



LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

Summer Term 2021

Elliptic Operators with Applications in Gauge Theory

Markus Röser

Course Description:

The aim of this course is to give some insight into the mathematical tools that lie at the foundation of the construction of gauge-theoretic moduli spaces. First we will study Sobolev spaces and generalized Laplace operators on compact manifolds. The theory developed in this part is of general mathematical interest and allows us to prove the Hodge decomposition theorem, for example. In the second part of the course we will apply these tools to discuss gauge-theoretic moduli spaces. Examples include moduli spaces of instantons on compact four-manifolds and, time permitting, Higgs bundles on a compact Riemann surface.

Prerequisites:

Good background in differential geometry (manifolds, vector bundles, connections). Some familiarity with operators on Hilbert spaces is desirable.

Literature:

Course material (lecture notes, problem sheets, pre-recorded lectures, BBB link) will be available via Moodle. Additional useful references are

- Donaldson, Kronheimer *The Geometry of Four-Manifolds*
- Kobayashi, *Differential Geometry of complex vector bundles*
- Wassermann, *Analysis of Operators* lecture notes available at <http://iml.univ-mrs.fr/~wasserm/>

Date and Place: Mon 12:15–13:45 (pre-recorded lectures)
<https://lernen.min.uni-hamburg.de/course/view.php?id=1216>,
Passcode: YangMills

Problem Classes: 1 hour per week (time TBA), BigBlueButton

Starting on: 5 April 2021
