

Programme on  
“Bivariant K-theory in Geometry and Physics”

November 5 - 30, 2018

organized by

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Seminars in Week 1, November 5 – 9, 2018

The seminar meets 10:30 - 11:30 in the Boltzmann Lecture Hall of the Erwin Schrödinger Institute

• Tuesday, November 6, 2018

**Speaker:** Hermann Schulz-Baldes (Friedrich-Alexander Universität Erlangen-Nürnberg)

**Title:** Monopole insertion and spectral flow in topological insulators

**Abstract:** TBA

• Wednesday, November 7, 2018

**Speaker:** Lashi Bandara (Universität Potsdam)

**Title:** First-order elliptic boundary value problems beyond self-adjoint induced boundary operators.

**Abstract:** The Bär-Ballmann framework is a comprehensive framework to consider elliptic boundary value problems (and also their index theory) for first-order elliptic operators on manifolds with compact and smooth boundary. A fundamental assumption in their work is that the induced operator on the boundary is symmetric. Many operators satisfy this requirement including the Hodge-Dirac operator as well as the Atiyah-Singer Dirac operator. Recently, there has been a desire to study more general operators with the quintessential example being the Rarita-Schwinger Dirac operator, which is an operator that fails to satisfy this hypothesis.

• Thursday, November 8, 2018

**Speaker:** Siegfried Echterhoff (Westfälische Wilhelms-Universität Münster)

**Title:** The minimal exact crossed product and the Baum-Connes conjecture

**Abstract:** If  $G$  is a locally compact group which acts on a  $C^*$ -algebra  $A$ , then the original Baum-Connes conjecture with coefficients asserts that a certain assembly map

$$\mu : K_G^*(\underline{EG}; A) \rightarrow K_*(A \rtimes_r G)$$

from the equivariant  $K$ -homology  $K_G^*(\underline{EG}; A)$  of the universal proper  $G$ -space  $\underline{EG}$  with coefficients in  $A$  into the  $K$ -theory of the reduced crossed product  $A \rtimes_r G$  should always be an isomorphism. However, it was observed by Higson, Lafforgue, and Skandalis in 2002 that the conjecture fails for non-exact groups. Recently, Baum, Guentner, and Willett proposed a new version of the conjecture where the reduced crossed product is replaced by the smallest exact crossed-product functor which dominates the reduced crossed product. In this lecture we will report on recent joint work with Alcides Buss and Rufus Willett on the new conjecture and the properties of the smallest exact crossed product functor.

- **Friday, November 9, 2018**

**Speaker:** Branimir Cacic (University of New Brunswick, Fredericton)

**Title:** Noncommutative principal bundles in unbounded KK-theory

**Abstract:** On the algebraic side of NCG, there is a well-established Hopf-algebraic theory of quantum principal bundles with quantum structure group; on the analytic side, unbounded KK-theory now allows us to treat various classes of Riemannian submersion, both commutative and noncommutative, in the language of spectral triples and correspondences. In the case of noncommutative principal bundles with compact connected Lie structure group  $G$ , one can combine these two approaches to yield a working unbounded KK-theoretic framework for noncommutative Riemannian principal  $G$ -bundles and principal connections that is fully compatible with Connes–Landi deformation; in particular, it yields explicit unbounded KK-theoretic factorisations of total geometries into vertical and basic geometries that are manifestly compatible with gauge-theoretic considerations. This is joint work with Bram Mesland.