ABSTRACTS FOR THE 2012 WEST COAST OPERATOR ALGEBRA SEMINAR, 20–21 OCTOBER 2012, UNIVERSITY OF OREGON

Branimir Cacic

California Institute of Technology

Reconstruction theorems in noncommutative Riemannian geometry

Connes's reconstruction theorem, which shows that every commutative spectral triple arises from a compact oriented manifold, famously restricts to a noncommutative-geometric characterisation of compact spin$^{(\mathbb{C})}$ manifolds (together with spinor bundle and suitable Dirac-type operator). We show how to generalise this into a noncommutative-geometric characterisation of compact oriented Riemannian manifolds together with Dirac-type operator, in full generality. Then, we apply this generalised characterisation to obtain an analogue of the reconstruction theorem for almost-commutative spectral triples, clarifying, in the process, the definition of almost-commutative spectral triple. Finally, we consider the consequences of these results for real commutative and almost-commutative spectral triples.

Michael Hartglass

University of California at Berkeley

Rigid C^* tensor categories of bimodules over interpolated free group factors

The notion of a fantastic planar algebra will be presented and some examples will be given. I will then show how such an object can be used to diagrammatically describe a rigid, countably generated C^* tensor category $\mathcal{C}$. Following in the steps of Guionnet, Jones, and Shlyakhtenko, I will present a diagrammatic construction of a II_1 factor M and a category of bimodules over M which is equivalent to $\mathcal{C}$. Finally, I will show that the factor M is an interpolated free group factor and can always be made to be isomorphic to $L(\mathbb{F}_\infty)$. Therefore we will deduce that every rigid, countably generated C^* tensor category is equivalent to a category of bimodules over $L(\mathbb{F}_\infty)$. This is joint work with Arnaud Brothier and David Penneys.

Date: 17 October 2012.

Adrian Ioana
University of California at San Diego

Cartan subalgebras in amalgamated free product II_1 factors

I will present some recent work on the structure of Cartan subalgebras in amalgamated free product II_1 factors. In particular, I will explain a result showing that any free ergodic probability measure preserving action of the free product $\Gamma = \Gamma_1 * \Gamma_2$ of any two groups satisfying $|\Gamma_1| > 1$ and $|\Gamma_2| > 2$ gives rise to a crossed product von Neumann algebra with a unique Cartan subalgebra, up to unitary conjugacy.

Andre Kornell
University of California at Berkeley

On the category of von Neumann algebras

We will view the category of von Neumann algebras and unital normal $*$-homomorphisms as being opposite to a category of set-like objects and their functions. This viewpoint will reveal that any unital normal completely positive map between von Neumann algebras arises from a normal state on their free exponential von Neumann algebra, which plays the role of their function space in the opposite category.

Frédéric Latrémolière
University of Denver

Quantum Locally Compact Metric Spaces

Noncommutative metric geometry is the study of noncommutative generalizations of algebras of Lipschitz functions on metric spaces. Inspired by the work of Connes, Rieffel introduced the notion of a compact quantum metric space and a generalization of the Gromov-Hausdorff distance, thus providing a framework for many approximations of quantum geometries by finite quantum spaces found in the mathematical physics literature and opening a new and fascinating area of inquiry for C*-algebra researchers. However, the question of extending this nascent theory to the more general locally compact setting has been raised many times, in contexts such as the study of spectral triples from C*-dynamical systems to the study of the Moyal planes and other physically relevant models, while an answer remained elusive for some years. In this talk, I propose my suggestion for the foundation of such an extension. I will present a notion of a quantum locally compact metric space, motivated in part by the development of a notion of a generalized quantum Gromov-Hausdorff convergence, provide a few useful characterizations of this new concept, as well as several examples. This talk will summarize my latest paper on this topic as well as provide some background from my earlier research on the topic.

Franz Luef
University of Vienna

On the structure of vector bundles over noncommutative tori

Vector bundles over noncommutative tori are finitely generated projective modules over noncommutative tori. A construction of these vector bundles due to Rieffel has an intrinsic relation to signal analysis. More concretely, vector bundles over noncommutative tori are (multi-window) Gabor frames, which are central objects in time-frequency analysis. Gabor frames have found applications in various areas such as music and wireless communication. There is a vast literature on Gabor frames. The main goal of this talk is the presentation of some of these results and its consequences on the existence and structure of vector bundles over noncommutative tori.

Matilde Marcolli
California Institute of Technology

Quantum statistical mechanics, operator algebras, and reconstruction of number fields

This talk is based on joint work with Gunther Cornelissen. It is known that two number fields with the same Dedekind zeta function are not necessarily isomorphic. The zeta function of a number field can be interpreted as the partition function of an associated quantum statistical mechanical system, given by a C* dynamical system. We show that these QSM systems contain enough information to reconstruct the number field up to isomorphism, and we also show that an isomorphism of character groups of the abelianized Galois groups of the two number fields that induces an equality of all corresponding L-series implies isomorphism of the number fields.

Yoshiko Ogata
Tokyo University

Probability distributions in quantum spin systems

Quantum spin systems are physical systems given by UHF algebras. We consider probability distributions of macroscopic observables with respect to KMS states of the systems. Noncommutative central limit theorems and large deviations are discussed.

Luis Santiago
University of Oregon

$\mathcal{W}$-stable C*-algebras

The C*-algebra $\mathcal{W}$ is a stably finite analog of the Cuntz algebra $\mathcal{O}_2$. It is a simple, nuclear, stably finite, stably projectionless C*-algebra with a unique tracial state and trivial K-groups. This C*-algebra should play a crucial role in the classification of nuclear C*-algebras; in fact, it was recently conjectured by Leonel Robert that up to $\mathcal{W}$-stability nuclear C*-algebras can be classified by their cones of lower semicontinuous extended-value traces. In this talk, I will present some recent work on the structure of $\mathcal{W}$-stable C*-algebras.

Yasuhiko Sato
Kyoto University/University of Oregon

Tracial state spaces of nuclear simple C*-algebras with finite dimensional extreme boundary

I will mainly discuss unital separable simple nuclear C*-algebra A with many extremal traces. Recently, we prove that if the trace space of A has compact finite-dimensional extreme boundary then there exist unital embeddings of matrix algebras into a certain central sequence algebra of A which is determined by the uniform topology on the trace space. As an application, it is shown that if furthermore A has strict comparison then A absorbs the Jiang-Su algebra tensorially.

Feng Xu
University of California at Riverside

On questions about intermediate subfactors

In this talk I will describe a few questions about intermediate subfactors motivated by the theory of finite groups, and report on some recent progress related to Hopf algebras, fusion categories and conformal field theory.