Banach Algebras and Abstract Harmonic Analysis
Algèbre de Banach et analyse harmonique abstraite
(Org: **Yong Zhang** (Manitoba))

YEMON CHOI, University of Manitoba, Winnipeg, R3T 2N2
Biflatness for Clifford semigroup algebras

We show how one may use classical ideas from the representation theory of Clifford semigroups (in particular certain Möbius inversion formulae) to characterize the biflatness of their ℓ^1-convolution algebras. A key tool is the old result of Duncan and Namioka that the ℓ^1-convolution algebra of a *semilattice* is amenable precisely when the semilattice is finite.

CONSTANTIN COSTARA, Univ. Laval, Dep. de Math. et Stat., Quebec, Canada, G1K 7P4
On local irreducibility of the spectrum

Let $\mathcal{M}_n$ be the algebra of $n \times n$ complex matrices, and for $x \in \mathcal{M}_n$ denote by $\sigma(x)$ and $\rho(x)$ the spectrum and spectral radius of x respectively. Let D be a domain in $\mathcal{M}_n$ containing 0, and let $F \colon D \to \mathcal{M}_n$ be a holomorphic map. We prove:

(1) if $\sigma\big(F(x)\big) \cap \sigma(x) \neq \emptyset$ for $x \in D$, then $\sigma\big(F(x)\big) = \sigma(x)$ for $x \in D$;

(2) if $\rho\big(F(x)\big) = \rho(x)$ for $x \in D$, there exists λ of modulus one such that $\sigma\big(F(x)\big) = \lambda\sigma(x)$ for $x \in D$.

Both results are special cases of theorems expressing the irreducibility of the spectrum $\sigma(x)$ near $x = 0$.

Joint work with T. J. Ransford.

BRIAN FORREST, University of Waterloo
Projective Operator Spaces, Almost Periodicity and Completely Complemented

The concept of an operator space or quantized Banach space has proved to be extremely useful in addressing problems in Abstract Harmonic Analysis. In this talk we will focus on the operator space analog of Grothendieck's notion of projectivity for Banach spaces. We will show how projective operator spaces arise naturally as spaces of almost periodic functions. In particular, we will show that a locally compact group is compact if and only if its Fourier–Stieltjes algebra (or equivalently its Fourier algebra $A(G)$) is projective as an operator space. From this we see that if K is a compact subgroup of G, then the ideal $I(K)$ of functions in $A(G)$ vanishing on K is completely complemented in $A(G)$.

NIELS GRONBAEK, Department of Mathematics, University of Copenhagen, Universitetsparken 5, DK-2100 Copenhagen Ø, Denmark
The $L_1(H)$-module $L_1(G)_H$

Let G be a locally compact group, and let H be a closed subgroup. Identifying Haar measure on H with an H-supported Borel measure on G, the Banach space $L_1(G)$ is naturally a right module over the convolution algebra $L_1(H)$, denoted $L_1(G)_H$. We prove that $L_1(G)_H$ is a strictly flat generator of the category of essential right $L_1(H)$-modules. This result is the key to understand the representations of G in terms of the representations of its closed subgroups. As an illustration we give a characterization of the strongly continuous 1-parameter group actions which are induced from some doubly power bounded operator.

ZHIGUO HU, University of Windsor, Windsor, Ontario
Multipliers on Banach algebras and applications to the second dual Banach algebras

We prove results on multiplier algebras for a large class of Banach algebras A. They are used to characterize the predual of a locally compact quantum group under a representation of its multipliers. Applications are obtained on the second dual Banach algebras A^{**} of A. Some results on the group algebra $L_1(G)$ and the Fourier algebra $A(G)$ of a locally compact group G are extended and unified through an abstract Banach algebraic approach.

The talk is based on joint work with M. Neufang and Z-J. Ruan.

ZINAIDA LYKOVA, School of Mathematics and Statistics, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK
The Hochschild and cyclic cohomology of simplicially trivial topological algebras

We give explicit formulae for the continuous Hochschild and cyclic homology and cohomology of simplicially trivial $\hat{\otimes}$-algebras. We show that, for a continuous morphism $\varphi\colon \mathcal{X}^* \to \mathcal{Y}^*$ of complexes of complete nuclear DF-spaces, the isomorphism of cohomology groups $H^n(\varphi)\colon H^n(\mathcal{X}^*) \to H^n(\mathcal{Y}^*)$ is automatically topological. The continuous cyclic-type homology and cohomology are described up to topological isomorphism for the following classes of biprojective $\hat{\otimes}$-algebras: the algebra of smooth functions $\mathcal{E}(G)$ on a compact Lie group G, the algebra of distributions $\mathcal{E}^*(G)$ on a compact Lie group G; the tensor algebra $E\hat{\otimes}F$ generated by the duality $(E, F, \langle\cdot,\cdot\rangle)$ for nuclear Fréchet spaces E and F or for nuclear DF-spaces E and F; nuclear biprojective Köthe algebras $\lambda(P)$ which are Fréchet spaces or DF-spaces.

TIANXUAN MIAO, Lakehead University
Approximation Properties of $A_p(G)$ and $A_p^r(G)$

Let G be a locally compact group and let $A_p(G)$ be the Figá–Talamanca–Herz algebra of G. In this talk, we will present some results on the approximation properties of $A_p(G)$ and $A_p^r(G) = A_p(G) \cap L^r(G)$ in their multiplier algebras.

MATTHIAS NEUFANG, Carleton University, School of Mathematics and Statistics, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6
Jordan Arens irregularity

Given a Banach algebra $\mathcal{A}$, its product admits two canonical extensions to the bidual, yielding the left and right Arens products. If these coincide, $\mathcal{A}$ is called Arens regular; this is the case, e.g. for all C^*-algebras $\mathcal{A}$. However, most Banach algebras arising in abstract harmonic analysis are preduals of Hopf–von Neumann algebras, and multiplication in the second dual is typically highly irregular. The degree of irregularity can be measured through the so-called left and right topological centres, i.e., the sets of elements in $\mathcal{A}^{**}$ for which the left, resp. right, Arens product is separately w^*-w^*-continuous. Arens regularity means precisely that both topological centres coincide with $\mathcal{A}^{**}$; if the left, resp. right, topological centre equals $\mathcal{A}$, following Dales–Lau, we call $\mathcal{A}$ left, resp. right, strongly Arens irregular (SAI). There are natural examples of Banach algebras (due to Dales–Lau and myself) which are left but not right SAI—such as the algebra $\big(\mathcal{T}(L_2(\mathcal{G})), *\big)$, for non-compact $\mathcal{G}$, equipped with a certain convolution type product I introduced and studied; its right topological centre can also be described explicitly for all discrete groups $\mathcal{G}$.

A canonical way to symmetrize a given Banach algebra is to consider the corresponding Jordan product. This prompts the question to what extent this symmetry is carried over to the second dual—in other words: what is the (algebraic) centre of the second dual of a Jordan algebra? We are thus led to the notion of Jordan Arens (ir)regularity.

We shall prove that for any discrete ICC group $\mathcal{G}$, the centre of the bidual of $\ell_1(\mathcal{G})$ endowed with the Jordan product, is exactly $\ell_1(\mathcal{G})$. The proof relies on our simultaneous left/right factorization theorem for bounded sequences in $\ell_\infty(\mathcal{G})$ through elements in $\ell_1(\mathcal{G})^{**}$ and a single function in $\ell_\infty(\mathcal{G})$. As a consequence, we shall derive that for the same class of groups, $\big(\mathcal{T}(\ell_2(\mathcal{G})), *\big)$ is Jordan SAI as well.

This is joint work with my Master's student, Chris Auger.

CHI-KEUNG NG, Nankai University, Tianjin 300071

Property (T) and strong property (T) for C^*-algebras

We study two (T)-type properties for unital C^*-algebras, namely, the property (T) as introduced by Bekka and a slightly stronger version of it, called the strong property (T). Similar to a result of Bekka, if Γ is a discrete group, then $C^*(\Gamma)$ have strong property (T) if and only if Γ have property (T). We will give some interesting equivalent formulations as well as some permanence properties for both property (T) and strong property (T). We will also relate them to some (T)-type properties of the unitary groups of the C^*-algebras.

THOMAS RANSFORD, Université Laval, Québec (QC), G1K 7P4

Pseudospectra and power growth

The pseudospectrum of a matrix is the set of level curves of the norm of the resolvent. It has become a very useful tool in the study of the evolution of the powers of the matrix. In this talk I shall discuss the following question: to what extent are the norms of the powers actually determined by the pseudospectrum?

ZHONG-JIN RUAN, University of Illinois at Urbana–Champaign

Completely Bounded Multipliers on Locally Compact Quantum Groups

I will discuss some of recent progress on completely bounded multipliers on locally compact quantum groups. I will also discuss the related representation theorems, something old and something new.

EBRAHIM SAMEI, University of Waterloo

2-weak amenability of Beurling algebras

Let $L^1_\omega(G)$ be a Beurling algebra on a locally compact abelian group G. We look for general conditions on the weight which allows the vanishing of continuous derivations of $L^1_\omega(G)$ into its iterated duals. This leads us to introducing vector-valued Beurling algebras and considering the translation of operators on them. This is then used to connect the augmentation ideals to the behavior of derivations space. We apply these results to give examples of various classes of 2-weakly amenable and none 2-weakly amenable Beurling algebras.

NICO SPRONK, University of Waterloo

Amenability constants for semilattice algebras

For any finite unital commutative idempotent semigroup S, a unital *semilattice*, we show how to compute the amenability constant of its semigroup algebra $\ell^1(S)$, which is always of the form $4n+1$. We then show that these give lower bounds to amenability constants of certain Banach algebras graded over semilattices. Our theory applies to certain natural subalgebras of Fourier–Stieltjes algebras.

This is joint work with Mahya Ghandehari and Hamed Hatami.

ROSS STOKKE, University of Winnipeg, Department of Mathematics and Statistics, 515 Portage Ave., Winnipeg, MB, R3B 2E9
Approximate and pseudo-amenability of the Fourier Algebra

The amenability of a Banach algebra can be defined in terms of the existence of certain bounded nets. By dropping the requirement that these nets are bounded, Ghahramani, Loy, and Zhang have introduced several generalized notions of amenability, including approximate and pseudo-amenability. Among many other things, these authors have shown that for group algebras, $L^1(G)$, approximate amenability, pseudo-amenability, and amenability are all equivalent. In this talk I will discuss several results showing that for Fourier algebras, $A(G)$, the situation is very different.

This talk is based on joint work with Fereidoun Ghahramani.

THOMAS V. TONEV, The University of Montana, Missoula, MT 59812
Peripheral additivity and isomorphisms between semisimple

We give sufficient conditions for mappings between semisimple commutative Banach algebras, not necessarily linear, to be algebra isomorphisms. Namely, if A and B are semisimple commutative Banach algebras, then a mapping $T\colon A \to B$ is *peripherally-additive* if $\sigma_\pi(Tf + Tg) = \sigma_\pi(f + g)$ for all $f, g \in A$, where $\sigma_\pi(f)$ is the peripheral spectrum of f.

It is shown that under natural conditions every such mapping T is an isometric algebra isomorphism from A onto B that preserves the spectral radii, and therefore is linear and multiplicative. It is shown that similar result holds also for symmetric semisimple commutative Banach algebras.

FARUK UYGUL, University of Alberta, 632 CAB, Edmonton, AB, T6G 2G1
A Representation Theorem for Completely Contractive Dual Banach Algebras

In this talk, we prove that every completely contractive dual Banach algebra $\mathfrak{A}$ is completely isometric to a w^*-closed subalgebra of $\mathcal{CB}(E)$, for some reflexive operator space E.

MICHAEL C. WHITE, Newcastle University, England
The Bicyclic semigroup algebra

The bicyclic semigroup is generated by two elements, q and p, subject to the relation $qp = 1$. For a model of this semigroup you may think of the C^*-algebra generated by the right shift and its adjoint on Hilbert space. This C^*-algebra is amenable and so most of its cohomology is trivial. One can also consider the 1-normed algebra generated by this semigroup. The algebra is not amenable, in particular it has (non-inner) derivations into its dual, so is not even weakly amenable. We will see how the semigroup's structure can be used to calculate the cohomology of this algebra.

YONG ZHANG, Department of Mathematics, University of Manitoba, Winnipeg MB, R3T 2N2
Fixed point properties characterized by existence of left invariant means on semigroups

Let S be a semitopological semigroup. Denote by $\mathrm{AP}(S)$, $\mathrm{WAP}(S)$ and $\mathrm{LUC}(S)$ the spaces of almost periodic functions on S, weakly almost periodic functions on S and left uniformly continuous functions on S respectively. Existence of left invariant means (LIM for short) on these spaces can characterize various fixed point properties (FPP for short) of S acting on subsets of locally convex spaces (and vice versa). We consider FPP of S acting as non-expansive quasi equicontinuous mappings on a weakly compact convex set. When S is separable we show, among other things, that this type of FPP is equivalent to the existence of a LIM on $\mathrm{WAP}(S)$ or a LIM on $\mathrm{WAP}(S) \cap \mathrm{LUC}(S)$. Some FPP characterized by the existence of LIM on $\mathrm{AP}(S)$ will also be discussed.

This is joint work with A. T.-M. Lau.