Finite and Infinite Dimensional Structures in Non-Commutative Analysis
Structures dimensionnelles finies et infinies en analyse non commutative
(Org: **Martin Argerami** and/et **Remus Floricel** (Regina))

BERNDT BRENKEN, University of Calgary
Partial isometries implementing cpc C- dynamical systems*

Associate with a completely positive contractive (cpc) map $\varphi : A \to A$ of a C*-algebra A a crossed product algebra $C^*(A, \varphi)$; namely a universal C*-algebra generated by A and a contraction implementing φ. One can dilate φ to a cpc map $\widetilde{\varphi}$ of an augmented C*-algebra A_q of A. The associated crossed product algebra $C^*(A_q, \widetilde{\varphi})$ is generated by A_q and a partial isometry implementing $\widetilde{\varphi}$, and is Morita equivalent to $C^*(A, \varphi)$.

RAPHAEL CLOUATRE, University of Manitoba
Residual finite-dimensionality for general operator algebras

Finite-dimensional approximation properties have proven to be a fruitful idea in the realm of C^*-algebras. It is thus natural to hope that similar ideas can elucidate the structure of general (not necessarily self-adjoint) operator algebras. In this talk we will study residual finite-dimensionality from that perspective. The departure from the self-adjoint world involves some interesting subtleties. For instance, it is well-known that finite-dimensional operator algebras cannot necessarily be represented completely isometrically inside of an algebra of matrices, in contrast with the situation for C^*-algebras. As such, it it not immediately obvious what the "natural" definition of this more general notion of residual finite-dimensionality should be. After clarifying this issue, we will explore the extent to which the residual finite-dimensionality of an operator algebra carries over to its C^*-envelope or its maximal C^*-algebra. This is joint work with Christopher Ramsey.

JASON CRANN, Carleton University
An equivariant weak expectation property and amenable actions

We introduce an equivariant version of the weak expectation property (WEP) at the level of operator modules over completely contractive Banach algebras. This yields a natural notion of group covariant WEP, related to recent work of Buss–Echterhoff–Willett, but also a dual notion of the $A(G)$-WEP for operator modules over the Fourier algebra of a locally compact group G. These dual notions are related in the setting of C^*-dynamical systems, where we show that an action $G \curvearrowright X$ of an exact locally compact group is topologically amenable if and only if $C_0(X)$ has the $L^1(G)$-WEP if and only if the reduced crossed product $C_0(X) \rtimes G$ has the $A(G)$-WEP. Along the way, we answer a question of Anantharaman-Delaroche and generalize the equivalence between topological amenability and Zimmer amenability of the bidual action to the locally compact setting. This is joint work with Alex Bearden and Mehrdad Kalantar.

DANIEL DRIMBE, University of Regina
Prime II_1 factors arising from actions of product groups

In this talk we show that any II_1 factor arising from a free ergodic probability measure preserving action $\Gamma \curvearrowright X$ of a product $\Gamma = \Gamma_1 \times \cdots \times \Gamma_n$ of $n \geq 1$ icc hyperbolic, free product or wreath product groups is prime, provided $\Gamma_i \curvearrowright X$ is ergodic, for any $1 \leq i \leq n$. Moreover, we prove a unique prime factorization result for any II_1 factor associated to a free ergodic probability measure preserving action of a product of icc, hyperbolic, property (T) groups.

HEATH EMERSON, University of Victoria
Transversals and Connes' duality for the irrational rotation algebra

In this talk we explain how transversals to Kronecker foliations of the 2-torus can be used to invert Connes' Poincaré duality map for the irrational rotation algebra. Connes' map, which uses a well-known spectral triple similar to the Dolbeault cycle for the ordinary 2-torus, gave the first example of a noncommutative C*-algebra exhibiting Poincaré duality in K-theory, but the result was (arguably) not quite complete until now as no cycle has ever been described representing the Poincaré dual of Connes' spectral triple. We rectify this with our constructions with transversals and re-prove duality for the irrational rotation algebra by verifying the zig-zag equations for Connes' class, and ours.

FRANCESCO FIDALEO, University of "Tor Vergata", Rome
Uniquely Ergodic C^*-Dynamical Systems for the noncommutative 2-torus

Consider a uniquely ergodic C^*-dynamical system $(\mathfrak{A}, \Phi)$ based on a identity-preserving $*$-endomorphism Φ of the unital C*-algebra $\mathfrak{A}$. We can prove the uniform convergence of Cesaro averages

$$M_{a,\lambda}(n) := \frac{1}{n}\sum_{k=0}^{n-1} \lambda^{-k}\Phi^k(a), \quad a \in \mathfrak{A},$$

for all values λ in the unit circle $\mathbb{T}$, which are not eigenvalues corresponding to "measurable non-continuous" eigenfunctions. This result generalizes an analogous one, known in commutative ergodic theory, which turns out to be a combination of the Wiener-Wintner theorem and the uniformly convergent ergodic theorem of Krylov and Bogolioubov. We also present counterexamples based on the tensor product construction, for which the above average does not converge even in the $*$-weak topology, for some $a \in \mathfrak{A}$ and $\lambda \in \mathbb{T}$.

It would however be desirable to produce more general examples than those (perhaps non trivial) based on the tensor product construction, for which the average $M_{a,\lambda}$ corresponding to some peripheral eigenvalue $\lambda \in \mathbb{T}$ fails to converge for some element $a \in \mathfrak{A}$. It is done as in the classical case, by defining the noncommutative extension of the Anzai skew product on the noncommutative 2-torus $\mathbb{A}_\alpha$ ($2\pi\alpha$ being the deformation angle), and show that, still in these cases, there exist elements $a \in \mathbb{A}_\alpha$ and $\lambda \in \mathbb{T}$ for which the average $M_{a,\lambda}$ does not converge.

CRISTIAN IVANESCU, MacEwan University
Pedersen ideals of tensor products of nonunital C-algebras*

We show that positive elements of Pedersen ideal of tensor product can be approximated in a strong sense by sums of tensor products of positive elements. This has a range of applications to the structure of tracial cones and related topics, such as the Cuntz semigroups. This is a joint work with Dan Kucerovsky.

MASOUD KHALKHALI, University of Western Ontario
Von Neumann information entropy, second quantization, and spectral action

We show that by incorporating chemical potentials one can extend the formalism of spectral action principle to Bosonic second quantization. In fact we show that the von Neumann information entropy, the average energy, and the negative free energy of the state defined by the Bosonic, or Fermionic, grand partition function can be expressed as spectral actions, and all spectral action coefficients can be given in terms of the modified Bessel functions.In the Fermionic case, we show that the spectral coefficients for the von Neumann entropy, in the limit when the chemical potential μ approaches to 0, can be expressed in terms of the Riemann zeta function. This recovers a recent result of Chamseddine-Connes-van Suijlekom (joint work with Rui Dong, arXiv:1903.09624).

MARCELO LACA, University of Victoria
Reconstructing directed graphs

We show how to reconstruct a finite directed graph E from its Toeplitz algebra, its gauge action, and the canonical finite-dimensional abelian subalgebra generated by the vertex projections. If E has no sinks, then we can recover E from its Toeplitz

algebra and the generalised gauge action that has, for each vertex, an independent copy of the circle acting on the generators corresponding to edges emanating from that vertex. We also show by example that it is not possible to recover E from its Toeplitz algebra and the gauge action alone. This is joint work with Nathan Brownlowe, David Robertson and Aidan Sims.

MATTHIAS NEUFANG, Carleton University and University of Lille

Solution to several problems regarding tensor products and crossed products of C^*- and von Neumann algebras

We present solutions to several problems concerning crossed products and tensor products of operator algebras. The common theme is our use of completely bounded module maps.

We prove that a locally compact group G has the approximation property (AP) if and only if a non-commutative Fejér theorem holds for the associated C^*- or von Neumann crossed products. We deduce that the AP always implies exactness. This generalizes a result of Haagerup–Kraus, and answers a question by Li. We also answer a problem of Bédos–Conti on discrete C^*-dynamical systems, and a question by Anoussis–Katavolos–Todorov on bimodules over the group von Neumann algebra $VN(G)$ for all locally compact groups G with the AP. In our approach, we develop a notion of Fubini crossed product for locally compact groups, and a dynamical version of the AP for actions. (Joint work with J. Crann.)

It has been open for almost 40 years to characterize when the projective Banach tensor square $\mathcal{A} \otimes_\gamma \mathcal{A}$ of a C^*-algebra $\mathcal{A}$ is Arens regular. We solve this problem for arbitrary C^*-algebras: Arens regularity is equivalent to $\mathcal{A}$ having the Phillips property; hence, it is encoded in the geometry of $\mathcal{A}$. For a von Neumann algebra $\mathcal{A}$, we conclude that $\mathcal{A} \otimes_\gamma \mathcal{A}$ is Arens regular only if $\mathcal{A}$ is finite-dimensional. We also show that this does not generalize to non-selfadjoint operator algebras. For commutative C^*-algebras $\mathcal{A}$, we prove that the centre of $(\mathcal{A} \otimes_\gamma \mathcal{A})^{**}$ is Banach algebra isomorphic to the extended Haagerup tensor product $\mathcal{A}^{**} \otimes_{eh} \mathcal{A}^{**}$.

VERN PAULSEN, University of Waterloo

Preservation of the joint essential matricial range

In this talk we present generalizations of several results of R. Smith and J. Ward about the essential matricial ranges of a single operator to d-tuples of operators. Given a d-tuple of operators, their joint k-th matricial range is the set of all d-tuples of the kxk matrices that can be obtained as their image under all unital completely positive maps into the kxk matrices. Their joint k-th essential matrix range is defined similarly, but using maps that factor through the Calkin algebra. We prove that one also obtains the joint k-th essential matricial range by taking the intersection of the k-th matrix ranges of all compact pertubations of the original d-tuple and that as long as k is fixed, this set can be attained by a single compact perturbation.

This talk is based on joint work with Chi-Kwon Lee and Yiu-Tung Poon.

VOLKER RUNDE, University of Alberta

Amenability of the Fourier algebra in the completely bounded multiplier norm

Let G be a locally compact group containing a copy of the free group on two generators as a closed subgroup, and let $A_{Mcb}(G)$ denote the closure of the Fourier algebra of G in the completely bounded multiplier norm. I will show that $A_{Mcb}(G)$ is not amenable.

ANAMARIA SAVU, University of Alberta

Conservative Restricted Solid-on-Solid Model

We introduce a new interacting particle system for dynamics of interfaces. The model is conservative in the sense that the total number of particles is preserved. In addition, the model is restricted in the sense that possible interface configurations are restricted to have a gradient that is bounded in absolute value by 1, $|h(x+1) - h(x)| \leq 1$. The model allows particles to climb, fall, jump, and slide. Mean-field approximations of this model will be discussed.

PAUL SKOUFRANIS, York University
Majorization, Convexity, and Expectations

The notion of majorization of spectral distributions yields a partial ordering on the collection of self-adjoint $n \times n$ matrices that has a wide variety of uses such as describing convex hulls of unitary orbits and describing expectations onto maximal abelian self-adjoint subalgebras. In this talk, extensions of these structures and results will be discussed in the context of C*-algebras. In particular, a notion of majorization of self-adjoint operators in any C*-algebra will be described that characterizes the norm closed convex hull of the unitary orbit of any self-adjoint operator in any C*-algebra. Furthermore, expectations of these convex hulls will be discussed in the context of von Neumann algebras.
(Based on joint work with Matthew Kennedy, Ping Wong Ng, and Leonel Roberts)

NICO SPRONK, University of Waterloo
Fixed points of contractive measures acting by convolution

The classical Choquet-Deny theorem tells us, for a locally compact abelian group, that the fixed points of a probability measure acting as a convolution operator are elements constant on cosets of the group generated by the support of the measure. Over the years this theorem has been extended to various classes of locally compact groups, and even studied in the context of quantum groups. We consider the case of a measure of norm 1. We explore some of the results in the context of locally compact quantum groups. This is joint work with M. Neufang (Carleton & Lille 1), A. Skalski (IMPAN), and P. Salmi (Oulu).

EDWARD TIMKO, University of Manitoba
The Spectrum of Constrained Model d-tuples

In this talk we give a few descriptions of the Taylor spectrum for compressions $Z^{(\mathfrak{a})}$ of the d-tuple of coordinate multiplication operators to co-invariant subspaces $H^2_d \ominus [\mathfrak{a}H^2_d]$ of the Drury-Arveson space H^2_d. We then discuss connections between the spectrum and some properties of the C*-algebra generated by $Z^{(\mathfrak{a})}$. This is joint work with Raphael Clouatre.

JIUN-CHAU WANG, University of Saskatchewan
Probability measures in bi-free probability

We report a list of important distributions in Voiculescu's bi-free probability, including infinitely divisible measures and extreme value measures.

DILIAN YANG, University of Windsor
KMS states of self-similar k-graph C-algebras*

Let G be a discrete amenable group, and Λ be a strongly connected finite k-graph. In this talk, we will describe the structure of the KMS simplex of the C*-algebra $\mathcal{O}_{G,\Lambda}$ associated to (G, Λ) when (G, Λ) is a pseudo free and locally faithful self-similar action. This is joint work with Hui Li.