Universität Hamburg
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CHAMPP
CENTER IN HAMBURG FOR ASTRO-, MATHEMATICAL AND PARTICLE PHYSICS

LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

Summer Term 2021

Introduction to 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 offers an introduction to the basic concepts of bosonic and superstring theory. Topics include:

- The classical bosonic string
- Quantisation of the bosonic string
- Introduction to conformal field theory
- Elementary bosonic string amplitudes and non-linear sigma model
- Superstring quantisation in RNS formalism
- D-branes, T-duality and effective actions

Prerequisites:

Apart from a background in quantum mechanics and classical electrodynamics:

- Quantum Field Theory: It is recommended to have familiarity with quantisation of the free scalar field, the free fermionic field and of the massless spin-one field, as discussed e.g. in a course on QFT I.
- General Relativity: Familiarity with basic concepts of differential geometry (manifold, covariant derivative, Riemann tensor) is helpful especially at the beginning of the course. This will be revised at the beginning.

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.
- Zwiebach: *A first Course in String Theory*, Cambridge University Press 2004.
- Becker, Becker, Schwarz: *String Theory and M-theory – a Modern Introduction*, Cambridge University Press 2007.
- Blumenhagen, Plauschinn: *Introduction to Conformal Field Theory*, Springer 2009.

Date and Place: Tue 9:15–10:45, Fri 9:15–10:45, Zoom
first lecture: `https://uni-hamburg.zoom.us/j/95504160725`, Meeting ID: 955 0416 0725, Passcode: 38261726

Starting on: 6 April 2021