

The seventh annual
East Coast Operator Algebras Symposium

October 24-25, 2009
Texas A&M University



Organizers

Michael Anshelevich, Ken Dykema,
David Kerr, Roger Smith

Scientific Committee

Dietmar Bisch, Marius Dădărlat,
Nigel Higson, Dirk Kreimer

Abstracts of Speakers

Intersection theory in finite factors

Hari Bercovici

We will describe some elements of a possible intersection theory in a II_1 factor. These results lead to a solution of the Horn problem in such factors, and they are related to the Connes embedding problem by results of Collins and Dykema.

Entropy in measurable dynamics

Lewis Bowen

In 1958, Kolmogorov defined the entropy of a probability measure preserving transformation. Entropy has since been central to the classification theory of measurable dynamics. In the 70s and 80s researchers extended entropy theory to measure preserving actions of amenable groups (Kieffer, Ornstein–Weiss). My recent work generalizes the entropy concept to actions of sofic groups; a class of groups that contains for example, all subgroups of $GL(n, C)$. Applications include the classification of Bernoulli shifts over a free group up to measure-conjugacy. This answers a question of Ornstein and Weiss.

On relative property (T) and Haagerup's property

Ionut Chifan

We consider the following three properties for a countable discrete group Γ :

- (1) Γ has a subgroup with relative property (T).
- (2) The group von Neumann algebra $L(\Gamma)$ has a diffuse subalgebra with relative property (T).
- (3) Γ does not have Haagerup property.

It is obvious that (1) \implies (2) \implies (3). We will show that both of the converses are false. This is a joint work with Adrian Ioana.

Tensor products of operator systems

Mark Tomforde

After formulating an axiomatic definition of tensor products in the category of operator systems, we will examine several particular examples, including a minimal operator system tensor product and maximal operator system tensor product. We will also describe how these tensor products may be characterized in terms of their universal properties and give descriptions of their positive cones. Additionally, we characterize the corresponding tensor products of operator spaces induced by a certain canonical inclusion of an operator space into an operator system. Finally, we will discuss notions of nuclearity for our tensor products, which on the category of C^* -algebras reduce to the classical notion. (This is joint work with Vern Paulsen, Ivan Todorov, and Ali Kavruk.)

Free Analysis: the analogue of the Riemann sphere

Dan Voiculescu

Approximately divisible C^* -algebras
Weihua Li

We show that a separable, unital, approximately divisible C^* -algebra is singly generated, and the topological free entropy dimension of any finite generating set of it is less than or equal to 1. In addition, we show that the similarity degree of a unital separable approximately divisible C^* -algebra is at most 5.

Cardinal invariants for von Neumann algebras
David Sherman

I will survey various ways of measuring the size of a von Neumann algebra and show that all “common” cardinal invariants can be expressed in terms of two particular ones. Among the applications are some reformulations of the generator problem.

Cocycle superrigidity for Gaussian actions
Thomas Sinclair

This talk will cover joint work with Jesse Peterson. In this talk I will discuss cocycle superrigidity within the context of Gaussian actions of countable, discrete groups. In particular, I will demonstrate that Bernoulli actions of L^2 -rigid groups are U_γ cocycle superrigid. The class of L^2 -rigid groups contains both groups with Kazhdan’s property (T) and direct products of infinite groups with non-amenable groups, recovering Popa’s cocycle superrigidity theorem for Bernoulli actions. Moreover, I will show that certain generalized wreath products of groups are L^2 -rigid, giving new examples of cocycle superrigid groups. I will also establish that groups with non-zero first L^2 -Betti number are not U_γ cocycle superrigid.

Perturbations of C^* -algebras
Erik Christensen*

In 1972 R. V. Kadison and D. Kastler initiated a study of *perturbations of operator algebras*. They considered von Neumann algebras acting on a given Hilbert space H . The unit ball of $B(H)$ equipped with the operator norm is a metric space, so it is possible to define the distance between two von Neumann algebras, acting on H , as the Hausdorff distance between their unit balls. In this pioneering work it was demonstrated that von Neumann algebras, which are sufficiently close, actually are of the same type, so it could be expected that quite a number of algebraic properties for C^* -algebras are so rigid that they will survive a *sufficiently small perturbation*. Kadison and Kastler even asked if it might be that sufficiently close C^* -algebras might be unitarily equivalent. During the 70’ties and 80’ties this conjecture was verified in some cases, and it was shown that for nuclear C^* -algebras many structures like K -groups are isomorphic if the algebras are sufficiently close. We have now revived this investigation seen in the light of the more recent development of C^* -algebraic theories concerning length, nuclearity and the classification program.

Our main results are that finite length is stable under perturbation and we verify Kadison and Kastler’s conjecture for separable nuclear C^* -algebras.

*(joint work with Allan M. Sinclair, Edinburgh; Roger R. Smith, Texas A&M; Stuart A. White, Glasgow; Wilhelm Winter, Nottingham)

On the classification of non-simple inductive limits of matrix algebras over certain one-dimensional spaces

Alin Ciuperca

In recent years the Cuntz semigroup became an important tool of investigation in the theory of C^* -algebras, especially in the work related to Elliott classification program. Perhaps the best illustration of its importance was provided by Andrew Toms, who constructed counterexamples to the Elliott conjecture and used the Cuntz semigroup as the distinguishing invariant. In a recent work with George Elliott we showed that, for C^* -algebras of stable rank one, the Cuntz invariant and the Thomsen invariant (the semigroup of closed unitary orbits of positive elements in the stabilization of a C^* -algebra) determine each other. Combined with an older result of Thomsen, this led to the classification of non-simple approximate interval (AI) algebras (i.e. inductive limits of algebras of the form $\bigoplus_{k=1}^N M_{n_k}(C[0, 1])$) using the Cuntz semigroup as an invariant. This result was recently pushed forward in a work with George Elliott and Luis Santiago Moreno, where we showed that the Cuntz semigroup is a complete invariant for the class of non-simple C^* -algebras obtained as inductive limits of matrix algebras over trees.

Pontryagin duality for Picard groupoids and Mukai transform
Calder Daenzer

I will describe an extension of Pontryagin duality for locally compact abelian groups to a duality on so-called Picard groupoids. By construction, the C^* -algebra of a Picard groupoid will be isomorphic to the C^* -algebra of its Pontryagin dual. However, a Picard groupoid is never Morita equivalent to its dual and in general does not even admit any nontrivial Morita morphisms to its dual. This lack of morphisms between two groupoids with isomorphic C^* -algebras motivates the introduction of new groupoid morphisms which resemble Mukai transform from algebraic geometry. I will describe this transform, then give some examples and applications.

Equivariant correspondences and applications
Heath Emerson

I will outline some of the work of myself and Ralf Meyer on describing equivariant Kasparov groups in purely geometric or topological terms. This is an extension of some ideas of Connes and Skandalis going back to the 1980's. I will also state an equivariant version of the Lefschetz fixed-point formula. This version involves an equivariant correspondence instead of a smooth self-map, and the Hattori–Stallings trace on equivariant K-theory instead of the usual trace on homology.

Weakly mixing and mixing subalgebras of finite
von Neumann algebras
Junsheng Fang

Jolissaint and Stalder introduced the definition of weak mixing and mixing for subalgebras of finite von Neumann algebras. They showed that a measure preserving action of a countable group on a finite measure space is (weakly) mixing if and only if the von Neumann subalgebra induced by the group is (weakly) mixing in the cross-product finite von Neumann algebra. In this talk, I will give a characterization of weak mixing subalgebras in terms of “normalizers” of the subalgebras. I will also talk about some interesting properties of mixing subalgebras. This is joint work with Jan Cameron and Kunal Mukherjee.