Invited Talks:

## On ergodic and mixing properties of probability measures on motion groups

Michalis Anoussis
University of the Aegean, Greece

Let $G$ be a semi-direct product $G = A \times_{\varphi} K$ with $A$ Abelian and normal and $K$ compact. We use representation theory to provide characterizations of mixing by convolutions and ergodic by convolutions probability measures on $G$ by means of their operator valued Fourier transforms.

## The Dixmier property in operator algebras

Robert Archbold
University of Aberdeen, UK

Dixmier's classical 'theorem of approximation' for a von Neumann algebra concerns the norm-closed convex hull of the unitary conjugates of an arbitrary element of the algebra. The theorem has a number of corollaries and applications, and it has some partial analogues in the wider context of $C^*$-algebras, including some group $C^*$-algebras. We shall review some of this before turning to a recent theorem of Ozawa which links the Dixmier property in a $C^*$-algebra to properties of tracial states. Ozawa applied this theorem to give a characterization of symmetric amenability in $C^*$-algebras. We shall describe some other consequences of Ozawa's theorem that have been obtained in collaboration with Luis Santiago and Aaron Tikuisis in Aberdeen.

Invited Talks:

## CAP and ITAP for group von Neumann algebras Abstract

Yemon Choi
Lancaster University, UK

The almost periodic compactification of a LCA group $G$ can be constructed in terms of the Banach algebra $L^1(G)$ as the spectrum of a certain subspace of $L^\infty(G)$. This definition can be extended to arbitrary Banach algebras, and hence to Fourier algebras; but the resulting space is poorly understood in general. In the presence of operator space structure, one can seek to modify this definition in order to obtain a more tractable space. In the first part of my talk, after reviewing some of the background and context, I will revisit Runde's definition of the space of "completely almost periodic" functionals, and outline a proof that when $M$ is a Hopf-von Neumann algebra (in particular, $L^\infty(G)$ or $VN(G)$) the space CAP($M$) is a unital $C^*$-subalgebra of $M$. In the second part I will focus on $VN(\Gamma)$ where $\Gamma$ is a discrete group. Does CAP($VN(\Gamma)$) always coincide with the reduced group $C^*$-algebra of $\Gamma$? I will sketch how this problem is equivalent to one arising in the study of uniform Roe algebras of discrete groups, and indicate how known results from that setting yield a positive solution to our problem for a wide class of discrete groups.

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## An intrinsic algebraic characterization of C*-simplicity for discrete groups

Matthew Kennedy
University of Waterloo, Canada

A discrete group is said to be C*-simple if its reduced C*-algebra is simple. It is not difficult to see that a group with this property does not have any non-trivial normal amenable subgroups, however it was an open question for many years to determine whether the converse holds. Recent examples constructed by Le Boudec show that the answer to this question is negative, but raise the question of whether there is an intrinsic algebraic characterization of C*-simplicity. In this talk I will discuss recent work providing such a characterization.

INVITED TALKS:

## Amenabilities of $L^1$-algebras of locally compact quantum groups

Hun Hee Lee
Seoul National University, South Korea

A locally compact quantum group $\mathbb{G}$ can be understood its $L^\infty$-algebra $L^\infty(\mathbb{G})$ together with the comultiplication and Haar weights on it. The $L^1$-algebra $L^1(\mathbb{G})$ is the predual of $L^\infty(\mathbb{G})$ with the algebra multiplication given by the pre-adjoint map of the comultiplication. While the properties of $L^\infty(\mathbb{G})$ (or its $C^*$-version $C_0(\mathbb{G})$) have been extensively studied, the properties of $L^1(\mathbb{G})$ remained uncovered so far, in particular, its various amenabilities.

In this talk we will review amenability related properties of $L^1$- algebras of locally compact quantum groups including some recent developments. More precisely, we will discuss (1) a full characterization of operator amenability of $L^1(\mathbb{G})$ for compact quantum group $\mathbb{G}$; (2) some partial results on operator weak amenability of $L^1(\mathbb{G})$ for compact quantum group $\mathbb{G}$; (3) Non-weak amenability of $L^1(\mathbb{G})$ for some discrete quantum group $\mathbb{G}$; (4) Non-existence of bounded point derivation on $L^1(\mathbb{G})$ for general locally compact quantum group.

This talk is based on joint works with M. Brannan, M. Caspers, E. Ricard, V. Runde, N. Spronk and S. Youn.

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## The $C^*$-algebras of some solvable Lie groups

Jean Ludwig
University of Lorraine, France

We describe the $C^*$-algebras of some nilpotent and exponential solvable Lie groups as algebras of operator fields defined over the spectrum of the group. The main challenge is to understand the behaviour of the operator fields near the boundary of the different Hausdorff layers in the spectrum.

Invited Talks:

# Around Property (T) and Haagerup property for quantum groups - a global point of view

Adam Skalski
Polish Academy of Sciences, Poland

Abstract: Haagerup property and Kazhdan's Property (T), both in the classical and quantum setting, can be viewed as strong negations of each other, related to the representation theory of a given (quantum) group. I will discuss these two concepts, focusing on the approach via 'typical' representations. The Haagerup part will be based on joint work with M.Daws, P.Fima and S.White, and the (T) case on the joint work with M.Daws and A.Viselter.

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# The $C^*$-algebra of lamplighter groups over finite groups

Alain Valette
Universite de Neuchatel, Switzerland

Let $F$ be a finite group, and $G = F \wr \mathbb{Z}$ be the corresponding lamplighter group. We compute the K-theory of the $C^*$-algebra $C^*(G)$: the $K_1$- group is infinite cyclic, generated by the shift on $\oplus_{\mathbb{Z}} F$; the $K_0$- group is free abelian of countable rank, with an explicit basis. Using the fact that $G$ admits a 2-dimensional classifying space for proper actions, we give a direct proof of the Baum-Connes conjecture for $G$ (which is known to hold for amenable groups, by Higson-Kasparov). As an application, we give new proofs of a few results regarding full shifts in topological dynamics.? This is joint work with Ramon Flores and Sanaz Pooya.

Contributed Talks:

## On $C^*$-algebras of exponential Lie groups

Ingrid Beltita
Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

For an exponential Lie group, we compute the real rank of its $C^*$-algebra. The proof relies on the existence of a finite composition series with successive subquotients that have continuous-trace and spectrum of finite covering dimensions. We discuss the connection between open coadjoint orbits of the group and the existence of projections in its $C^*$-algebra, and give some examples.

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## Classification of locally representable actions of finite dimensional quantum groups on AF $C^*$-algebras

Andrew J. Dean
Lakehead University, Canada

A $K$-theoretic classification is given of actions of finite dimensional quantum groups on AF $C^*$-algebras that arise as inductive limits of inner actions on finite dimensional building blocks. The invariant used consists of the ordered $K_0$ group of the smash product of the $C^*$- algebra by the quantum group endowed with a module structure and a distinguished element.

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## On $p$-Ditkin sets

Antoine Derighetti
Ecole Polytechnique Fdrale de Lausanne, Switzerland

We present an injection theorem for locally $p$-Ditkin sets for Figà-Talamanca Herz algebras $A_p(G)$.The precise statement is the following. Let $1 < p < \infty$, $G$ a locally compact group, $H$ a closed subgroup and $F$ a closed subset of $H$. We show that $F$ is locally $p$-Ditkin in $G$ if and only if $F$ is locally $p$-Ditkin in $H$.

Contributed Talks:

## On the spectral radius algebras of weighted conditional expectation operators on $L^2(\Sigma)$

Yousef Estaremi
Payame Noor University, Iran

In this paper, we investigate the spectral radius algebras related to the weighted conditional expectation operators on the Hilbert spaces $L^2(\mathcal{F})$. We give a large classes of operators on $L^2(\mathcal{F})$ that have the same spectral radius algebra. As a consequence we get that the spectral radius algebras of a weighted conditional expectation operator and its Aluthge transformation are equal. Also, we obtain an ideal of the spectral radius algebra related to the rank one operators on the Hilbert space $\mathcal{H}$. Finally we get that the operator $T$ majorizes all closed range elements of the spectral radius algebra of $T$, when $T$ is a weighted conditional expectation operator on $L^2(\mathcal{F})$ or a rank one operator on the arbitrary Hilbert space $\mathcal{H}$.

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## Classes of Operator Multipliers

Åse Fahlander
Chalmers University of Technology, Sweden

Operator multipliers is a non-commutative version of Schur multipliers which was introduced by Kissin and Schulman. They are elements of the minimal tensor product of two $C^*$-algebras which satisfy certain boundedness conditions depending on a pair of representations of the $C^*$-algebras. I will give the background and definition of these objects, including a proposed extension of the definition. Moreover I will explain a connection between operator multipliers, approximate subordination of representations, and complete boundedness of certain maps, which is very useful when studying these objects. Finally I will state some results about certain classes of operator multipliers.

Contributed Talks:

## Approximate amenability of tensor products of Banach algebras

Fereidoun Ghahramani
University of Manitoba, Canada

A well-known result of Barry Johnson - from 1972 - states that if the Banach algebras $A$ and $B$ are amenable, then so is their projective tensor product Banach albegbra $A\hat{\otimes}B$. In this talk first I'll show that the tensor product of two boundedly approximately amenable Banach algebras need not be approximately amenable - even if they are unital. Then I'll show that with some additional conditions on the components - such as existence of central bounded approximate identities - approximate amenability of $A\hat{\otimes}B$ necessitates approximate amenability of $A$ and $B$. Our methods can also be used to prove that if $A\hat{\otimes}B$ is amenable then each of the components $A$ and $B$ is amenable. The latter result was proved by Barry Johnson - with some additional assumption - in 1996. This is joint work with Richard J. Loy.

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## Smooth subalgebras and analytic surgery

Magnus Goffeng
University of Gothenburg, Sweden

In this talk I will present a geometric model for Higson-Roes analytic surgery group of a discrete group. This geometric model lends itself to modelling analytic surgery groups also for assembly mappings using smooth subalgebras of the reduced group $C^*$-algebra and the possibility of numerical invariants for PSC-metrics and surgery. Based on joint work with Robin Deeley.

Contributed Talks:

## The Operator Space Projective Tensor Product: Embedding into second dual and ideal structure

Ranjana Jain
University Delhi, India

We present a review of some of our recent contributions towards the understanding of ideal structures and embeddings into biduals of operator space projetive tensor product. For operator spaces $V$ and $W$, we identify certain conditions under which the canonical embedding of $V^{**}\otimes_\alpha W^{**}$ into $(V\otimes_\alpha W)^{**}$ is complete isometry or has a continuous inverse, where $\alpha$ is either the operator space projective tensor product or the Haagerup tensor product. Further, for $C^*$-algebras $A$ and $B$, we discuss the (closed) ideal structure of $A\widehat{\otimes}B$, which, in particular, determines the lattice of closed ideals of $B(H)\widehat{\otimes}B(H)$ completely, $\widehat{\otimes}$ being the operator space projective tensor product. This talk is based on joint works with Ajay Kumar.

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## Harmonic operators and ideals of the Fourier algebra

Aristides Katavolos
University of Athens, Greece

We examine the common null spaces of families of Herz-Schur multipliers and apply our results to study jointly harmonic operators and their relation with jointly harmonic functionals, arriving at a new characterisation of 'jointly invariant' subspaces of $\mathcal{B}(L^2(G))$. We obtain a generalisation of a result of Neufang and Runde concerning harmonic operators with respect to a normalised positive definite function.
(Joint work with A.G. Todorov and M. Anoussis)

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## A Fourier inversion theorem for nilpotent Lie groups

Ying-Fen Lin
Queen's University Belfast, UK

In this talk, I will give a version of the Fourier inversion theorem for nilpotent Lie groups by constructing a continuous retract from the space of adapted smooth kernel functions defined on a submanifold of $\mathfrak{g}^*$ into the Schwartz functions on the nilpotent Lie group G. As an application, the prime ideals of $L^1(G)$ will be characterised. This is a joint work with Jean Ludwig and Carine Molitor-Braun.

Contributed Talks:

## Herz-Schur multipliers of dynamical systems

Andrew McKee
Queen's University Belfast, UK

Abstract: I will introduce and characterise 'operator valued' versions of Schur and Herz-Schur multipliers, showing how classical scalar valued Schur and Herz-Schur multipliers, and their characterisations, can be obtained as a special case. If time permits I will discuss possible applications to approximation properties.

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## Non-separability of the Gelfand space of measure algebras

Przemysław Ohrysko
Institute of Mathematics of Polish Academy of Sciences, Poland

In this talk I would like to present some recent results concerning the Banach algebra $M(G)$ of Borel regular measures on a locally compact Abelian group with the convolution product. Since it is well-known that the spectrum of a measure can be much bigger then the closure of the values of its Fourier-Stieltjes transform (the Wiener-Pitt phenomenon) it is natural to ask what kind of topological properties of the Gelfand space $\mathfrak{M}(M(G))$ are responsible for this unusual spectral behaviour. It follows immediately from the existence of the Wiener-Pitt phenomenon that the set $\Gamma$ (the dual group) identified with Fourier-Stieltjes coefficients is not dense in $\mathfrak{M}(M(G))$. However, it is not clear if any other countable dense subset of this space exists. During my talk, I will disprove this fact - i.e. I will show the non-separability of the Gelfand space of measure algebras on any non-discrete locally compact Abelian group. This is the main result of the paper 'Non-separability of the Gelfand space of measure algebras' written in collaboration with Michaa Wojciechowski and Colin C. Graham which will be published soon in Arkiv för Matematik and is available on arxiv.org with the identi er: 1603.05864.

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Contributed Talks:

# On representations of "all but $m$" algebras

Vasyl Ostrovskyi
Institute of Mathematics, National Academy of Sciences, Ukraine

In [1], the structure of families of projections, $Q_1, \dots, Q_n$, $P$, for which $Q_1 + \dots + Q_n = I$, has been studied. Such families arise, in particular, in the study of Toeplitz operators with piecewise continuous symbols. It was shown that such families can be described in terms of families of positive self-adjoint operators $C_1, \dots, C_n$, for which $C_1 + \dots + C_n = I$. In the case, where these operators form a commuting family, the irreducible representations correspond to the points of a simplex $c_1 + \dots + c_n = 1$, $c_j \geq 0$, $j = 1, \dots, n$. Representations of the $*$-algebra generated by $m$ projections $P_1, P_2, \dots, P_m$, $P_i \perp P_j$, $i, j = 1, \dots, m$ and $n$ more projections $Q_1 + \dots + Q_n = I$ in a Hilbert space arise in the study of a wider class of Toeplitz operators [2]. We show that representations of such algebra can be described in terms of families of positive self-adjoint $m \times m$ block matrices $B_1, \dots, B_n$, for which $B_1 + \dots + B_n = I$. Also, we construct a family of normal operators $C_\alpha$ where $\alpha$ is a multi-index, such that the commutativity of the family of all $C_\alpha$ is equivalent to $\dim P_j \leq 1$, $j = 1, \dots, m$ for irreducible representations. A finite subset of multi-indices is selected, which is sufficient to identify an irreducible representation. The talk is based on a joint research with Emine Ashurova and Yurii Samoilenko.

## References

[1] N. Vasilevski. $C^*$-algebras generated by orthogonal projections and their applications. Int. Equat. Oper. Theory. **31** (1998), p. 113–132.

[2] Yu. I. Karlovich, Luis V. Pessoa. $C^*$-algebras of Bergman type operators with piecewise continuous coefficients. Int. Equat. Oper. Theory. **57** (2007), p. 521–565.

Contributed Talks:

## On $*$-representations of q-deformed anti-commutation relations

Danylo Proskurin
Kyiv National Taras Shevchenko University, Ukraine

In our talk we present recent results on representation theory of certain deformation of canonical anti-commutation relations. Namely, we consider $*$-algebras

$$\mathfrak{A}_{2,q} = \mathbb{C}\langle a_i,\ a_i^* \mid a_i^* a_i + a_i a_i^* = 1,\ a_1^* a_2 = q a_2 a_1^*,\ i = 1, 2\rangle, \quad q \in (0, 1).$$

The case $q = 0$ was studied separately.

$$\mathfrak{A}_{2,0} = \mathbb{C}\langle a_i,\ a_i^* \mid a_i^* a_i + a_i a_i^* = 1,\ a_1^* a_2 = 0,\ i = 1, 2\rangle$$

In both cases classification of irreducible representations is obtained. In particular, precise picture of Fock representations was done. It is proved that $C^*$-algebras $\mathcal{A}_q$ and $\mathcal{A}_0$ generated by Fock representation operators of $\mathfrak{A}_{2,q}$ and $\mathfrak{A}_{2,0}$ resp., are isomorphic. Also we show that universal $C^*$-algebra of algebra $\mathfrak{A}_{2,0}$ can be embedded into certain $C^*$-algebra of continuous operator-valued functions on some compact.

This is a joint work with Vasyl Ostrovskyi and Roman Yakymiv.

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## On real linear combinations of orthoprojections

Viacheslav Rabanovych
Institute of Mathematics, Ukraine

We consider here linear combinations of orthogonal projections $P_i$, $P_i^* = P_i^2 = P_i$, on a separable Hilbert space $H$. In 1984 K. Matsumoto proved that every bounded self-adjoint operator on $H$ is a real linear combination of 5 orhthoprojections. In 2005 V. Rabanovych showed that every *diagonalizable* self-adjoint bounded operator is a real linear combination of 4 orthoprojections. We now prove that *every* self-adjoint bounded operator can be decomposed into a real linear combination of 4 orthoprojections. We give a class of Hermitian operators for which there is no decomposition for an operator from the class into a real linear combination of 3 orthoprojections. Also we give a class of bounded operators for which any operator from this class is not a complex linear combination of 4 orthoprojections. For a Hermitian $n \times n$ matrix $A$, Y. Nakamura proved in 1984 that $A$ is a linear combination of 4 orthoprojections, and $A$ is a linear combination of 3 orthoprojections for $n \leq 7$. Using ideas applied for infinite dimensional space, we find $52 \times 52$ matrix that can not be presented as a real linear combination of 3 orthoprojection.

Contributed Talks:

## Ultra-operator amenability

Volker Runde
University of Alberta, Canada

M. Daws defined a Banach algebra to be ultra-amenable if each of its ultrapowers is amenable. Analogously, one can introduce the notion of ultra-operator amenability for completely contractive Banach algebras. We discuss this notion with particular emphasis on the Fourier algebra $A(G)$ of a locally compact $G$. We show that the operator ultra-amenability of $A(G)$ forces $G$ to discrete, amenable, and not contain any infinite abelian subgroup. For many classes of groups $G$, this means that $G$ is finite. This is joint work with B. E. Forrest and K. Schlitt.

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## Finitely-Generated Left Ideals in $L^1(G, \omega)$ and Related Algebras

Jared White
University of Lancaster, UK

Let $G$ be a locally compact group, and $\omega : G \to [1, \infty)$ a weight on $G$ (i.e. a Borel measurable function satisfying $\omega(st) \leq \omega(s)\omega(t)$ $(s, t \in G)$). We consider the weighted convolution algebra

$$L^1(G, \omega) = \left\{ f \in L^1(G) : \int_G |f(t)|\omega(t)dt < \infty \right\}.$$

This Banach algebra contains a codimension-1 ideal, known as the augmentation ideal, given by

$$L^1_0(G, \omega) = \left\{ f \in L^1(G, \omega) : \int_G f = 0 \right\}.$$

We investigate when $L^1_0(G, \omega)$ is finitely-generated as a left ideal, and describe how this relates to a conjecture of Dalesand Żelazko about maximal left ideals in Banach algebras. Our main results are that for any weight on a non-discrete group, the augmentation ideal is not finitely-generated, and a characterization of those radial weights on a finitely-generated group for which the corresponding augmentation ideal is finitely-generated. Time permitting, we may also discuss variants of our theory for weighted measure algebras, and semigroup algebras.

Contributed Talks:

## Weak amenability of central Beurling algebras

Yong Zhang
University of Manitoba, Canada

It is known that a nontrivial central Beurling algebra is isomorphic to a central Beurling algebra on an $[\mathrm{FC}]^-$ group. For a compactly generated $[\mathrm{FC}]^-$ group $G$ there is a natural length function $|x|$: $G \to \mathbb{N}$ so that, for each $\alpha \geq 0$, $\omega_\alpha(x) = (1 + |x|)^\alpha$ defines a weight function on $G$. We show that the central Beurling algebra $ZL^1(G, \omega_\alpha)$ is weakly amenable if and only if $0 \leq \alpha < \frac{1}{2}$. To this end, we will establish some necessary conditions and some sufficient conditions for a central Beurling algebra to be weakly amenable. This is joint work with Varvara Shepelska.