

Seminar in Analysis, Fall 2016,
Course description
by

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Tensor products of C^* algebras and Operator space theory

Abstract.

The course will revolve around the famous Connes-Kirchberg open problem. The various equivalent forms of the problem will be described and the necessary accompanying background will be presented, with emphasis on the Weak Expectation Property (WEP), the Local Lifting Property (LLP), approximate injectivity and the open problems related to these notions. Our goal is that the audience become familiar with the contents of Kirchberg's paper (reference below), which is not easy reading (to say the least !).

In the process, the general theory of tensor products of C^* -algebras will be described. The notion of exact C^* -algebra (and exact operator space) will play an important role there, with a special emphasis on C^* -algebras associated to discrete groups.

For instance: Amenable discrete groups give rise to nuclear C^* -algebras, while non-amenable ones such as free groups, although not nuclear, are exact. Sofic groups lead to a von Neumann algebra that satisfies the Connes conjecture (and no example is known of non-sofic group).

Various forms of the non-commutative Grothendieck theorem will be presented in view of its recent connection with Bell's inequality. If time permits, an introduction to quantum information theory will be given.

Lecture Notes for the entire course (a new book in preparation) will be distributed.

References: E. Kirchberg, On nonsemsplit extensions, tensor products and exactness of group C^* -algebras. *Invent. Math.* **112** (1993), 449–489.

G. Pisier, *An introduction to operator space theory*, Cambridge Univ. Press, 2003.

N. Brown and N. Ozawa, *C^* -Algebras and Finite-Dimensional Approximations*, AMS, 2008