ABSTRACTS OF TALKS AT WCOAS 2013

Jean Bellissard

Title: **Bloch Theory for Aperiodic Media with Finite Local Complexity**

Abstract: Bloch Theory is the core of all spectral calculation for periodic solids. It uses the periodicity through a Fourier analysis to reduce the Schrdinger operator to simpler forms. This talk will show how, even if periodicity is lost, it is possible to extend the Bloch theory to aperiodic solids. The simplest solids have Finite Local Complexity (FLC), namely the set of local patches of a given diameter is finite. In such a case, the spectral analysis of the Schrdinger operator can be made through a noncommutative analog of Bloch theory, using the special features of the Hull and its Transversal (tiling space). The translation group acts through a groupoid and the Bloch decomposition leads to several fields of Hilbert spaces holding a representation of this groupoid. This talk will focus on discrete Schrdinger operators and one dimensional aperiodic lattices, for which a series of approximations (renormalization group) will be shown to converges giving informations on the energy spectrum.

Nigel Higson

Title: **A noncommutative geometry perspective on parabolic induction and parabolic restriction**

Abstract: This talk is about the decomposition of the regular representation of a group like SL(2,R) into its irreducible constituents. The operation of parabolic induction features prominently in this area of representation theory, and a Hilbert bimodule construction due to Pierre Clare places parabolic induction in a noncommutative-geometric, or C*-algebraic, context. It is also possible to construct an opposite bimodule, corresponding to a notion of parabolic restriction. The construction of the second bimodule is not at all trivial at the C*-algebra level, but it is more elementary at the level of smooth, dense subalgebras. I'll discuss at both levels the connections between induction and restriction.

Kate Juschenko

Title: **Extensions of amenable groups by recurrent groupoids**

Abstract: I will discuss a theorem on amenability which unifies many know technical proofs of amenability to the one common proof as well as produces examples of groups for which amenability was an open problem. This is joint with V. Nekrashevych and M. de la Salle.

David Kerr

Title: **Bernoulli actions and sofic entropy**

Abstract: By the work of Ornstein and Weiss, every factor of a Bernoulli action of a countable amenable group is again Bernoulli. In particular, every such Bernoulli action has completely positive entropy, meaning that every nontrivial factor has positive entropy. On the other hand, Popa's deformation-rigidity theory has demonstrated that many nonamenable groups, including those with property (T), have Bernoulli actions with non-Bernoulli factors. Nevertheless, we show that every Bernoulli action of a sofic group, independently of whether it admits a non-Bernoulli factor, has completely positive entropy.

Zhuang Niu

Title: **All irrational extended rotation algebras are AF**

Abstract: An extended rotation algebra is the C*-algebra generated by the rotation algebra together with certain spectral projections of the canonical unitary generators. Recently, it is shown that all irrational extended rotation algebras are approximate finite-dimensional. This is a joint work with George Elliott.

Ian Putnam

Title: **A homology theory for Smale spaces**

Abstract: Smale spaces were defined by David Ruelle as abstract topological versions of the basic sets for Smales Axiom A systems. Later, he also showed how (several) C*-algebras could be constructed from such systems. Smale spaces include shifts of finite type and here the C*-algebras are the well-known Cuntz-Krieger algebras, as well as their AF-cores. Rufus Bowen conjectured the existence of a homology theory for Smale spaces which would provide a Lefschetz-type formula to count the number of periodic points. This was first done for shifts of finite type by Bowen-Franks and Krieger (independently). The Krieger invariant was the K-theory of the AF-algebra. Here, we provide a solution to Bowen's conjecture which is heavily based on the dimension group invariant. This should also provide a method of computation of the K-theory of the C*-algebras for general Smale spaces.

Thomas Sinclair

Title: **Inner amenability and central sequences in group factors**

Abstract: We will show that every group admitting an unbounded quasi-cocycle into a mixing non-amenable representation is not inner amenable. We will discuss how our approach generalizes a recent result of Dahmani, Guirardel, and Osin on the non-inner amenability of so-called acylindrically hyperbolic groups. Other applications such as to central sequences in group-measure space algebras as well as some open problems will also be touched upon. This is based on joint work with Ionut Chifan and Bogdan Udrea.

Jan Jitse Venselaar

Title: **Morita equivalences of torus equivariant spectral triples**

Abstract: Morita equivalences of spectral triples can be thought of to be the generalization of isometries from differential geometry to noncommutative geometry. However, while on the topological level (the C^*- algebra) a Morita equivalence is an equivalence relation, with the added geometric data in a spectral triple the relation is not known to be symmetric anymore. In this talk, we show that if we restrict to a certain class of spectral triples, torus equivariant ones, the relation can be shown to be symmetric.

Dan Voiculescu

Title: **Free probability with left and right variables**

Abstract: I will describe the extension of free probability to systems with left and right variables, based on a notion of bi-freeness. This includes bi-free convolution operations, bi-free cumulants and bi-free central limit.

Nik Weaver

Title: **Kadison-Singer and discrepancy**

Abstract: I will describe the "discrepancy" interpretation of the Kadison-Singer problem, compare it with other discrepancy results, and try to explain why this version is so pregnant with operator-theoretic implications. Finally I will talk about what extra information the spectacular recent work of Marcus, Spielman, and Srivastava reveals, beyond the bare fact that the problem has a positive answer.

Tim Wertz

Localization of Matrix Factorizations

Abstract: Matrices with off-diagonal decay, characterized here by membership in a particular Banach algebra, appear in a variety of fields in mathematics and in numerous applications, such as signal processing, statistics, communications engineering, condensed matter physics, and quantum chemistry. Numerical algorithms dealing with such matrices often take advantage (implicitly or explicitly) of the empirical observation that this off-diagonal decay property seems to be preserved when computing various useful matrix factorizations, such as the Cholesky factorization or the QR-factorization. There is a fairly extensive theory describing when the inverse of a matrix inherits the localization properties of the original matrix. Yet, except for the special case of band matrices, surprisingly very little theory exists that would establish similar results for matrix factorizations. Exploiting the inverse-closedness of the Banach algebras in question, we answer the question when and under which conditions the matrix factors inherit the localization of the original matrix for such fundamental matrix factorizations as the LU-, QR-, Cholesky, and Polar factorization.

Paulette Willis

Title: **One-sided shift spaces over infinite alphabets**

Abstract: In this presentation, I will discuss joint work with William Ott and Mark Tomforde concerning shift spaces over infinite alphabets. In particular, I will how we define a shift space over infinite alphabets such that the resulting shift space is a compact Hausdorff space. I will also discuss three distinct shift spaces that generalize to shifts of finite type. If time permits, I will show that a property we call "row-finite" allows shift morphisms to be identified with sliding block codes. Lastly (time permitting) I will show that with our definitions, if two directed graphs have conjugate edge shifts, then the groupoids of the graphs are isomorphic therefore the C^*-algebras of the graphs are isomorphic.