THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

ROBERT BOYER

Traces on Operator Algebras and Interpolation Polynomials

Preliminary Report R Boyer and L Thiel the beginning of this study is the observation that several classical interpolation operators, such as the Bernstein, Stancu, and Baskahov operators, are given as traces on certain AF- algebras associated with the infinite unitary group. We give a new characterization of the Stancu polynomials and start an investigation of multivariate polynomial schems. Traces can be viewed as probability generating functions indexed by signatures (partitions). The problem of convergence is attacked by means of the asymptotic character formula, which was developed, by Vershik and Kerov, Boyer, and Okounkov and Olshanski. The asymptotic character formula may be viewed as a law of large numbers for representations and so gives a natural interpretation of the first moment of the probability distribution corresponding to a trace. Interpolation problems require a refinement of this method because the variance or second moment governs the rate of convergence.

BRENDT BRENKEN

Graph algebras and Cuntz-Krieger algebras

The Cuntz - Krieger algebra is defined for an arbitrary, possibly infinite and infinte valued matrix B. A graph C*- algebra G*(E) is then defined for an arbitrary directed graph E, which coincides with previously defined graph algebras if each source of E emits only finitely many edges. Each graph algebra G*(E) is isomorphic to the Cuntz - Krieger algebra associated with the vertex matrix of E.

KENNETH DAVIDSON

The structure of free semigroup algebras

A free semigroup algebra is the WOT-closed (nonself- adjoint) algebra generated by n isometries with orthogonal ranges. I will describe a general structure theorem for all of these algebras. Applications include a complete description of the radical, and shows that the convex hull of the isometries contains the whole open ball. A number of open questions will be raised.

JULIANA ERLIJMAN

Multi-sided braid type subfactors

We generalize the two-sided construction of examples of pairs of the hyperfinite II_1 factor R – which arise by considering unitary braid representations with certain properties – to multi-sided pairs. The index for the multi- sided pair can be expressed as a power of that for the two- sided pair. We also compute the (first) relative commutants. The construction can be applied to the natural examples – where the braid representations are obtained in connection with the representative theory of the algebras of types A,B,C,D.

CARLA FARSI

Orbifold boundary value problems

I will talk about some results on orbifold boundary value problems.

IGOR FULMAN

Classification of certain C-algebras*

I will talk about classification of C*-algebras which are inductive limits of finite direct sums of matrix algebras tensored with C([0,1]). George Elliott proved that if the algebra is assumed to be simple, the complete invariant is the K0-group together with the trace space. We are trying to drop the condition of simplicity. Our hypothesis is that in the general case, the complete invariant is the set of K0-groups of all the quotients of the algebra, together with the trace spaces of all its ideals generated by projections. This is joint work with George Elliott; the work is still in progress.

THIERRY GIORDANO

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MASHA GORDINA

Heat kernel analysis and holomorphic functions on a II_1-factor

The motivation for this work comes from a well-known identity used in the quantum field theory (due to Bargmann, Segal et al.). This identity relates Taylor coefficients of a holomorphic function with the L^2–norm of this function with respect to the heat kernel measure. My previous results dealt with this problem for infinite dimensional groups. In this talk I will describe the setting for a II_1-factor realized as the weak closure of a subalgebra of the CAR-algebra. I will begin from a construction of the heat kernel measure determined by the Clifford algebra. The main tools in the construction are stochastic differential equations in infinite dimensional spaces. Then I will describe holomorphic functions and their properties. In particular, I will talk about an isometry, which is an infinite dimensional analog of the Taylor expansion.

DON HADWIN

An alternative to free entropy for free group factors

(Co-authored with Michal Dostal) We show how the recent applications of free entropy to the free group factors can be more easily obtained using a different invariant

DAVID HANDELMAN

A definitive limit ratio theorem.

ALAN HOPENWASSER

Automatic Closure of Invariant Linear Manifolds for Operator Algebras

Kadison's transitivity theorem implies that, for irreducible representations of C^*-algebras, every invariant linear manifold is closed. CSL algebras has this property if, and only if, the lattice is hyperatomic (every projection is generated by a finite number of atoms).

We show that two families of norm-closed operator algebras also have this property. First, let L be a CSL and suppose A is a norm closed algebra which is weakly dense in Alg L and is a bimodule over the (not necessarily closed) algebra generated by the atoms of L. If L is hyperatomic and if, for each atom e of L, eAe is an irreducible C^*-algebra, then every linear manifold invariant under A is closed. Secondly, if A is the image of a strongly maximal triangular AF algebra under a multiplicity free nest representation,

where the nest has order type $-mathbbN$, then every linear manifold invariant under A is closed and is singly generated.

Most of this is joint work with Allan Donsig and David Pitts.

PALLE JORGENSEN

Palle Jorgensen

Wavelets are constructed from numbers which relate translation and scaling on the line, or in R^n. There is an intertwining operator which relates a discrete setting with the $L^2(R)$ one, and the discrete one lends itself to algorithms. We show that there is a class of representations of the Cuntz algebra O_N (where N is the scale number) which correspond to wavelets, and they are labled by elements in a loop group. The representations are shown to be generically irreducible, ie the wavelet data is minimal.

BJ KAHNG

Quantum Heisenberg group algebras

By deformation quantization of certain non-linear Poisson brackets, we have recently been able to construct a class of C*-algebraic quantum groups (Hopf C*-algebras) that are quantum versions of $C*(H)$ and $C_0(H)$, where H is the Heisenberg group. We plan to discuss their *- representations, including the property of quasitriangularity.

DAVID KRIBS

The curvature invariant of a non-commuting n- tuple

Non-commutative versions of Arveson's curvature invariant and Euler characteristic for a commuting n-tuple of operators will be introduced. In general both invariants can be thought of as measuring the freeness or curvature of an n-tuple. Most importantly, the curvature invariant is sensitive enough to determine if an n-tuple is free. The connection with dilation theory provides motivation and exhibits relationships between the invariants.

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NAHUN KRUPNIK

Generalized Gelfand Tranform in Non-Commutative Banach Algebras

Let A be a unital Banach algebra. By definition A admits a generalized Gelfand transform of order n if there exists a set H of homomorphisms h from A into an algebra h(A) of k by k matrices such that: 1.k = k(h) is less than or equal to n, and 2.an element x is invertible in A if and only if all matrices h(x) are a non-singular .

Let L(B) be the algebra of all linear bounded operators on a Banach space B. By definition a subalgebra A of the algebra L(B) admits a Fredholm symbol of order n if there exists a set of homomorphisms h from A into an algebra h (A) of k by k matrices such that: 1.k = k (h) is less than or equal to n, and 2. an operator T from A is Fredholm if and only if all matrices h(T) are a non-singular .

Connection between various properties of algebras A such as: A is with Amitsur - Levitsky polynomial identity ; A is generated by two idempotents or by several idempotents with some relations; A is a closure of a finite - dimensional module over its center; A admits a generalized Gelfand transform; A admits a Fredholm symbol, are considered.

Applications to symbol calculus for various algebras of singular integral operators and Toeplitz operators with discontinuous symbols are obtained.

DAN KUCEROVSKY

The extension picture of KK-theory

We explain the extension picture of KK-theory in detail, and give some recent results about absorbing extensions.

LEO LIVSHITS

Banach Space Duality in Absolute Schur Algebras

Matrix Schur product is the entry-wise product of matrices of the same size. It was shown by P. Chaisuriya and S.-C. Ong in 1998 that (for $r \geq 1$) infinite matrices $[a_{jk}]$ such that $[|a_{jk}|^r] \in \mathcal{B}(\ell^2)$ form a Banach algebra under the norm $\|[a_{jk}]\|_r = \|[|a_{jk}|^r]\|^{\frac{1}{r}}$ and the Schur product. I this paper we demonstrate the existence of Banach space duality within the class of these algebras which is analogous to the classical duality between the spaces of compact, trace class, and bounded operators on ℓ^2. Also we obtain a general functional calculus on these algebras, which is used to determine the spectrum and to justify the notion of ∞-norm introduced by P. Chaisuriya and S.-C. Ong.

Joint work with Sing-Cheong Ong and Sheng-Wang Wang.

NUNO MARTINS

K_0-groups for C^*-algebras arising from linear mod one transformations

Given the pair (β, α) of real numbers such that $1 < \beta < 2$ and $0 \leqslant a < 1$, we construct a C^*-algebra $O_{\beta,\alpha}$ as a C^*-algebra arising from the linear mod one transformation $f_{\beta,\alpha}$. These C^*-algebras could be viewed, in a sense, as generalizations of the C^*- algebras O_β constructed by Katayama, Matsumoto and Watatani. For those (β, α) that determines a finite kneading invariant pair $(k^+(c), k^-(c))$ (c is the single discontinuity point of $f_{\beta,\alpha}$), we construct, using symbolic dynamics technics, the associated transition Markov matrix A. We prove that $K_0(O_A)$ could be directly computed from the cardinality of the symbols in the kneading invariant.

MARTIN MATHIEU

Local multipliers and automorphisms of separable C-algebras*

We shall report on recent joint work with Pere Ara (Barcelona), which will appear in our forthcoming book,

JAMES MINGO

On the Characteristic Polynomial of the Almost Mathieu Operator

To follow

TOSHI NATSUME

Quantizations of manifolds and C-algebras*

We show the existence of C*-algebraic quantization of symplectic manifolds.

PING WONG NG

On the Characteristic Polynomial of the Almost Mathieu Operator

We prove the following: Let R be a von Neumann algebra and V a subspace of R_*. V is the range of a completely contractive projection on R_* if and only if V is completely isometric to pS_*q, where S is a von Neumman algebra and p, q are projections in S.

This is joint work with Narutaka Ozawa.

IGOR NIKOLAEV

Geometry of Bratteli diagrams

The space of paths of simple Bratteli diagram is identified with a geodesic lamination of a compact surface of genus g¿1. Such laminations were studied by W. Thurston in the context of measured foliations and diffeomorphisms on sur- faces. This link between Bratteli diagrams and Thurston la- minations is established with the help of the Koebe-Morse coding of the geodesic lines. THEOREM. There is a one-to- one correspondence between (equivalence classes of) simple Bratteli diagrams and Thurston's geodesic laminations on the hyperbolic compacta.

VICTOR NISTOR

A C^*-algebra approach to elliptic theory on non-compact manifolds

The analysis of geometric operators on non-compact manifolds with a uniform structure at infinity can be described using certain type I C^*-algebras. This leads to criteria for compactness and Fredholmness of geometric (Laplace, Dirac, ...) operators acting between suitable Sobolev spaces. We can also set an inductive procedure to study the spectrum of these operators, which leads, in particular, to the proof of the conjectured form of the essential spectrum of the Laplace operator on a manifold with multi-cylindrical ends.

GERT K. PEDERSEN

Extremal K-Theory and Index for C-Algebras*

A general theory for a new functor K_e on the category of C*-algebras is developed. The extremal K–set is defined by means of homotopy classes of extreme partial isometries. It contains K_1 and admits a partially defined addition extending the addition in K_1, so that we have an action of K_1 on K_e. This new functor relates to K_1 and K_0 for various ideals and quotients of the algebra, and can be used to extend the classical notion of index of Fredholm and - in particular - semi-Fredholm operators.

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CHRISTOPHER PHILLIPS

Direct limit decomposition for crossed products by minimal diffeomorphisms

Let M be a compact smooth manifold and let f be a minimal diffeomorphism of M. We discuss the representation of the corresponding crossed product C*-algebra C* (Z, M, f) as a direct limit of recursive subhomogeneous C*-algebras. (Joint work with Qing Lin.)

DAVID PITTS

Invariance of Spectra for Triangular AF algebras under Algebraic Isomorphism

The spectrum for a triangular AF algebra was defined by S. Power, and is an isometric isomorphism invariant for triangular AF algebras. I will discuss recent work, joint with A. Donsig and S. Power which shows that the spectrum is in fact an algebraic isomorphism invariant for triangular AF algebras. It follows that if two triangular AF algebras are isomorphic as algebras, then they are in fact isometrically isomorphic.

SARADA RAJEEV

Derivations of Cuntz Algebras and Yang-Mills Theories of Large Rank

It is known (Voiculescu) that random matrices of large dimension are described by Cuntz algebras. We find that a class of quantum field theories (including Yang–Mills theories) whose dynamical variables are matrices of large dimension N, have as their algebra of observables the Lie algebra of derivations of the Cuntz algebra. We unravel the structure of this Lie algebra partially. References: C.W.H. Lee and S. G. Rajeev Phys Rev Lett *0,2285,(1998), Nucl. Phys. B 529, 656-688(1998); S. G. Rajeev and O. T. Turgut, Comm. Math. Phys. 192, 493 (1998);

BAHRAM RANGIPOUR

A Generalized Cyclic Eilenberg-Zilber Theorem.

In this talk we introduce a new category for every category $\mathcal{C}$, the category $bic\mathcal{C}$ whose objects are contravariant functors from $\delta_c \times \delta_c$ to $\mathcal{C}$.Then we prove a new version of cyclic Eilenberg-Zilber Theorem in the category $bic\mathcal{C}$ where $\mathcal{C}$ is an abelian category.

This is joint work with M. Khalkhali

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ALBERT J. L. SHEU

The structure of quantum spheres

We give an explicit description of the C*-algebra of a quantum odd-dimensional sphere as consisting of continuous fields, over the unit circle, of operators with a common symbol modulo the compact operators.

FRANCISZEK HUGON SZAFRANIEC

Subnormality in the Quantum Harmonic Oscillator

After introducing to unbounded subnormality I intend to show how it gets involved in solving the commutation relation of the quantum harmonic oscillator. The talk is based on my recent paper (Commun. Math. Phys., 210(2000), 323-334). If time permits I would like to say a word on the q-deformed case.

WAI-SHING TANG

Oblique multiwavelets in Hilbert spaces

We consider the problem of existence of oblique multiwavelets in the Hilbert space setting, and show that oblique multiwavelets exist under a very natural assumption.

TUONG TON-THAT

Representation Theory of some infinite- dimensional groups

In this talk we present a theory of representations of some inductive limits of groups on generalized Bargmann-Segal- Fock spaces. This includes explicit realizations of irreducible representations and decomposition of the Bagmann-Segal- Fock spaces.We also introduce an invariant theory involving inverse limits of algebras in connection with these representations.

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IVAN TODOROV

Normalizers of operator algebras and reflexivity

The set of normalizers between von Neumann (or, more generally, reflexive) algebras A and B, (that is, the set of all operators T such that T*BT is a subset of A and TAT* is a subset of B) possesses 'local linear structure': it is a union of reflexive linear spaces. These spaces belong to the interesting class of normalizing linear spaces, namely, those linear spaces U for which UU*U is a subset of U. Such a space is reflexive whenever it is ultraweakly closed. Normalizing spaces which are bimodules over maximal abelian selfadjoint algebras consist of operators 'supported' on sets of the form [f=g] where f and g are appropriate Borel functions. They also satisfy spectral synthesis in the sense of Arveson.

DANIEL TURCOTTE

On the Constancy of Differentiable Families of Banach Subspaces in a Normed Vector Space and Projection- Valued Functions in Banach Algebras

We show the equivalence between the formalism of differentiable families of finite-dimensional vector subspaces of a normed vector space and the formalism of differentiable families of finite rank projections. This allows us to extend the result obtained by Evard to the context of Banach star algebras and Banach algebras. This work provides new results for projection-valued functions in Banach algebras such that $p'(s) = p(s)p'(s)$ that have their origin in fundamental geometric considerations in normed vector spaces.

NIK WEAVER

Set Theory and Invariant Subspaces

I will discuss my progress on the conjecture that the invariant subspace problem is independent of ZFC.