Titles & Abstracts

Minicourse

Pierre Clare (William & Mary College, Williamsburg)

Title: C^*-algebras and the tempered dual

Abstract:
The goal of these lectures will be to introduce some tools of operator algebras to study representations of Lie groups. Using this language, we will see how the tempered dual can be studied as a noncommutative topological space and what kind of insight into representation theory these methods may provide.

Tentative schedule of topics:

Lecture 1. C*-algebras and the tempered dual

Lecture 2. Hilbert modules and induced representations

Lecture 3. The reduced C*-algebra of a real reductive group

Lecture 4. Organizing principles from NCG

Research talks

Spyros Afentoulidis-Almpanis

Title: Some thoughts on $\mathbb{Z}_2\times\mathbb{Z}_2$-graded Lie algebras.

Abstract:
A $\mathbb{Z}_2 \times \mathbb{Z}_2$-graded Lie algebra is a special case of color Lie algebra. These algebras have applications in mathematical physics, such as in the study of symmetries of the Lévy-Leblond equation or in graded quantum mechanics. In this talk, I would like to share some thoughts regarding a class of complex $\mathbb{Z}_2 \times \mathbb{Z}_2$-graded Lie algebras that are, in some sense, closely related to complex semisimple Lie algebras.

Jacob Bradd (Université de Lorraine)

Title: The Connes-Kasparov isomorphism and Vogan's theorem on tempiric representations

Abstract:
(Joint work with Nigel Higson and Robert Yuncken.)
An important result of Vogan in the representation theory of semisimple (or reductive) groups states that if K is a maximal compact subgroup of a real reductive group G, then the tempered irreducible representations of G with real infinitesimal character (the "tempiric" representations, as coined by Afgoustidis), up to equivalence, are in bijection with irreducible unitary representations of K up to equivalence (given by taking the unique minimal K-type). The only known proof of this bijection (as far as I'm aware) goes through Vogan's classification of tempered representations (i.e. through the "green book"). Nigel Higson, Robert Yuncken and I prove that the "linearized" version of this Vogan bijection is equivalent to the Connes-Kasparov isomorphism. Because V. Lafforgue has given a proof of the Connes-Kasparov isomorphism through K-theoretic and index-theoretic techniques, this essentially gives a proof of (the linearized version of) Vogan's theorem with more elementary representation-theoretic requirements. (Conversely, this also indicates how Vogan essentially proved the Connes-Kasparov isomorphism, before it was even conjectured!)

Clément Cren (Göttingen)

Title: Toeplitz algebras and the Heisenberg group

Abstract:
I will show how a connection between creation and annihilation operators on the one hand, and shift operators on the other, can be extended to an isomorphism between (an ideal of) the C^*-algebra of a Heisenberg group and (a natural crossed product of) a Toeplitz algebra. I will explain how this relates to harmonic analysis on Heisenberg groups and try to generalize the question to other nilpotent groups. I will also give a geometric interpretation of this result and, if time permits, extend this analogy to contact manifolds.

Eske Ewert (Hannover)

Title: Shubin calculi for actions of graded Lie groups

Abstract:
One way to obtain Fredholm operators on the non-compact space $\mathbb R^n$ is consider pseudodifferential operators with elliptic Shubin symbols. In this talk, I will describe a generalization of Shubin's calculus to an action of a graded Lie group

G on a graded vector space X. The calculus contains fundamental vector fields of the action and multiplication by polynomials on X, where their order is measured by the gradings of G and X, respectively. We use a groupoid approach similar to the one by van Erp and Yuncken to define the calculus. We show that certain generalizations of the harmonic oscillator are hypoelliptic and define Fredholm operators.
The talk is based on joint work with Philipp Schmitt.

Paul Meunier

Title: Noncommutative combinatorics and quantum automorphism groups of graphs

Abstract:
We will talk about quantum automorphism groups of graphs and how to compute them using combinatorial techniques.
This talk is based on arxiv:2312.01516.

Rafailia Tsiavou (Thessaloniki)

Title: Seiberg-Witten equations on Hermitian symmetric spaces

Abstract:
A Dirac operator D on a Riemannian manifold M may be thought of as the operator-square root of the Laplacian Δ. Seiberg-Witten equations, originally stated on 4-dimensional manifolds, involve the kernel of a Dirac-type operator and a monopole-type condition on the curvature of the line bundle of the spin^c-structure of M. I will describe how one can use representation theory to generalize Seiberg-Witten equations to Hermitian symmetric spaces. These results are part of my PhD thesis.

Robert Yuncken (Lorraine)

Title: K-theory of compact groups via groupoid C*-algebras

Abstract:
The algebra of functions on a compact group, or a flag manifold, fits into a deformation family of quantized function algebras indexed by q in [0,∞], which are (probably) all *KK*-equivalent. At q=1 we get the abelian algebra of functions on the classical group. At q=0 or ∞ we get the C*-algebra of an ample groupoid coming from a subshift of finite type. This gives a new way to calculate the K-theory of compact groups and flag varieties.
(Joint work with Marco Matassa and Aidan Sims.)