Conformal Field Theory

Spring 2012

Level of course

PhD Course

Semester/quarter

3rd + 4th quarter (Spring 2012)

Hours per week

4

Name of lecturers

Jørgen Ellegaard Andersen, Hans-Christian Herbig, Benjamin Himpel, Johan Martens

Prerequisites

A basic understanding of algebraic topology and differential geometry.

Objectives of the course

We will study a systematic approach to conformal field theory with gauge symmetry—the so-called Wess-Zumino-Witten-Novikov model—from the point of view of complex algebraic geometry.

Course contents

We will first review all the algebraic prerequisites necessary for introducing conformal blocks associated to the special cases of smooth curves. The prerequisites include affine Lie algebras, the energy-momentum tensor, the Virasoro algebra, highest weight representations, and a filtration of the highest weight modules.

After introducing conformal blocks with formal neighborhoods for smooth curves we discuss their basic properties and correlation functions, we will generalize all of this to nodal curves and get to the sheaf of conformal blocks. We will show that the sheaf of conformal blocks is a locally free module, for which it is necessary to review some basic deformation theory. We will construct a connection in the vector bundle of conformal blocks and show that it is projectively flat. Then we will discuss the degeneration to nodal curves.

Learning outcomes and competences

Relevant to the course subject matter the student should at the end of the course be able to:

- reproduce key results and give rigorous and detailed proofs of them,
- compare key results,
- to study a prescribed topic on his own and give an oral presentation of selected parts of the topic for his fellow students with pertinent written notes,

Literature

Ueno, Kenji, *Conformal field theory with gauge symmetry.* Fields Institute Monographs, 24. American Mathematical Society, Providence, RI; Fields Institute for Research in Mathematical Sciences, Toronto, ON, 2008. viii+168 pp.

Teaching methods

4 hours of lectures per week

Assessment methods

Passed / not passed will be based on the students participation in the course

Credits

10 ECTS

Language of instruction

English