



Introduction to Noncommutative Differential Geometry

Lecture in the Summer Term 2019

In 1982, the French mathematician Alain Connes was awarded the Fields medal for his numerous contributions to the theory of operator algebras, and in particular for applications of operator algebraic methods to differential geometry. The latter he developed further intensively to an influential theory at the interface of various fields of mathematics and with deep connections to physics, which became known as *Noncommutative (Differential) Geometry*. The underlying idea is that there are interesting “spaces” (such as the space of leaves of a foliation, or the orbit space of the action of a discrete group on a manifold) which are badly behaved as point sets, but become accessible via canonically associated (often noncommutative) operator algebras. In such situations, the usual methods of differential geometry cannot be applied directly, but they can be imitated in an operator theoretic framework using the notion of so-called *spectral triples*. This opens the door to the noncommutative world and extends differential geometry far beyond its traditional setting.

In this lecture, we want to give an introduction to this circle of ideas from an operator algebraic perspective. Participants are thus required to have a solid background in functional analysis, especially on C^* - and von Neumann algebras. Prior knowledge in differential geometry and homological algebra might be helpful, but is not required; this can be discussed when necessary.

Time and Place: Mondays, 10–12, SR 10, Building E2 4

The lecture will be accompanied by a bi-weekly exercise session (the date will be fixed later), so that 4.5 ECTS points can be earned.

For further information, please contact Tobias Mai (mai@math.uni-sb.de, room 225 in building E2 4). See also:

<https://www.math.uni-sb.de/ag/speicher/lehre.html>