William Arveson

1. Operator theory and the K-homology of algebraic varieties.
2. Standard Hilbert modules: the Fredholm property.
3. Recent progress in noncommutative dynamics.

Man-Duen Choi

Matrix analysis in quantum computing

Abstract:I was surprised that much of my earliest research work (in the early 70's) had been used intensively in the very recent developments of quantum computing theory. Let me re-examine the mathematical underpinnings, in order to realize the new value of the old meanings (as well as to seek the new meaning of the old values).

Ken Davidson

Nonself-adjoint operator algebras of dynamical systems
(joint work with Elias Katsoulis)

Abstract: Following Arveson and Hadwin--Hoover, one can define topological conjugacy algebras associated to a dynamical system (X,η). The only condition on η is continuity. We show that if two topological conjugacy algebras are isomorphic as algebras, then the two systems are conjugate.

More generally we look at multivariable systems and obtain a classification theorem under certain hypothesis. This part of the work is in a preliminary stage.

Chandler Davis

Not quite a canonical form

Andrew Dean

Classification of C*-dynamical systems

Abstract: We shall discuss the problem of classifying, up to equivariant isomorphism, C*-dynamical systems arising as inductive limits of inner actions on finite direct sums of matrix algebras over graphs.

Ron Douglas

Essentially Reductive Hilbert Modules

Abstract: A few years back Arveson conjectured that all homogeneous submodules of the m-shift Hilbert space H^2_m are essentially reductive. That is, all the commutators of

the operators defined by module multiplication and their adjoints are compact. He proved the result in case the submodule is generated by monomials and this researcher extended the result to related Hilbert modules defined by certain commuting shifts. Subsequently, Guo and then Guo and Wang proved the result for m = 2 and for ideals for which the zero variety has complex dimension one. More recently, Guo and Wang have extended the result to quasi-homogeneous submodules in H^2_2.

The elements of H^_m can be regarded as holomorphic functions on the unit ball B^m in C^m and, indeed, the foregoing results can be shown to extend to other Hilbert spaces of holomorphic functions on B^m such as the Hardy and Bergman spaces. In this talk, I will discuss these latter results of Guo and Wang and some extensions of them, in particular, to Hilbert spaces of holomorphic functions on other domains in C^2.

Roman Drnovsek

Products of quasi-nilpotent operators

Abstract: We prove that a (bounded linear) operator acting on an infinite-dimensional, separable, complex Hilbert space can be written as a product of two quasi-nilpotent operators if and only if it is not a semi-Fredholm operator. This solves the problem posed by Fong and Sourour in 1984. We also show that an operator can be expressed as a product of two nilpotent operators if and only if its kernel and its co-kernel are both infinite-dimensional.

This is joint work with Vladimir Mueller and Nika Novak.

George Elliott

The structure of the Cuntz semigroup

Abstract: A category is described to which the Cuntz semigroup belongs and as a functor into which it preserves inductive limits. (This is joint work with Cristian Ivanescu and Kristofer Coward.)

Avraham Feintuch

On Operator Algebras Determined by a Sequence of Operator Norms

Abstract: We consider a family of operators determined by a sequence of operator norms. When the sequence of norms is determined by a single operator the natural question that arises in the motivating examples is when the algebra properly contains the commutant of the operator. In this case the existence of invariant subspaces for the algebra is stronger than the existence of hyperinvariant subspaces for the operator.

Don Hadwin

New Free Entropy Invariants (joint with Junhao Shen and Weihua Li)

Abstract: We introduce a new free entropy invariant, based on covering numbers by neighborhoods of unitary orbits, that leads to quick and elementary proofs of significant extensions of most of the known applications of Voiculescu's free entropy. Our work leads to a new invariant (and results) for von Neumann algebras that may not be finitely generated.

Ilan Hirshberg

Rokhlin actions and strongly self-absorbing C*-algebras

Abstract: A strongly self-absorbing C*-algebra, in the sense of Toms and Winter, is a unital and separable C*-algebra D such that the first coordinate embedding of D into D \otimes D is approximately unitarily equivalent to an isomorphism. Examples include the Cuntz algebras O_2 and O_\infty, certain UHF algebras and the Jiang-Su algebra.

An algebra A is said to be D-absorbing if A \cong A \otimes D. In this talk, we will address the following question: if A is D-absorbing and G acts on A, is the crossed product A\times G D-absorbing as well? While the answer is in general negative, we will show that if G is compact, Z or R, and the action satisfies an appropriate version of the Rokhlin property, we do obtain a positive answer.

This is joint work with W. Winter.

John Holbrook

Quantum computing and higher-rank numerical ranges

Abstract: Quantum error correction is one of the keys to unlocking the potential of quantum computation. Choi, Kribs, and Zyczkowski have recognized that the search for correctable codes leads to the study of higher-rank generalizations of the classical numerical range for matrices. We treat the CKZ conjecture about the geometry of these numerical ranges and we discuss a related phenomenon concerning planar convex polygons.

Toan Ho Minh

On inductive limits of homogeneous C*-algebras with diagonal morphisms.

Abstract: An inductive limit of homogeneous C*-algebras with diagonal morphisms between the building blocks is simple if and only if it has the `constant eigenvalue map' property. Some applications of this equivalence, namely, every simple algebra under consideration has stable rank one and the property SP will also be presented. Under certain conditions, such an inductive limit will be unchanged when we relabel (by means of continuously varying permutations) the eigenvalue paterns of the morphisms between the building blocks.

Cristian Ivanescu

Non-stable Elliott invariant and the classification of projectionless C*-algebras.

Abstract: I will present a classification result for a class of C*-algebras which are simple stably projectionless C*-algebras but not necessarily stable C*-algebras and which are inductive limits of certainbuilding blocks with trivial K_0 and K_1-groups. At the level of the building blocks the invariant is the dimensions of the irreducible representations (i.e. the non-stable Elliott invariant which in the present case can be reduced to two positive integers) and the affine function space of continuous functions defined on the cone of positive traces. An Existence Theorem and a technique to obtain a non-zero gap so that the hypothesis of the Existence Theorem is satisfied will be presented. A classification result of a special class of such algebras has been obtained by S. Razak and K.W. Tsang.

Todd Kemp

Haagerup Inequalities in Free Probability

Abstract: In 1978, Uffe Haagerup introduced what has become known as the Haagerup inequality: a functional inequality relating the norm and the (non-commutative) L^2-norm in the Free group factor. Over the past 30 years, the Haagerup inequality has found important applications in geometric group theory (rapid decay, Kazhdan's property (T) and a-T-menability), probability theory (return probabilities for random walks on groups), and non-commutative geometry (the Baum-Connes conjecture), just to name a few.

In this talk, I will discuss the Haagerup inequality in free probability. The original inequality fits into the natural framework of an important class of free random variables called R-diagonal elements (which includes both circular elements and Haar unitaries). I will address some of my recent joint work with Roland Speicher, in which we prove a strengthened version of the Haagerup inequality for R-diagonal elements. The result is surprising, and (together with the results of my dissertation) supports the authors' supposition that R-diagonal elements have holomorphic structure.

David Kribs

On some mathematical aspects of quantum error correction

Marcelo Laca

A tale of four isometries

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Nadia Slavila Larsen

Generalised Hecke algebras and C*-completions

Abstract: To a Hecke pair (G, H) and a character of H with finite range we associate a "generalised Hecke algebra", which is a *-algebra that reduces to the Hecke algebra of (G, H) in the case of the trivial character. We employ Schlichting completions of Hecke pairs to study existence and structure of C^*-completions of a generalised Hecke algebra, and we highlight and illustrate the new aspects of the theory as arise from the presence of the character. This is joint work with Magnus Landstad.

Huaxin Lin

Tracial Rokhlin Property for automorphisms and AF-embeddings of crossed products

Abstract: We will show that there are abundant automorphisms with the tracial cyclic Rokhlin property on simple C*-algebras. For example, given a unital simple AT-algebra A of real rank zero, and an isomorphism $\kappa: K_1(A)\to K_1(A),$ there exists an automorphism $\af\in Aut(A)$ with the tracial cyclic Rokhlin property such that $\af_{*1}=\kappa.$

We will discuss why such automorphisms are interesting. Some special constructions related to minimal dynamical systems on a connected compact metric space will be presented. We will also discuss the problem when crossed products of certain C*-algebras can be embedded into a unital simple AF-algebra. Applications of the results about automotphisms with tracial cyclic Rokhlin property to the AF-embeddings of crossed products will be given.

Ying Fen Lin

Jordan isomorphism of purely infinite C*algebras

We show that every unital bounded linear mapping from a unital purely infinite C*-algebra of real rank zero onto a unital semisimple Banach algebra preserving elements of square zero is a Jordan epimorphism. This entails a description of unital spectral isometries as Jordan isomorphisms in this setting.

Laurent Marcoux

Abelian, triangular, total reduction algebras

Abstract: Suppose that ${\mathfrak H}$ is a complex, separable Hilbert space and that ${\mathcal B}({\mathfrak H})$ denotes the bounded linear operators on ${\mathfrak H}$. In this paper we show that if ${\mathcal A} \subseteq {\mathcal B}({\mathfrak H})$ is an abelian algebra whose elements admit triangular matrix representations, and if ${\mathcal A}$ has the property that given any bounded representation $\varrho: {\mathcal A} \to {\mathcal B}({\mathfrak H} _\varrho)$ of ${\mathcal A}$ on a Hilbert space ${\mathfrak H}_ \varrho$, every invariant subspace of $\varrho({\mathcal A})$ is topologically complemented by an invariant subspace of $\varrho ({\mathcal A})$, then ${\mathcal A}$ is similar to an abelian $C^* $-algebra. From this it follows that any

amenable Banach algebra of triangular operators on a Hilbert space is similar to an abelian C^*-algebra.

Ruben A. Martinez Avendaño

Eigenmatrices and operators commuting with finite rank operators

Abstract: Using eigenmatrices, we characterize when a bounded operator in Hilbert space commutes with a finite rank operator. We use this characterization to prove that if an operator commutes with a finite rank operator, then it must commute with an operator of rank one. As a corollary of this, we show that (classical) Toeplitz operators do not commute with operators of finite rank.

Martin Mathieu

Some fundamental properties of the maximal C*-algebra of quotients

Abstract. A C*-algebraic analogue of the maximal symmetric ring of quotients is introduced for arbitrary C*-algebras. This construction resembles to some extent the concept of the local multiplier algebra but works with one-sided essential ideals. However, there are various natural notions of "essentiality" in this case and part of the talk will discuss the interrelations between them. We shall also devote some attention to the situation of AW*-algebras. This is joint work in progress with Pere Ara, Barcelona.

Jamie Mingo

Second order freeness

Abstract: Second order freeness aims to do for the study of fluctuations of random matrices what (first order) freeness of Voiculescu did for eigenvalue distributions. In 1991 Voiculescu showed how to calculate the limiting eigenvalue distribution of sums and products of independent randomly rotated random matrices via the R and S transforms. I will explain what second order freeness is and give some examples of how to use it.

Ping Wong Ng

Stability of a sigma_P unital continuous field algebra

Abstract: Let K be the algebra of compact operators on a separable infinite dimensional Hilbert space. A C*-algebra A is said to be stable if A \otimes K (the stabilization of A) is isomorphic to A. Stability is interesting from the point of view of structure of C*-algebras, K-theory, extension theory and many other areas.

It is interesting to study the permanence properties of stability - i.e., what operations preserve stability. This subject has been looked at a great deal by Hjelmborg and Rordam - with interesting consequences for structure theory as well as extension theory of C*-algebras. In this talk, we discuss preservation of stability under the formation of continuous field algebras. In general, when the base space (of the continuous field algebra) is infinite dimensional, this need not be true. However, when the base space is

among certain finite dimensional spaces (together with other properties) we have a positive result. In more detail, we have the following:

Theorem: Let A be a separable sigma_P-unital maximal full algebra of operator fields over an n-cube or an n-torus. If every fibre algebra of A is stable then A is stable.

We also use our techniques to study preservation of the corona factorization property under the formation of continuous field algebras. (The corona factorization property will be defined and described during the talk.) Under similar hypotheses, we also have a positive result:
Theorem: Let A be a separable sigma_P-unital maximal full algebra of operator fields over an n-cube or an n-torus. If every fibre algebra of A is stable and has the corona factorization property then A is stable and has the corona factorization property.

Part of this is joint work with Bernhard Burgstaller and part is joint work with Dan Kucerovsky.

Zhuang Niu

On the classification of certain inductive limits of subhomogeneous C*-algebras.

Abstract: Using the abstract approach of Huaxin Lin to the classification for inductive limits of homogeneous C*-algebras, certain inductive limits of subhomogeneous C*-algebras are classified. More precisely, we consider the unital simple inductive limits of splitting interval algebras together with certain homogeneous C*-algebras, showing that they can be tracially approximated by splitting interval algebras in sense of Lin. Using the message of Lin's works, this class of C*-algebra is shown to be classified by their Elliott invariant.

Vern Paulsen

A Constrained Nevanlinna-Pick Problem

Abstract: We study the classical Nevanlinna-Pick problem with the additional constraint that the interpolating function satisfy, f'(0) = 0. We exhibit a family of analytic reproducing kernel Hilbert spaces on the disk, indexed by the 4-dimensional sphere, which determine whether or not a solution exists. Thus, our result is analogous to Abrahamse results on multiply-connected domains in the plane.

Chris Phillips

The Calkin algebra has outer automorphisms.

Abstract: Let Q be the Calkin algebra. Assuming the Continuum Hypothesis, we prove that the cardinality of the automorphism group of Q is strictly larger than the cardinality of the unitary group of Q. In particular, almost all automorphisms of Q are outer.

This is joint work with Nik Weaver.

Heydar Radjavi

Which polynomials are triangularizing?

Abstract: We study noncommutative polynomials f in two variables which have the following property: If f(A, B) = 0 for all A and B in a semigroup of compact operators, then the semigroup is simultaneously triangularizable. We also consider the effect of the weaker condition that f(A, B) is merely quasinilpotent for all A and B. Results in this direction, obtained a few years ago, mainly concerned the special case of polynomials of the form f(xy, yx). We present more general results in this talk.

Efren Ruiz

Classification of C*-algebras associated to certain shift spaces

Abstract: In recent years, we have seen a fruitful interaction between topological dynamics and operator algebras. The classification of C*-algebras by K-theoretical data has played an important role in this interplay. A construction originating from Matsumoto associate a shift space, in a flow invariant way, a stable C*-algebra.

In joint work with Eilers and Restorff, we show that the Matsumoto C*-algebras associated to certain shift spaces are classified by some K-theoretical data. Our classification results is a generalization of one obtained by Rordam and can be applied to other contexts.

Volker Runde

Amenability and co-amenability in non-abelian group duality

Abstract: Leptin's theorem asserts that a locally compact group is amenable if and only if its Fourier algebra has a bounded (by one) approximate identity. In the language of locally compact quantum groups - in the sense of J. Kustermans and S. Vaes -, it states that a locally compact group is amenable if and only if its quantum group dual is co-amenable. It is an open problem whether this is true for general locally compact quantum groups. We approach this problem focussing on the role of multiplicative unitaries. For a Hilbert space H, a multiplicative unitary $W \in B(H \otimes_2 H)$ defines a co-multiplication Γ_W on $B(H)$, so that $(B(H) ,\Gamma_W)$ is a Hopf-von Neumann algebra. We introduce the notion of an admissible, multiplicative unitary. With an admissible, multiplicative unitary W, we associate another Hopf-von Neumann algebra ($\M^W, \Gamma_W)$. We show that $(B(H), \Gamma_W)$ is left amenable (co-amenable) if and only if this is true for $(\M^W, \Gamma_W)$. Setting $\hat{W} := \sigma W^\ast \sigma$, where σ is the flip map on $H \otimes_2 H$, we prove that the left co-amenability of $(B(H), \Gamma_W)$ implies the left amenability of $(B (H), \Gamma_{\hat{W}})$, and - for infinite-dimensional H and under an additional

technical hypothesis - also establish the converse. Applying these results to locally compact quantum groups - and, in particular, to Kac algebras -, we obtain that a Kac algebra is amenable if and only if its dual is co-amenable. This extends Leptin's theorem to Kac algebras and answers a problem left open by D. Voiculescu.

Ana Savu

Closed and exact functions for discrete models

Abstract: Finding the codimension of the space of exact functions inside the space of closed functions is a key point in the derivation of the scaling limit of nongradient interacting particle systems. In my talk I will discuss the space of closed functions and the space of exact functions for a class of discrete models including the discrete solid-on-solid model. I will present ideas supporting the hypothesis that discrete models resemble continuous models and hence the codimension can be either zero or one. This is work in progress.

Nico Spronk

Amenability properties of Fourier-Stieltjes algebras

Abstract: For a locally compact group G we have pairs of algebras, the group algebra $L^1(G)$, and the Fourier algebra $A(G)$; also the measure algebra $M(G)$, and the Fourier-Stieltjes algebra $B(G)$. These pairs are each "dual pairs" in a sense which generalises Pontryagin duality from abelian groups. The realisation that $A(G)$ and $B(G)$, being preduals of certain von Neumann algebras, admit certain natural operator space structures augments our understanding of the duality. B.\ Johnson's now classic theorem is that $L^1(G)$ is an amenable Banach algebra, if and only if G is an amenable group. The dual version is Z.-J.\ Ruan's theorem that $A(G)$ is an operator amenable completely contractive Banach algebra, if and only if G is an amenable group. Also, Johnson proved that $L^1(G)$ is always weakly amenable; while I, and independently E.\ Samei, proved that $A(G)$ is always operator weakly amenable.

It was proved recently by Dales, Ghahramani and Helemskii that $M(G)$ is weakly amenable if and only if G is discrete; and further that $M(G)$ is amenable if and only if G is discrete and amenable. The natural conjecture is that the dual result must hold: {\it $B(G)$ is operator (weakly) amenable if and only if G is compact}. A few years ago V.\ Runde and I had produced evidence suggesting that this conjecture is true. However, we now have a counterexample to show it is false in a more profound way than we expected.

Ivan Todorov

Lattices of operator ranges in C*-algebras

Abstract: The set of all operator ranges in a von Neumann algebra forms a lattice with respect to intersection and (non-closed) linear span. This is no longer true for general C*-algebras of operators. We study the C*-algebras A which possess this property, as well as the C*-algebras A with the companion property that their projections form a sublattice

of the lattice of projections in the second dual of A. We discuss these properties in relation with results of Akemann and of Lazar, and characterise the AW* algebras possessing these properties.

This is a report on a joint work with M. Anoussis and A. Katavolos.

Gary Weiss

3 Paving Small Matrices and the Kadison-Singer Extension Problem

The Kadison-Singer Problem, posed in 1959, asks whether every pure state on the diagonal of $B(l^2)$ extends uniquely to a pure state on all of $B(l^2)$. It is equivalent to a variety of important problems in mathematics and engineering(cf. Casazza's invited addresses at GPOTS 2005 and the AMS Annual Meeting 2006 on the Kadison-Singer Problem in Mathematics and Engineering). Among these reformulations is the Paving Conjecture of Anderson:
Given $\varepsilon > 0$, there exists a k in **N** such that for any n in **N** and any A in $M_n(\mathbf{C})$ underline with zero diagonal, there exist diagonal projections $P_1, P_2, ..., P_k$ in $M_n(\mathbf{C})$ such that $P_1 + P_2 + ... + P_k = I$ and $\| P_j A P_j \| \leq \varepsilon$, $1 \leq j \leq k$.

Despite significant progress by the many contributors mentioned in Casazza's recent survey on the Kadison-Singer Problem and, in particular, on the Paving Conjecture by Bourgain-Tzafriri and Berman-Halpern-Kaftal-Weiss, the Paving Conjecture (and therefore the Kadison-Singer Problem) remain open.

We know since the 80's that the Paving Conjecture fails for k = 2 for the 3 by 3 permutation matrix with 0 diagonal and the question was posed whether or not k=3 suffices to settle the Paving Conjecture. In this talk, we present some basic history of the problem and examine the Paving Conjecture for k = 3 and $n \leq 10$.Using a combination of graph theory and operator theory, we determine the sharp ε for n = 4, 5, 6. By altogether different considerations, we produce examples of ``bad pavers'' of size n = 7, 10. Along the way we consider some elementary operator theoretic tools that may hold independent interest.

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This is joint work with V. Zarikian.

Bamdad R. Yahaghi

Simultaneous triangularization over arbitrary Banach (resp.Hilbert) spaces

Abstract: In this talk, we consider collections of compact (resp. trace class) operators on arbitrary Banach (resp. Hilbert) spaces. We prove that every triangularizability result on certain collections, e.g.,semigroups, of compact operators on a complex Banach (resp. Hilbert) space gives rise to its counterpart on a real Banach (resp. Hilbert) space. We also prove generalizations of certain classical theorems (i.e., those due to Kolchin and Guralnick) to trace class (resp. compact) operators on arbitrary Hilbert (resp. Banach) spaces.