WABASH
EXTRAMURAL MODERN ANALYSIS
MINICONFERENCE

September 6 and 7, 2008

Abstracts

Invited Talks

9:30–10:20, Saturday, Room: 252

Equivariant correspondences and applications

Heath Emerson, *University of Victoria*

We develop a purely topological model for Kasparov's equivariant bivariant K-theory (for locally compact spaces); in other words, the morphisms $X \to Y$ in this model are given by purely topological data. As an application, we compute Lefschetz invariants of arbitrary equivariant Kasparov morphisms $X \to X$ when X is a smooth manifold carrying a smooth and proper action of a discrete group. This leads to a generalisation of the classical Lefschetz fixed-point formula.

10:30–11:20, Saturday, Room: 252

Matrix Convexity, Quantum Inequalities, and Non-commutative Differentiation

Edward G. Effros, *University of California at Los Angeles*

Convexity methods play a central role in both functional analysis and thermodynamics. This has remained the case in both non-commutative functional analysis and quantum thermodynamics. The techniques of the latter subject have required considerable analytic ingenuity, as will be apparent to anyone interested in non-commutative entropy theory. We show that some of these difficulties can be eliminated if one uses simple notions of matrix convexity theory. In particular it is possible to give one-line proofs of some celebrated inequalties due to Lieb and others. On the other hand, matrix convexity techniques can be used to formulate notions of smoothness for operator spaces, and more general systems.

2:00–2:50, Saturday, Room: 252

Dimension(s) for C*-algebras

Andrew Toms, *York University*

The study of C*-algebras may be regarded as noncommutative topology. As such, is it natural to ask for C*-algebra generalisations of notions from the study of locally compact Hausdorff spaces. One such notion is the covering dimension of the space. In this talk I will survey various methods of generalising this concept to C*-algebras, and also variants on these methods which account more effectively for the "matricial" structure of C*-algebras. We will define dimensions for C*-algebras by topological, operator algebraic, and homological means, and see how they are sensitive to differences between steadily more exotic C*-algebras. Finally, we will discuss the relationships between these dimension theories, and their bearing on K-theoretic rigidity phenomena.

3:05–3:55, Saturday, Room 252

Group cocycles and the ring of affiliated operators

Jesse Peterson, *Vanderbilt University*

I will present some results (joint work with Andreas Thom) on cocycles from a group into its left regular representation and also into the ring of affiliated operators of the group von Neumann algebra. I will present a strong generalization of a result of Lück and Gaboriau which states that if Λ is a finitely generated normal subgroup of a group Γ with $0 < \beta_1^{(2)}(\Gamma) < \infty$ then either $|\Lambda| < \infty$ or $[\Gamma : \Lambda] < \infty$.

9:00–9:50, Sunday, Room: 252

Twisting and Rieffel's Deformation of Locally Compact Quantum Groups

Leonid Vainerman, *University of Caen*

We develop the twisting construction for locally compact quantum groups. A new feature, in contrast to my previous joint work with M. Enock, is a non-trivial deformation of the Haar measure. Then we construct Rieffel's deformation of locally compact quantum groups and show that it is dual to the twisting. This allows to give new interesting concrete examples of locally compact quantum groups, in particular, deformations of the classical "az+b" groups and of Woronowicz' quantum "az+b" group. (This is joint work with Pierre Fima.

10:00–10:50, Sunday, Room 252

Beginnings of a theory of nonlinear noncommutative elliptic partial differential equations

Jonathan Rosenberg, *University of Maryland*

The full development of Connes' program of noncommutative geometry will eventually lead to the study of noncommutative "geometric elliptic PDE", for the same reasons that geometric elliptic PDE play an important role in classical differential geometry. We discuss the beginnings of a theory for treating such equations, in the simplest test case of equations involving the Laplacian on the irrational rotation algebras.

11:00–11:50, Sunday, Room: 252

Turbulence, representations, and trace-preserving actions

Hanfeng Li, *SUNY Buffalo*

I will give criteria for tubulence in spaces of C*-algebra representations, and indicate how this helps to establish results of nonclassifiability by countable structures, for group actions on a standard atomless probability space and on the hyperfinite II_1 factor. This is a joint work with David Kerr and Mikael Pichot.

Contributed Talks

Parallel Sessions

11:35–12:00, Saturday, Room: 252

A Singular Subfactor That is Not Strongly Singular

Alain Wiggins, *Vanderbilt University*

A subalgebra B of a II_1 factor M is singular if every normalizing unitary in M of B actually lives in B. Smith and Sinclair defined B to be α-strongly singular in M if there is a constant $0 < \alpha \leq 1$ such that

$$\alpha \|u - \mathbb{E}_B(u)\|_2 \leq \|\mathbb{E}_B - \mathbb{E}_{uBu^*}\|_{\infty,2}$$

for all unitaries $u \in M$. B is strongly singular if α can be taken to be 1. Employing techniques from planar algebras, we give an example of a finite index subfactor inclusion $N \subseteq M$ such that N is singular in M but not strongly singular. This is joint work with Pinhas Grossman.

11:35–12:00, Saturday, Room: 274

Irregular orbits of operators

Gabriel Prajitura, *SUNY-Brockport*

We will discuss a geometric property of orbits which is one side of hyperclicity.

4:10–4:35, Saturday, Room: 252

Planar algebra of the diagonal subfactor

Paramita Das, *Vanderbilt University*

Starting with a finite set $\{\theta_i\}_{i\in I}$ of automorphisms of a II_1 factor N, one can construct the *diagonal subfactor* $N \subset M_I(N)$ where an element $x \in N$ sits in $M_I(N)$ diagonally where the i-th diagonal element is given by $\theta_i(x)$. Diagonal subfactors are among the most basic subfactors. For instance, a correspondence between amenability of such subfactors and amenability of the group generated by the automorphisms in $Out(N)$ was obtained by Popa and the standard invariant is well-known. We will describe the planar algebra of these subfactors. The action of the planar tangles depends on the cocycle obstruction for the group generated by θ_i in $Out(N)$ to have an action. When the obstruction is trivial, this planar algebra matches with Jones's example of planar algebra associated to finitely generated group. This is a joint work with Dietmar Bisch and Shamindra Ghosh.

4:10–4:35, Saturday, Room: 274

Characterizations of Bloch type spaces by divided differences

Ruhan Zhao, *SUNY-Brockport*

Bloch type spaces on the unit disk are characterized by using Newton's divided differences. Several other characterizations of Bloch type spaces involving two or more points as well as applications to polynomial interpolation to Bloch type functions are also given.

4:45–5:10, Saturday, Room: 252

Planar algebra of group-type subfactors

Shamindra Kumar Ghosh, *Vanderbilt University*

We describe the planar algebra, or equivalently, the standard invariant, of the subfactor $P^H \subset P \rtimes K$ arising from outer actions of two finite groups H and K on a II_1-factor P. These subfactors, introduced by Bisch and Haagerup, play an important role in the theory providing a very simple mechanism to construct irreducible subfactors whose standard invariant has infinite depth. The planar algebra heavily depends on the cocycle arising as an obstruction to lifting the subgroup G in $Out(P)$ generated by H and K. If we assume that the group generated by H and K in $Aut(P)$ intersects trivially with $Inn(P)$, (equivalently, the obstruction is trivial), then the planar algebra has an interesting similarity with IRF models in Statistical Mechanics. This is a joint work with Dietmar Bisch and Paramita Das.

4:45–5:10, Saturday, Room: 274

A Connection Between Spectral Synthesis, Operator Topologies, Polynomial Interpolation, and Linear Independence of Exponential Series

Ian Nathaniel Deters, *Bowling Green State University*

Diagonal Operators operators on Hilbert spaces have been well studied. However, one could look at linear operators on the space of functions analytic on a disk of arbitrary radius whose eigenvectors are the monomials. These are interesting operators to consider since they are not defined on a Banach space. Hence, not all of the classical spectral theory applies. For instance, a continuous operator may have unbounded eigenvalues. However, not all is lost since one has the results of complex analysis at one's disposal.

In this talk we will determine what must happen in order for such operators to admit spectral synthesis. These questions lead nicely to creating connections between spectral synthesis of diagonal operators, operator topologies, polynomial approximation, and linear independence of exponential series.

5:20–5:45, Saturday, Room: 252

Littlewood-Paley inequality for operator- valued function at the end point

Tao Mei, *University of Illinois at Urbana-Champaign*

We consider n by n matrix-valued function f for large n and corresponding Littlewood-Paley type square functions $G(f)$. We estimate the L^p boundedness of $G(f)$ at the end point $(p = 1, \infty)$. We will show and the difference from the scalar-valued case connections to non-commutative martingales. This is a recent joint work with Javier Parcet.

5:55–6:20, Saturday, Room: 252

The Isocohomological Property, Higher Dehn Functions, and Relatively Hyperbolic Groups

Bobby Ramsey, *IUPUI*

The property that the polynomial cohomology with coefficients of a finitely generated discrete group is canonically isomorphic to the group cohomology is called the (weak) isocohomological property for the group. In the case when a group is of type HF^∞, i.e. that has a classifying space with the homotopy type of a cellular complex with finitely many cells in each dimension, we show that the isocohomological property is equivalent to the classifying space satisfying polynomially bounded higher Dehn functions. If a group is hyperbolic relative to a collection of subgroups, each of which is polynomially combable (respectively HF^∞ and isocohomological), then we show that the group itself has these respective properties too. Combining with the

results of Connes-Moscovici and Druţu-Sapir we conclude that a group satisfies the Novikov conjecture if it is relatively hyperbolic to subgroups that are of property RD, of type HF^∞ and isocohomological.

12:00–12:25, Sunday, Room: 252

Property T for discrete quantum groups

Pierre Fima, *University of Illinois at Urbana-Champaign*

We give a simple definition a property T for discrete quantum groups and we show that, for I.C.C. discrete quantum groups, this definition is equivalent to the Connes' property T of the associated von Neumann algebra. This allows us to give the first example of property T discrete quantum group which is not a group using the twisting construction.