

Workshop on index theory and related areas Radboud University

19–20 May 2022

Titles and abstracts

Alexandre Afgoustidis

Title: *Local Langlands correspondence and lowest K -types for real groups*

Abstract: Let G be a reductive group over a local field. The local Langlands conjecture describes the irreducible (smooth, complex) representations of G in terms of certain homomorphisms from the Weil group of F into the Langlands dual group of G . What is expected is that a finite ‘ L -packet’ of representations can be attached to each such ‘ L -homomorphism’, and that the L -packets give a partition of the smooth dual.

Now suppose G is a real reductive group. Then Langlands gave a famous description of L -packets in the 1970s. Later work of Langlands and Shelstad or Adams–Barbasch–Vogan led to a refined version of the correspondence, where each of the L -packet in turn admits a parametrization in terms of data arising from the geometry of the Langlands dual group.

Suppose we are given such a ‘refined’ Langlands parameter, and observe the corresponding representation of G . Is it easy to read its restriction to a maximal compact subgroup of G directly on the Langlands data? I will describe work in progress with Jeffrey Adams on the case of tempered representations.

Francesca Arici

Title: *SU(2)-symmetries and Gysin sequences for C^* -algebras*

Abstract: Motivated by the study of group symmetries, as well as by the Gysin sequence in topological K -theory, in this talk we will introduce the notion of an SU(2)-equivariant subproduct system of Hilbert spaces. We

will describe their Toeplitz and Cuntz–Pimsner algebras and provide results about their topological invariants through $K(K)$ -theory. In particular, we will show that the Toeplitz algebra of the subproduct system of an irreducible $SU(2)$ representation is equivariantly KK -equivalent to the algebra of complex numbers so that the $(K)K$ -theory groups of the Cuntz–Pimsner algebra can be effectively computed using a Gysin exact sequence involving an analogue of the Euler class. Based on joint work with Jens Kaad (SDU).

Nigel Higson

Title: *On Perrot’s approach to index theory*

Abstract: Ten years ago, Denis Perrot discovered a remarkable new approach to index theory. Its main features are (a) the introduction of an algebra of infinite-order differential operators, in which the heat operator $\exp(-\Delta)$ can be treated algebraically, as a power series, and (b) the construction of a trace on (a submodule of) this algebra, modeled on the noncommutative residue. Perrot showed that the index cocycle built from these ingredients may be computed explicitly, leading to a new realization of the Todd class that appears in the Atiyah–Singer index theorem. But despite them being a radical departure from anything that came before, and despite them solving long-standing problems in noncommutative geometry, Perrot’s ideas have not been widely adopted, so far. I shall try to remedy that by presenting an overview of some of Perrot’s work in this talk.

Bram Mesland

Title: *Howe’s theta correspondence as a Rieffel induction*

Abstract: Howe’s local theta correspondence relates irreducible representations of a reductive dual pair (G, H) of subgroups of a symplectic group over a local field. In joint work with M.H.Sengun (Sheffield) we have shown that various instances of Howe’s correspondence can be realised as a Rieffel induction via a C^* -correspondence between the full or reduced group C^* -algebras of G and H . In this talk I will discuss our construction and its implications for K -theory and representation theory.

Teun van Nuland

Title: *A cyclic expansion of the spectral action*

Abstract: The spectral action principle, introduced by Chamsedinne and Connes in ’97, produces physical models from noncommutative geometry. Put in math, the spectral action is given by $\text{Tr}(f(D + V))$, where f is

a test function, D is the Dirac operator of a spectral triple, and V is a fluctuation. In this talk we will expand the spectral action in V , and uncover a fascinating structure, involving (entire) cyclic cocycles and gauge theoretic forms. Applications will also be discussed. Based on joint work with Walter van Suijlekom.

Hessel Posthuma

Title: *The equivariant Chern character in cyclic cohomology*

Abstract: Given a vector bundle that is equivariant with respect to a smooth action of a Lie group, we give two constructions of a Chern character in the cyclic cohomology of a crossed product algebra. The first is based on the formalism of cycles, the second uses Getzler's complex for equivariant cohomology. We prove that two constructions agree when the underlying action is proper. This talk is based on joint work with B. Kosmeijer.

Yanli Song

Title: *Geometric orbital integrals and its large time behavior.*

Abstract: In this talk, we will discuss one application of Bismut's orbital integral formula to representation theory. In particular, I will talk about the larger time behavior of the orbital integral associated to the heat operator of the Casimir on symmetric spaces.