The Mill 2020 vs Corona – Round 2

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What is... the Atiyah–Singer index theorem?

7 April 2020
21.15h

Abstract

The *Atiyah–Singer index theorem* is certainly one of the break-throughs of Mathematics in the 20th century and was awarded with the Abel Prize in 2004. The theorem computes the index of an elliptic pseudodifferential operator from its symbol and topological data of the underlying manifold, and thereby establishes surprisingly deep connections between the fields of Functional Analysis, Differential and Algebraic Topology, and Geometry. By now, many mathematicians have generalized the theorem in different directions. For example, the *algebraic index theorem* discovered by Fedosov and Nest–Tsygan, computes the trace of a deformation quantization in terms of topological data.

In this talk, I would like to explain the general motivation behind index theorems, and the statement of the Atiyah–Singer index theorem in particular. I will briefly discuss Fredholm operators, pseudodifferential operators, K-theory, and characteristic classes.

Index theory certainly provides enough material for a whole year lecture course. Depending on the interest of participants, we can have a follow-up talk (or maybe a whole lecture series?) on the algebraic index theorem, cyclic (co)homology and the Chern character, spin structures and Dirac operators, and many other interesting topics.

We meet 15min before the talk starts on discord, make sure to have zoom installed. Write to mschotz (YouKnowWhatSymbolComesHere) ulb.ac.be if you don't have access yet or have any questions.