

# Seminar on “Boundary value problems for first order elliptic operators”

Winter term 2019/20

Prof. Bernd Ammann

Tuesday 16.15-18.00

## Summary

The goal of the seminar is a better understanding of boundary values for Dirac operators, as they are used e.g. in the Atiyah-Patodi-Singer index theorem. We follow the very readable and systematic article by Bär and Ballmann with a similar title [1], see here for a link.

**Talk no. 1: Overview and Introduction, Part I.** 15.10. BERND AMMANN.

**Talk no. 2: Overview and Introduction, PartII, and distribution of talks.** 22.10. BERND AMMANN.

**Talk no. 3: Preliminaries and Completeness.** 29.10. + 5.11. (first half) JULIAN SEIPEL. [1, Section 2 & 3]

**Talk no. 4: Normal form.** 5.11.(second half) + 12.11. (first half) GUADALUPE CASTILLO SOLANO. [1, Section 4]

No talk on 19.11. (*Several participants absent*)

**Talk no. 5: Trace theorem and the Model operator.** 12.11. (Second half)+ 26.11. J. SEIPEL. Introduce the classical trace theorem, used in [1, Facts 5.4(v)]. For this you can either follow the reference of Adams, cited in [1], or [3, Chapter 4, Proposition 1.6]. Then explain [1, Section 5, pp 25–30].

No talk on 3.12. Instead: excursion of the seminar to lifespin on Dec. 2, 2019. Windberg meeting on 10.12. (*Windberg week*).

**Supplementary Talk no. 1: Double eigenvalues for Dirac operators** 17.12. INFORMAL DISCUSSION WITH N. NOWACZYK, B. AMMANN ET AL..

The date 7.1. is taken by the h-cobordism seminar.

**Talk no. 6: The maximal domain.** 14.1. + 21.1. + 28.1. BERND AMMANN. [1, Section 6, pp 30–40]. (Two sessions)

**Talk no. 7: Boundary value problems.** 28.1.+ 4.2. + 11.2. JONATHAN GLÖCKLE. [1, Section 7, pp 40–58] (Two sessions)

**Talk no. 8: Index theory, Part 1.** 18.2.BERND AMMANN. [1, Sections 8.1 to 8.3]

**Talk no. 9: Index theory, Part II: Relative Index theorem.** .3.3.JONATHAN GLÖCKLE. [1, Sections 8.4]

## Possible extensions

**Talk no. 10: Extension to non-compact spaces.** *next term* N.N.. Work by N. Große and R. Nakad, <https://arxiv.org/abs/1207.4568>

**Talk no. 11: The Atiyah-Patodi-Singer index theorem.** *next term* N.N.. Literature will follow

**Talk no. 12: Comparison to Lorentzian APS boundary conditions.** *next term* N.N.. Compare the results of the seminar to the Lorentzian setting, see Bär and Hannes <https://arxiv.org/abs/1704.03224>

## Seminar Homepage

[http://www.mathematik.uni-r.de/ammann/lehre/2019w\\_boundval/index.html](http://www.mathematik.uni-r.de/ammann/lehre/2019w_boundval/index.html)

## References

- [1] C. Bär, W. Ballmann, Boundary value problems for elliptic differential operators of first order, ArXiv: 1101.1196
- [2] C. Bär, W. Ballmann, Guide to Boundary Value Problems for Dirac-Type Operators Christian Baer, Werner Ballmann, ArXiv: 1307.3021
- [3] M. Taylor, Partial differential equations, Basic theory, Springer Texts in Applied mathematics, Second edition, 1999