Dirac operators on manifolds with boundary

Paolo Antonini & Koen van den Dungen

Lecture schedule

Lectures are scheduled from January to March 2018 as follows.

- Friday 26 Jan, 14:15–16:00, Room 134
- Friday 2 Feb, 14:15–16:00, Room 134
- Wednesday 7 Feb, 9:15–11:00, Room 136
- Friday 9 Feb, 14:15–16:00, Room 136
- Wednesday 14 Feb, 9:15–11:00, Room 136
- Friday 16 Feb, 14:15–16:00, Room 136
- Friday 23 Feb, 14:15–16:00, Room 136
- Wednesday 28 Feb, 9:15–11:00, Room 136
- Friday 2 Mar, 14:15–16:00, Room 136
- Friday 9 Mar, 14:15–16:00, Room 136

Course contents

This is an introductory course on the analysis of Dirac operators on manifolds with boundary. Our goal is to prepare the background to deal with a number of applications of elliptic boundary value problems for Dirac operators which are frequently encountered in Geometry and in Mathematical Physics.

The first part of the course will focus on the general theory of elliptic boundary value problems. We will discuss Dirac-type operators, boundary conditions (local and global), ellipticity of boundary conditions, Fredholmness of the realisations, and some general index theorems.

In the second part of the course we will illustrate the Atiyah-Patodi-Singer index formula and the eta-invariant, discussing as an application the signature formula for a manifold with boundary.

The first part of the course will mostly follow the paper [BB16], with additional details and proofs taken from [BB12]. The second part of the course is largely based on [BW93].

Examination

Students are expected to attend and actively participate in the lectures. The exam will consist of a seminar presentation on an advanced topic related to the material of the course.

Literature

[BB12] C. Bär and W. Ballmann, *Boundary value problems for elliptic differential operators of first order*, Surveys in Differential Geometry **17** (2012), 1–78.

[BB13] D. Bleecker and B. Booss-Bavnbek, *Index theory with applications to mathematics and physics*, International Press, Boston, 2013.

[BB16] C. Bär and W. Ballmann, *Guide to elliptic boundary value problems for Dirac-type operators*, Arbeitstagung Bonn 2013: In Memory of Friedrich Hirzebruch (W. Ballmann, C. Blohmann, G. Faltings, P. Teichner, and D. Zagier, eds.), Springer International Publishing, 2016, pp. 43–80.

[BW93] B. Booss-Bavnbek and K. P. Wojciechowski, *Elliptic boundary problems for Dirac operators*, Mathematics Theory & Applications, Birkhäuser, Boston, 1993.