WABASH MINI-CONFERENCE, September 12–13, 2015

Titles and Abstracts

INVITED TALKS

BRANIMIR ĆAĆIĆ, Vanderbilt University

Good quotients of noncommutative Riemannian manifolds

Abstract: If the quotient of a compact Hausdorff space by a suitable group action is again a compact Hausdorff space, then the C^*-algebra of the quotient is simply the fixed point subalgebra of the C^*-algebra of the original space. If the quotient of a compact oriented Riemannian manifold by a suitable Lie group action is again a compact oriented Riemannian manifold, what happens at the level of spectral triples? In this talk, I will discuss an unbounded KK-theoretic construction of a good quotient for the spectral triple corresponding to a generalised Dirac operator equivariant under a free and isometric action of a compact connected Lie group. As time permits, I will then discuss applications to explicit unbounded KK-theoretic factorisations of noncommutative principal bundles arising via Rieffel's strict deformation quantisation. This is joint work with Bram Mesland.

MEHRDAD KALANTAR, University of Houston

C*-simplicity and the unique trace property for discrete groups

Abstract: A discrete group is said to be C*-simple if the reduced C*-algebra of the group is simple, and is said to have the unique trace property if the reduced C*-algebra has a unique trace. In this talk we present some recent results where a surprising connection between Furstenberg's theory of boundary actions and Hamana's work on injective envelopes is used to give answer to the problem of which groups have these properties.

Based on joint work with Emmanuel Breuillard, Matthew Kennedy and Narutaka Ozawa.

JOSEPH MIGLER, Ohio Sate University

Determinants in K-theory and operator algebras

Abstract: A determinant in algebraic K-theory is associated to any two Fredholm operators that commute modulo the trace ideal. One can also calculate a homological invariant known as joint torsion. In this talk I will discuss recent work on these invariants and some applications.

ADAM SKALSKI, Inst. of Math. of Polish Acad. of Sci. and University of Warsaw

Haagerup approximation property for arbitrary von Neumann algebras

Abstract: The Haagerup approximation property for finite von Neumann algebras (i.e.von Neumann algebras with a tracial faithful normal state) has been studied for more than 30 years. The original motivation to study the Haagerup approximation property comes from the case of group von Neumann algebras of discrete groups, where it corresponds to the geometric Haagerup property of the underlying group. Last few years brought a lot of interest in the Haagerup property for discrete and general locally compact quantum groups. If the discrete quantum group in question is not unimodular, the associated (quantum) group von Neumann algebra cannot be finite. In this talk, I will present recent developments regarding the Haagerup approximation property for arbitrary von Neumann algebras, focusing on potential relations with the noncommutative geometry. (Mainly based on joint work with Martijn Caspers.)

XIANG TANG, Washington University in St. Louis

An analytic Grothendieck Riemann Roch theorem

Abstract: In this talk, we will introduce an extension of the Boutet de Monvel Toeplitz index theorem to complex manifold with isolated singularities following the relative K-homology theory of Baum, Douglas, and Taylor for manifold with boundary. As an application, we will use this index theorem to study the Arveson-Douglas conjecture. This is joint work with R. Douglas and G. Yu.

GUOLIANG YU, Texas A&M University

K-theory of group C*-algebras and non-rigidity of manifolds

Abstract: I will discuss how K-theory of group C*-algebras can be used to measure the degree of non-rigidity of manifolds. This talk will be accessible to graduate students. This is joint work with Shmuel Weinberger.

JOACHIM ZACHARIAS, University of Glasgow

Covering dimension for C*-algebras and dynamical systems

Abstract: Various noncommutative generalisations of dimension have been considered and studied in the past decades. Some years ago, nuclear dimension, a dimension concept for noncommutative nuclear C*-algebras, has been introduced based on previous similar definitions. The basic idea of this notion is that open covers may be regarded as approximations of spaces but also encode the covering dimension of a space. Thus nuclear dimension relates covering dimension and approximations. It has turned out to be important in the classification programme of simple nuclear C*-algebras. More recently, Rokhlin dimension, a closely related dimension concept for dynamical systems, has been introduced. In case of actions

on spaces it corresponds to a kind of equivariant covering dimension. The current definition requires the group to be residually finite. Actions with finite Rokhlin dimension preserve finiteness of nuclear dimension provided the group has finite dimensional box space. There is a topological version of the classical Rokhlin Lemma: free actions on finite dimensional compact spaces have finite Rokhlin dimension. It turns out that Rokhlin dimension is linked to amenability dimension, another dimension concept for dynamical systems linking it to coarse geometry. We will give an introduction to these concepts and survey some applications and connections between them. This survey is based on work in collaboration with Hirshberg, Szabo, Winter, Wu and further recent developments

CONTRIBUTED TALKS

CHENG CHU, Washington University in St. Louis:

A Spectral Area estimate of some Toeplitz Operators

Abstract: On the Hardy space of the unit disk $\mathbb{D}$, it is known that the spectrum of Toeplitz operator with an analytic symbol f is the closure of $f(\mathbb{D})$. We consider a rather large class of Toeplitz operators, hyponormal operators with a harmonic symbol, and give a lower bound for the area of the spectrum.

HUNG-CHANG LIAO, Pennsylvania State University:

A Rokhlin type theorem for automorphisms of simple C*-algebras of finite nuclear dimension

Abstract: Following Connes' work on automorphisms of the hyperfinite II_1 factor and Kishimoto's work on automorphisms of AF and A$\mathbb{T}$ algebras, we prove a Rokhlin type theorem for automorphisms of unital simple separable stably finite C^*-algebras of finite nuclear dimension. More precisely, under suitable assumptions on the trace space and/or the induced action on it, we show that strongly outer $\mathbb{Z}$-actions have finite Rokhlin dimension. In particular the crossed product formed by such an action has finite nuclear dimension. This result is inspired by an unpublished work of Hiroki Matui and Yasuhiko Sato.

BENJAMIN PASSER, Washington University in St. Louis:

Noncommutative Borsuk-Ulam Theorems

Abstract: The Borsuk-Ulam theorem in algebraic topology states that any odd, continuous map from the sphere $\mathbb{S}^k$ to Euclidean space $\mathbb{R}^k$ of the same dimension must have a zero, and the theorem has many alternative forms. Each of these leads to an algebraic translation in terms of the C^*-algebra $C(\mathbb{S}^k)$. I will discuss what happens when we view these same statements in the Natsume-Olsen spheres $C(\mathbb{S}^k_\rho)$, reaching some noncommutative Borsuk-Ulam theorems (and non-theorems).

BEN WALLIS, Northern Illinois University:

Closed ideals in $\mathcal{L}(X)$ and $\mathcal{L}(X^*)$ when X contains certain copies of ℓ_p and c_0

Abstract: Let X denote a Banach space, and let $\mathcal{L}(X)$ denote the space of continuous linear operators acting on X. An ideal of $\mathcal{L}(X)$ is a linear subspace $\mathcal{J}$ of $\mathcal{L}(X)$ which is closed under composition with arbitrary operators in $\mathcal{L}(X)$, i.e. such that if $A, B \in \mathcal{L}(X)$ and $T \in \mathcal{J}$ then $BTA \in \mathcal{J}$. It is called closed if it is closed in the norm topology of $\mathcal{L}(X)$. We show that there are uncountably many closed ideals in $\mathcal{L}(\ell_p \oplus \ell_q)$ for $1 \leq p < q \leq \infty$, and in $\mathcal{L}(\ell_p \oplus c_0)$ for $1 \leq p < 2$. This finishes answering a longstanding question of Pietsch (1978). Additional results are obtained for Rosenthal's X_p spaces and Woo's $X_{p,r}$ generalizations thereof. This is joint work with Gleb Sirotkin.