Dirac operators

Time: Monday, 16:15-17:45
Room: H.S. 5
Lecturer: Robin Deeley

Dirac operators are ubiquitous in mathematics. The aim of this course is an introduction to Dirac operators and an outline of their importance in various fields. In particular, we will try to understand the local index theorem. Even this result requires understanding results from various areas of mathematics. Despite this, we will endeavour to make the lectures accessible and interesting to a wide audience. Indeed, we hope to attract participants from varying fields. The course will be aimed at graduate students.

The structure of the course is as follows. The first half (6-7 lectures) will consist of an introduction to Dirac operators and to the statement (and possibly the proof) of the Atiyah-Singer index theorem via the heat kernel method (i.e., the local index theorem). The second half (5-6 lectures) will consist of self-contained lectures which deal with the appearance of Dirac operators in various fields (e.g., complex geometry, gauge theory, Lie group theory, noncommutative geometry, etc). As such, the lectures in the first half of the course will be given for the most part, by students; while the lectures in the second half will be given, for the most part, by more experienced researchers. The first lecture will take place on Monday October 22, 2012. An outline for the first half of the course is as follows.

1. Overview of Dirac operators and index theory (i.e., the “big picture”)
2. Review of some results from differential geometry and operator theory
3. Introduction to differential operators
4. Clifford algebras, modules and the like
5. Dirac operators; definition, examples, and basic properties
6. The heat kernel and its asymptotic expansion
7. The local index theorem; statement, examples, and outline of the proof

The topics of the lectures in the second half of the course will be more flexible; in particular, they will depend on the interests of the audience. As such, they will be determined during the first few lectures. For the topics to be covered in the first half of the course, there are a number of good references (for example, [1, 2, 3, 4]).
REFERENCES


