WABASH MINI-CONFERENCE, September 17–18, 2016

Titles and Abstracts

INVITED TALKS

MARIUS JUNGE, University of Illinois at Urbana-Champaign

TRO's in Quantum Information Theory

Abstract: Quantum information Theory and Operator algebras share their interest in studying completely positive maps. In this talk we want to prove results on certain notions of capacity in quantum information theory for nice classes of channels. More precisely, we consider families of completely positive maps given by a finite dimensional TRO (ternary ring of operators) and symbols from an algebra which forms a commuting square with one of the linking algebras. This works provides an example for the fact that some more recent tools in operator algebras may have a significant impact in studying quantum information theory.

This is joint work with Nick LaRacurente and Li Gao.

JOHN MCCARTHY, Washington University in St. Louis

Interpolating Sequences on Spaces with the complete Pick Property

Abstract: Carleson's interpolation theorem, characterizing interpolating sequences in H^∞, was recast by Shapiro and Shields as a theorem about the Gram matrix that comes from Szego kernel functions. Later, Marshall and Sundberg realized this could be done in any space that has the Pick property, and used it to characterize interpolating sequences for the multiplier algebra of the Dirichlet space. This led to a conjecture about interpolating sequences in any space with the (complete) Pick property, such as the Drury-Arveson space. I will discuss some recent joint work with Aleman, Hartz and Richter on this conjecture.

PIOTR NOWAK, Institute of Mathematics of the Polish Academy of Sciences and University of Warsaw

Warped metrics, spectral gaps and the coarse Baum-Connes conjecture

Abstract: The coarse Baum-Connes conjecture is a large-scale geometric variant of the Baum-Connes conjecture. In 1999 Higson showed that certain expanders are counterexamples to the conjecture. I will discuss the construction of a warped cone over a group action and show that the spectral gap for the action gives rise to the existence of a certain ghost projection with additional properties. This provides strong evidence that warped cones over actions with spectral gaps form a new class of counterexamples to the coarse Baum-Connes conjecture. This is joint work with Cornelia Drutu.

DAVID PENNEYS, Ohio State University

Bicommutant categories from (multi)fusion categories

Abstract: I'll discuss an ongoing joint project with Andre Henriques. Just as a tensor category is a categorification of a ring, and its Drinfel'd center is a categorification of the center of a ring, a bicommutant category is a categorification of a von Neumann algebra. I'll define the notion of the commutant C' of a tensor category C inside an ambient tensor category B. Since there is a functor C' to B, we can then take the bicommutant C'' inside B, and C naturally sits inside C''. Note, however, that C'' is not always equivalent to its bicommutant!

Because we are interested in von Neumann algebras, we work in the ambient category $B = \mathrm{Bim}(R)$, the tensor category of bimodules over a hyperfinite von Neumann factor R, which can be thought of as a categorification of $B(H)$. Given a unitary fusion category C inside $\mathrm{Bim}(R)$, we identify its bicommutant C'', and we show that C'' is a bicommutant category. This categorifies the theorem by which a finite dimensional $*$-algebra that can be faithfully represented on a Hilbert space is actually a von Neumann algebra.

We will also discuss applications, including machinery to construct elements of C', the quantum double subfactor, and commutants of multifusion categories.

NICO SPRONK , University of Waterloo

On similarity problems for Fourier algebras

Abstract: Let G be locally compact group. Thanks to theorems of Dixmier and Pisier, the amenability of G may be characterized by whether every bounded representation of G on a Hilbert space is similar to a unitary representation with a certain bound on the conditioning number of the similarity; equivalently, each representation of its convolutive group algebra $L^1(G)$ is similar to a $*$-representation, with the same extra condition. The Fourier algebra $A(G)$ is the dual object to $L^1(G)$ in a manner which generalizes Pontryagin duality. Due to the considerations around this duality, we suspect that any completely bounded representation of $A(G)$ on a Hilbert space is similar to a $*$-representation. H.H. Lee (Seoul), E. Samei (Saskatchewan) and I have found a proof for this result for a wide class of groups which includes amenable groups and small-invariant neighbourhood (hence discrete) groups.

NIK WEAVER, Washington University in St. Louis

Quantum measurable cardinals

Abstract: An investigation of Blecher and Labuschagne into the existence of "peak projections" gave rise to questions about the existence of singular states on von Neumann algebras with partial continuity properties. We systematically study singular von Neumann algebra states which enjoy various forms of infinite additivity, and show that these exist on $B(H)$ if and only if the cardinality of an orthonormal basis of H satisfies various large cardinal conditions related to measurability. For instance, there is a singular countably additive pure state on $B(l^2(X))$ if and only if $|X|$ is Ulam measurable.

RUFUS WILLETT, University of Hawaii

Roe algebras associated to foliations

Abstract: I'll recall the construction of Roe algebras: these are C*-algebras that capture the large-scale geometry of a metric space that are important in index theory, as well as having some applications to dynamics. I'll then talk about generalizing this to foliations and related geometric structures. I'll try to give a concrete approach to all of this based on kernel operators, without assuming any background in coarse geometry or foliation theory.

This is based on joint work with Xiang Tang and Yi-Jun Yao.

CONTRIBUTED TALKS

LI GAO, University of Illinois at Urbana-Champaign:

Continuous Perturbations of Heisenberg Relations and of Noncommutative Tori

Abstract: Haagerup and Rørdam have proved that the family of rotation C^*-algebra forms a continuous field in a strong sense where the sections of generators are $\mathrm{Lip}^{\frac{1}{2}}$ continuous. We prove a noncompact analog of this pertutbation result on the Heisenberg commutation relations. The construction is generalized to noncommutative Euclidean spaces of dimension $d \geq 2$. As a corollary, we obtain $\mathrm{Lip}^{\frac{1}{2}}$ continuous sections of generators for noncommutative d-tori.

WEIHUA LIU, Indiana University:

Noncommutative distributional symmetries

Abstract: In this talk, I will introduce the notion of distributional symmetries in noncommutative probability. We will see how those symmetries are related to universal independence relations.

JIREH LOREAUX, Southern Illinois University Edwardsville:

Kadison's Pythagorean theorem and essential codimension

Abstract: Kadison's Pythagorean theorem (2002), along with his carpenter's theorem, provides a characterization of the diagonals of projections with a subtle integer condition when the diagonal entries accumulate rapidly at 0 and 1. In particular if $0 \leq d_n \leq 1$ are the diagonal entries of a projection and $a := \sum_{d_n \leq \frac{1}{2}} d_n < \infty$ and $b := \sum_{d_n > \frac{1}{2}} (1 - d_n) < \infty$, then $a - b \in \mathbb{Z}$.

Kadison's proof that $a - b$ is an integer involved showing $a - b$ is arbitrarily close to an integer, while later Arveson (2007), Kaftal, Ng, Zhang (2009), and Argerami (2015) all provided different proofs of the same fact. In this talk I will fully explain Kadison's integer by linking it in a natural way to the essential codimension of two projections. In the process, I will give background on the notion of essential codimension introduced by Brown, Douglas and Fillmore (1973), as well as its generalization as the index of Fredholm pairs of projections. (This is joint work with Victor Kaftal)

EDWARD TIMKO, Indiana University:

On polynomial n-tuples of commuting isometries

Abstract: We extend some of the results of Agler, Knese, and McCarthy [1] to n-tuples of commuting isometries for $n > 2$. Let $V = (V_1, ..., V_n)$ be an n- tuple of a commuting isometries on a Hilbert space and let $Ann(V)$ denote the set of all n-variable polynomials p such that $p(V) = 0$. When $Ann(V)$ defines an affine algebraic variety of dimension 1 and V is completely non- unitary, we show that V decomposes as a direct sum of n-tuples $W = (W_1, ..., W_n)$ with the property that, for each $i = 1, ..., n$, W_i is either a shift or a scalar multiple of the identity. If V is a cyclic n-tuple of commuting shifts, then we show that V is determined by $Ann(V)$ up to near unitary equivalence, as defined in [1].