Eusebio Gardella and Ilan Hirshberg.

Ana Savu

Title: Monotonic coupling of dynamics that preserves the total number of particles

Abstract: Construction of monotonic coupling of particle dynamics is a technique used to find bounds on the dynamics mixing time. We discuss monotonic coupling of dynamics that preserves the total number of particles. The existence of monotonic coupling of these dynamics that are supported on hyperplanes is reduced to the existence of monotonic coupling of the 2-site conditional distributions of the dynamics equilibrium measures. We present conditions on the equilibrium measures that are sufficient for the existence of monotonic coupling.

Christopher Schafhauser

Title: On the Tikuisis-White-Winter Theorem

Abstract: A tracial state on a C*-algebra A is called amenable (resp. quasidiagonal) if there is a sequence of completely positive contractive maps from A into matrix algebras with approximately preserve the trace and approximately preserve the multiplication in the 2-norm (resp. operator norm). Every quasdiagonal trace is amenable and the converse remains open. In the nuclear setting, classical results imply every trace on a nuclear C*-algebra is amenable, but even here, the quasidiagonal question remains unsolved.

Substantial progress on this question was made recently by Tikuisis, White, and Winter: every faithful trace on a separable, nuclear C*-algebra in the UCT class is quasidiagonal. This result has several important consequences in Elliott's Program and elsewhere. We will discuss this problem and a short proof of the Tikuisis-White-Winter Theorem using Kasparov's KK-Theory and a Hilbert module version of Voiculescu's Weyl-von Neumann Theorem due to Elliott and Kucerovsky.

Paul Skoufranis

Title: Majorization in C^*-Algebras

Abstract: A classical result in matrix theory characterizes the convex hull of the unitary orbit of a self-adjoint matrix using spectral data. The description of these convex hulls has many applications such as characterizing the possible diagonal n-tuples of a self-adjoint matrix based on its eigenvalues. As all of these questions have natural analogues in an arbitrary unital C^*-algebra, it is natural to ask whether these results have generalizations.

In this talk, using a notion of majorization against unbounded traces, we characterize the norm-closed convex hulls of the unitary orbits of self-adjoint operators in any unital C^*-algebra. Furthermore, for several classes of C^*-algebras, such as those satisfying Blackadars strict comparison of positive elements, an upper bound for the number of unitary conjugates in a convex combination required to approximate an element in the closed convex hull within a given error is shown to exist.

This is joint work with P. Ng and L. Robert.

Zsolt Tanko

Title: Injectivity of the group von Neumann algebra as an operator module over the Fourier algebra

Abstract: The group von Neumann algebra $VN(G)$ of a locally compact group G can be viewed as an operator module over its predual, the Fourier algebra $A(G)$. This talk will focus on the correspondence between injectivity properties of $VN(G)$ as an $A(G)$-module or bimodule and amenability conditions on the group. We will show that, as a one-sided $A(G)$-module, the 1-injectivity of $VN(G)$ characterizes amenability of G and that relative 1-injectivity captures inner amenability. Considering $VN(G)$ as an $A(G)$-bimodule, this perspective allows us to exhibit the first examples of locally compact groups for which $A(G)$ fails to be operator biflat. We are also able to characterize operator amenability of $A_{cb}(G)$, the cb-multiplier closure of $A(G)$, for a large class of groups and obtain examples of weakly amenable groups for which $A_{cb}(G)$ fails to be operator amenable.

This talk is based on joint work with Jason Crann.

Grazia Viola

Title: Structure of Ideals on a spatial L_p AF algebra

Abstract: Spatial L_p AF algebras were introduced by Phillips and Viola, and shown to be completely classifiable by their scaled preordered K_0 group, In this talk we describe the structure of ideals of a spatial L_p AF algebra. We also show that any spatial L_p AF algebra is residually incompressible and completely residually incompressible. We conclude by discussing some properties of the automorphisms of a spatial L_p AF algebras.

Dilian Yang

Title: Boundary quotient C*-algebras of products of odometers

Abstract: To the full C*-algebra of a semigroup, one can associate several quotients. There is a distinguished one called the boundary quotient. For a given standard product of k odometers, it is natural to associate a semigroup. In this talk, I present some characterizations on the simplicity of its boundary quotient C*-algebra, and discuss its nuclearity and pure infiniteness. Some relations with the C*-algebra $\mathcal{Q}_{\mathbb{N}}$ introduced by Cuntz will also be given.

This is joint work with Hui Li.

Ping Zhong

Title: Quasifree Quantum Stochastic Calculus and Quantum Random Walks

Abstract: Attal and Joye studied an operator-valued quantum random walk driven by particles in a faithful normal state. They found the quantum stochastic differential equation obeyed by its limit process, and showed that the quantum noises appearing in this Langevin equation satisfy the commutation relations for a certain quasifree state.

We develop a theory of quasifree quantum stochastic calculus for infinite-dimensional noise within the framework of Hudson-Parthasarathy quantum stochastic calculus. We study the question of uniqueness for the covariance amplitude with respect to

which a given unitary quantum stochastic cocycle is quasifree. The theory is applied to the identification of a wide class of quantum random walks whose limit processes are driven by quasifree noises. Joint work with Alexander Belton, Michal Gnacik and Martin Lindsay.