



## LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

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Winter Term 2023/24

# Advanced String Theory

Timo Weigand

### Course Description:

String theory is the leading candidate for a consistent, i.e. ultra-violet finite, quantum theory of particle interactions and gravity. It has revolutionised our understanding of quantum field theory, gravitational physics and the very nature of spacetime. This course is the continuation of the course Introduction to String Theory taught in summer term 2023 and discusses some advanced topics in string theory, with a focus on a spacetime rather than a worldsheet perspective. This includes some relevant aspects of quantum field theory such as anomalies or, time permitting, instantons, which are usually not covered in the QFT 2 course for reasons of time.

Topics include:

- The heterotic string
- 10d effective actions, Green-Schwarz mechanism and anomalies
- D-branes as BPS objects
- String duality and non-perturbative string theory
- String compactifications
- AdS/CFT correspondence (if time permits)

### Prerequisites:

- Quantum Field Theory 1 and 2
- String Theory 1 (as taught e.g. in summer term 2023)

### Literature:

- Blumenhagen, Lüst, Theisen: *Basic Concepts of String Theory*, Springer 2013.
- Polchinski: *String Theory 1+2*, Cambridge University Press 1998.
- Green, Schwarz, Witten: *Superstring Theory 1+2*, Cambridge U. Press 1987.
- Becker, Becker, Schwarz: *String Theory and M-theory – a Modern Introduction*, Cambridge University Press 2007.
- Weinberg, *The Quantum Theory of Fields 2*, Cambridge University Press 2007.

**Date and Place:** Wed 08:30–10:00, and 10:15–11:00, SR 2, Building 2a,  
Bahrenfeld

**Starting on:** October 18th, 2023

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