Operator Algebras Over Groups
Algèbres d'opérateurs sur des groupes
(Org: **Volker Runde** and/et **Matthew Wiersma** (University of Alberta))

MICHAEL BRANNAN, Texas A&M University
Quantum permutations and their matrix models

A quantum permutation matrix is a square matrix P whose entries are orthogonal projections on a Hilbert space H with the property that the rows and columns of P sum to the identity operator on H. In the special case where H is the one dimensional Hilbert space, a quantum permutation matrix is simply an ordinary permutation matrix, and can be thought of as describing a symmetry of a finite set. In this talk I will explain how arbitrary quantum permutation matrices describe the "quantum symmetries" of finite sets. Putting all of these quantum permutation matrices together in a cohesive way yields the structure of a quantum group, which is commonly called the Quantum Permutation Group. Unlike the classical permutation groups, quantum permutation groups turn out to highly infinite and noncommutative objects – in many ways they behave algebraically like the C*- and von Neumann algebras associated to nonabelian free groups. Despite their inherent infiniteness, I will show how quantum permutation groups can still be well-approximated by finite-dimensional structures. In particular, these objects turn out to be residually finite as discrete quantum groups, and this residual finiteness can in fact be achieved using very simple finite-dimensional matrix models which I will describe. (Joint work with Alexandru Chirvasitu and Amaury Freslon.)

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.

CALEB ECKHARDT, Miami University
C-rigidity of two-step nilpotent groups*

(Joint work with Sven Raum) We examine the following classic question–Does a group ring remember its generating group?–from a C*-algebraic perspective. A group G is called C*-superrigid if $C_r^*(G) \cong C_r^*(H)$ implies $G \cong H$ for any other group H. It has long been known that torsion free abelian groups are C*-superrigid because such a group G is recovered as the quotient of the unitary group of $C^*(G)$ by the connected component of the identity. Beyond abelian groups very little was known about C*-superrigid groups. The "next" natural class of groups to consider are the nilpotent ones. In this talk I will discuss a recent result with S. Raum that shows finitely generated two-step nilpotent groups are C*-superrigid.

BRIAN FORREST, University of Waterloo
Exotic Ideals in the Fourier-Stieltjes Algebra of a Locally Compact group.

Recently, there has been considerable interest in identifying natural intermediate C^*-algebras sitting strictly between the full group C^*-algebra $C^*(G)$ and the reduced C^*-algebra $C_r^*(G)$ for various non-amenable groups such as the free group on two generators. In this talk we will focus on the dual version of this problem. In particular, we show that for large classes of locally compact groups, including even abelian groups, that L^p-representations generate distinct exotic ideals in the Fourier-Stieltjes of G which contain the Fourier algebra. We also look at some basic properties of these exotic ideals that distinguish them from the Fourier algebra itself.

This is joint work with Zsolt Tanko and Matthew Wiersma.

MAHYA GHANDEHARI, University of Delaware

Spectra of Beurling-Fourier Algebras

Beurling-Fourier algebras are analogues of the Beurling algebra in the non-commutative setting. These algebras for general locally compact groups were defined by Lee and Samei as the predual of certain weighted von Neumann algebras, where a weight on $\widehat{G}$ is defined to be a suitable unbounded operator affiliated with the group von Neumann algebra. In this talk, we present the general definition of a Beurling-Fourier algebra, and discuss how their spectra can be computed. In particular, we determine the Gelfand spectrum of Beurling-Fourier algebras for some representative examples of Lie groups, such as $\mathrm{SU}(n)$, the Heisenberg group, and the Euclidean motion group, emphasizing the connection of spectra to the complexification of underlying Lie groups. This talk is based on joint work with Lee, Ludwig, Spronk, and Turowska.

THIERRY GIORDANO, University of Ottawa/Université d'Ottawa

A relative bicommutant theorem: the stable case of Pedersen's question

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 question, obtained in a joint work with Ping W. Ng

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QIANHONG HUANG, University of Alberta

Translation continuous measures on locally compact semigroup

Let S be a locally compact (semitopological) semigroup. The set $L(S)$ of translation continuous measures on S, consists of those regular complex Borel measures μ such that $s \to \delta_s * |\mu|$ is weakly continuous. If S is a locally compact group, $L(S) = L_1(S)$. I will show that $L(S)$ is a closed ideal and a sublattice of the measure algebra $M(S)$. When $L(S)$ is non-trivial, it shows an abundance existence of measures such that the above map is norm continuous. I will also present a characterization of $L(G^w)$, where G^w is the wap-compactification of a locally compact group G.

MARCELO LACA, University of Victoria

PRACHI LOLIENCAR, University of Alberta

Measures on compact right topological groups

Compact admissible right topological groups, arising naturally from the distal semigroup flows, were initially studied in topological dynamics. However, Namioka's topological analysis of these groups, and Pym and Milnes' discovery of the existence of a Haar measure, have since inspired an Abstract Harmonic Analytic interest. Lau and Loy have introduced and analyzed measure and Fourier algebra analogues on such groups in great detail.

Most of the existing literature however, relies on the admissibility property of such groups. In this talk, we shall introduce alternate sufficient conditions for the existence of a Haar measure, dealing with arbitrary compact right topological groups. We shall introduce measure algebras that characterize this existence, and discuss some Hereditary properties of these groups, relating the existence of a Haar measure on the group to that on its sub-structures.

IAN PUTNAM, University of Victoria

Odometers

Classical odometers are well-known dynamical systems on totally disconnected spaces. They can be generalized in the following way: begin with a countable group and a decreasing sequence of subgroups whose intersection is the identity and let the group act on the inverse limit of the quotient spaces in the obvious way. Here, we consider the case that the group is a finitely generated, free abelian group. We show that cohomological invariants completely determine the system up to either isomorphism or orbit equivalence. This is joint work with T. Giordano and C. Skau.

EBRAHIM SAMEI, University of Saskatchewan
Exotic C^*-algebras of geometric groups

We consider a new class of potentially exotic group C*-algebras $C^*(\mathsf{PF}^*_p(G))$ for a locally compact group G, and its connection with the class of potentially exotic group C*-algebras $C^*_{L^p}(G)$ introduced by Brown and Guentner. Surprisingly, these two classes of C*-algebras are intimately related. By exploiting this connection, we show $C^*_{L^p}(G) = C^*(\mathsf{PF}^*_p(G))$ for $p \in (2,\infty)$, and the C*-algebras $C^*_{L^p}(G)$ are pairwise distinct for $p \in (2,\infty)$ when G belongs to a large class of nonamenable groups possessing the Haagerup property and either the rapid decay property or Kunze-Stein phenomenon by characterizing the positive definite functions that extend to positive linear functionals of $C^*_{L^p}(G)$ and $C^*(\mathsf{PF}^*_p(G))$. This greatly generalizes earlier results of Okayasu and the second author on the pairwise distinctness of $C^*_{L^p}(G)$ for $2 < p < \infty$ when G is either a noncommutative free group or the group $\mathsf{SL}(2,\mathbb{R})$, respectively.

This is a joint work with M. Wiersma.

CHRISTOPHER SCHAFHAUSER, York University
MF approximations of crossed products

A C*-algebra is MF (matricial field) if it approximate embeds into finite-dimensional C*-algebras. A classical question of Blackadar and Kirchberg asks if every stably finite C*-algebra is MF. I will discuss the MF approximation problem as it relates to group C*-algebras and to crossed products of nuclear C*-algebras by free groups. This is partially based on joint work with Tim Rainone.

CAMILA FABRE SEHNEM,
On C^*-algebras associated to product systems

Many examples of product systems arise from actions of semigroups by endomorphisms of a C^*-algebra. In this talk, assuming that P is a unital subsemigroup of a group G, we will define the covariance algebra of a product system $\mathcal{E} = (\mathcal{E}_p)_{p\in P}$ over a C^*-algebra A, which is constructed out of a gauge-invariant ideal of the Toeplitz algebra of $\mathcal{E}$. The covariance algebra, denoted by $A \times_{\mathcal{E}} P$, does not depend on the group G. We will discuss further properties of a covariance algebra: under the appropriate assumptions, a representation of $A \times_{\mathcal{E}} P$ in a C^*-algebra is injective if and only if it is injective on A. In particular, this may be viewed as a generalization of a Cuntz-Pimsner algebra of a single correspondence. We will also see examples of C^*-algebras in the setting of irreversible C^*-dynamical systems that can be described as a covariance algebra of a product system.

VARVARA SHEPELSKA, University of Saskatchewan
Norm-controlled inversion in weighted convolution algebras

Let $\mathcal{A} \subseteq \mathcal{B}$ be two Banach algebras with a common unit. If $\mathcal{A}$ is inverse-closed in $\mathcal{B}$ and there is a function $h : \mathbb{R}^+ \times \mathbb{R}^+ \to \mathbb{R}^+$ such that

$$\|a^{-1}\|_{\mathcal{A}} \le h(\|a\|_{\mathcal{A}}, \|a^{-1}\|_{\mathcal{B}}),$$

we say that $\mathcal{A}$ *admits norm-controlled inversion in* $\mathcal{B}$. This notion was introduced by K. Gröchenig and A. Klotz who showed that if $\mathcal{B}$ is a C^*-algebra and $\mathcal{A}$ is a differential $*$-subalgebra of $\mathcal{B}$, then $\mathcal{A}$ admits norm-controlled inversion in $\mathcal{B}$.

In case $\mathcal{B} = C(X)$, norm-controlled inversion is closely related to the phenomenon of invisible spectrum studied by N. Nikolski. From his results it follows that $\ell^1(G)$ for a discrete abelian group G or the unitization $L^1(G) + \mathbb{C}\cdot e$ of the group algebra of a locally compact abelian non-discrete group G do not admit norm-controlled inversion in $C(\widehat{G})$. On the other hand, certain weighted group algebras $\ell^p(\mathbb{Z}, \omega)$ admit norm-controlled inversion in $C(\mathbb{T})$.

In this talk, we will present some results on norm-controlled inversion for non-commutative weighted group algebras. In particular, we will provide sufficient conditions on a weight ω for $\ell^p(G, \omega)$ to be a Banach algebra admitting a norm-controlled inversion in $C_r^*(G)$ and show how this can be applied to locally finite groups as well as finitely generated groups of polynomial or intermediate growth and a natural class of weights on them. In the non-discrete case, we will discuss the existence of norm-controlled inversion in $B(L^2(G))$ for some related convolution algebras.

This is a joint work with E. Samei.

NICO SPRONK, University of Waterloo
Idempotents, topologies and ideals

A classical theorem due to Jacobs, and de Leeuw and Glicksberg, shows that a continuous representation of a topological group G on a reflexive Banach space may be decomposed into a "returning" subspace and a "weakly mixing" subspace. Furthermore, following Dye, Bergelson and Rosenblatt characterized the weakly mixing vectors as those for which the closure of the weak orbit of the vector contains zero. I wish to exhibit a generalization of these results, inspired, in part, by some work of Ruppert on abelian groups. I will exhibit a bijective correspondence between

(1) central idempotents in the weakly almost periodic compactification of G;

(2) certain topologies on G; and

(3) certain ideals in the algebra of weakly almost periodic functions.

Given time, I will indicate some applications to Fourier-Steiltjes algebras.

KEITH TAYLOR, Dalhousie University
Wavelet Sets for Shifts by Wallpaper Symmetries

The wallpaper groups are the symmetry groups of two dimensional crystals. If Γ is a wallpaper group and A is a 2×2 dilation matrix compatible with Γ, there is a concept of an $A\Gamma$-wavelet, which is a function $\psi \in L^2(\mathbb{R}^2)$ for which the set of shifts by members of Γ and dilations by integer powers of A is an orthonormal basis of $L^2(\mathbb{R}^2)$. An $A\Gamma$-wavelet set, is a Borel subset Ω of $\mathbb{R}^2$ such that the characteristic function of Ω is the Fourier transform of an $A\Gamma$-wavelet. We will report on the search for simple $A\Gamma$-wavelet sets. (This is joint work with Larry Baggett, Alex Christie, Kathy Merrill, and Judy Packer.)

RUFUS WILLETT, University of Hawaii at Manoa
Lp group algebras

Let G be a unimodular group, $L^1(G)$ the associated convolution algebra, and $p \in [2, \infty)$. One can complete $L^1(G)$ to a Banach-$*$ algebra by representing it as convolution operators on $L^p(G)$, and taking the norm to be the max of the operator norm, and the operator norm of the adjoint acting on $L^q(G)$, q the conjugate index to p. On the other hand, one can define a C^*-algebra completion of $L^1(G)$ by taking the norm to be the supremum over the norms coming from unitary representations with a dense set of matrix coefficients in $L^p(G)$; this latter construction has been studied recently by Brown-Guentner, Okayasu, Wiersma, and others.

I'll discuss what these two constructions have to do with each other, and what one can say (at least sometimes) about the K-theory of the associated algebras. This will be based partly on work of Benben Liao and Guoliang Yu (which I was not involved in), partly on joint work with Alcides Buss and Siegfried Echterhoff, and partly on joint work with Ján Špakula.

SANG-GYUN YOUN, Queen's University
On the complete representability of convolution algebras of quantum groups as operator algebras

A (completely contractive) Banach algebra $\mathcal{A}$ is called (completely) representable as an operator algebra if there is a (complete) isomorphism from $\mathcal{A}$ into a closed subalgebra of $B(H)$, and we will focus on the case of convolution algebras $\mathcal{A} = L^1(\mathbb{G})$ of locally compact quantum groups $\mathbb{G}$. The complete answer for locally compact groups G and their duals $\widehat{G}$, and several recent results for locally compact quantum groups $\mathbb{G}$ will be presented.