JOURNÉES DE JEUNES ANALYSTES NON-COMMUTATIFS

Monday, November 25		Tuesday, November 26	
9:30–10:30	Isabelle Baraquin	9:30–10:30	Runlian Xia
10:30–11:30	Xiao Xiong	10:30–11:30	Thomas Scheckter
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ABSTRACTS

Isabelle Baraquin

De Finetti Theorems

In this talk, we will present de Finetti Theorem and some similar results in noncommutative probability. After looking at the quantum case, we will study a de Finetti theorem in the dual unitary group.

Edward McDonald

Singular traces and the density of states

Abstract: The density of states is a non-negative measure associated to a Schrodinger operator H which is supported on the essential spectrum of H. Theoretical questions concerning the existence and properties of the density of states are of interest in solid state physics. We have recently found that quite generally the density of states can be recovered from a formula involving a Dixmier trace. This is a surprising new application of noncommutative measure theory to mathematical physics which uses recently developed techniques in operator integration theory. Joint work with N. Azamov, F. Sukochev and D. Zanin.

Lahcen Oussi

Noncommutative analogues of the law of small numbers for random variables indexed by elements of positive symmetric cones

We present an analogue of the classical Law of Small Numbers, formulated for a noncommutative independence (the bm-independence), where the random variables are indexed by elements of positive symmetric cones in Euclidean spaces, including $\mathbb{R}^d_+$, the Lorentz cone in Minkowski spacetime and positive definite real symmetric matrices. The geometry of the cones plays an important role in the study as the volume characteristic sequences of each cone, related to the growth of volumes of intervals in the cone, appears in our final formulas. Also the combinatorics of ordered partitions is crucial for our study as one of the main tools for performed computations.

Thomas Scheckter

On the Operator Space Structure of Orlicz Spaces

We seek to address two questions. How may one associate an operator space structure to the Schatten–Orlicz spaces, and how may one extend the theory of function spaces associated to an arbitrary von Neumann algebra beyond L^p-spaces?

It would seem that the answers to these questions are deeply intertwined. We will discuss the failure of real interpolation in these settings, and introduce the "one-dimensional interpolation functor", which provides a basis for the study of operator space structures for noncommutative Orlicz spaces.

This is a joint work with Marius Junge, Fedor Sukochev, and Quanhua Xu.

Yin Sheng

Realization of free field

This talk is based on a recent joint-work with Tobias Mai and Roland Speicher. The free field is the skew field (aka division ring) which extends the noncommutative ring of polynomials in several variables with some universal property. Elements in the skew field are known as non-commutative rational functions. In this talk, we address the question when a tuple of operators in a finite von Neumann algebra can realize the free field in the algebra of affiliated operators. It turns out that the quantity Δ introduced by A. Connes and D. Shlyakhtenko in their paper, L2-homology for von Neumann algebras, gives a description for such operators. More precisely, for a tuple of operators, the maximality of its Δ is equivalent to the realization of the free field by these operators.

Some application of this equivalent will be given in this talk. On one side, Δ is related to many concepts, for examples, free entropy dimension and dual system, in free probability. So the tools in free probability can be used to check if a tuple of operators has maximal Δ or not. On the other side, the realization of free field is also equivalent to some Atiyah property. This property can be used to answer questions on zero divisors or atoms for non-commutative random variables.

Ignacio Vergara

Positive definite radial kernels on homogeneous trees and products

A classical result in harmonic analysis on homogeneous trees characterises positive definite radial kernels in terms of Borel measures on the interval $[-1, 1]$. I will discuss a new proof of this result, which relies on a characterisation of radial Schur multipliers by Haagerup–Steenstrup–Szwarc and a variation of the Hamburger moment problem. Moreover, this new method allows one to extend the result to finite products of trees.

Hua Wang

Classification of irreducible representations of semi-direct products of a compact quantum group with a finite group

It is trivial to classify irreducible representations of a direct product of groups in terms of the representations of the factor groups. But once we replace the direct product by the much more ubiquitous semi-direct product, the situtation quickly becomes complicated. In the 20th century, G. Mackey developed a powerful machinery, aka. Mackey's analysis, to treat such questions in the context of locally compact groups. In this talk, I will present a quantum analogue of Mackey's analysis, which is inspired by the ideas of rigid C^*-tensor categories, in the context of semi-direct products of a compact quantum group with a finite group. In particular, I will mainly focus on classifying all irreducible representations of such quantum groups. If time permits, I will mention the more delicate topic of fusion rules of these quantum groups, and perhaps some interesting applications.

Xumin Wang

Pointwise convergence of noncommutative Fourier series

This talk is about convergence of Fourier series for non-abelian groups and quantum groups. It is well-known that a number of approximation properties of groups can be interpreted as some summation methods and mean convergence of associated noncommutative Fourier series. Based on this framework, this work studies the refined counterpart of pointwise convergence of these Fourier series. We establish a general criterion of maximal inequalities for approximative identities of noncommutative Fourier multipliers. As a result we prove that for any countable discrete amenable group, there exists a sequence of finitely supported positive definite functions tending to 1 pointwise, so that the associated Fourier multipliers on noncommutative L_p-spaces satisfy the pointwise convergence for all $p > 1$. In a similar fashion, we also obtain results for a large subclass of groups (as well as discrete quantum groups) with the Haagerup property and weak amenability. We also consider the analogues of Fejér means and Bochner-Riesz means in the noncommutative setting. Our results in particular apply to the almost everywhere convergence of Fourier series of L_p-functions on non-abelian compact groups.

Runlian Xia

Algebraic Calderón-Zygmund theory

In the classical harmonic analysis, Calderón-Zygmund theory has been traditionally developed on metric measure spaces satisfying additional regularity properties. In the lack of good metrics, we present a new approach for general measure spaces (von Neumann algebras) which admit a Markov semigroup satisfying purely algebraic assumptions. We shall construct an abstract form of 'Markov metric' governing the Markov process and the naturally associated BMO spaces, which interpolate with the L_p-scale and admit endpoint inequalities for Calderón-Zygmund operators.

Xiao Xiong

Quantum differentiability on quantum tori and quantum euclidean spaces

The core ingredients of the quantized calculus, introduced by A. Connes, are a separable Hilbert space H, a unitary self-adjoint operator F on H and a C^*-algebra $\mathcal{A}$ represented on H such that for all $a \in \mathcal{A}$ the commutator $[F, a]$ is a compact operator on H. Then the quantized differential of $a \in \mathcal{A}$ is defined to be the operator $\mathbf{d}a = i[F, a]$. We provide a full characterization of quantum differentiability in the sense of Connes on quantum tori $\mathbb{T}^d_\theta$ and quantum euclidean spaces $\mathbb{R}_\theta$. We also prove a quantum integration formula which differs substantially from the commutative case.

Based on joint work with Edward McDonald and Fedor Sukochev.