



DEPARTMENT OF PHYSICS

FYM485 String theory, 7.5 credits

Strängteori, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2022-02-07 to be valid from 2022-08-29, autumn semester of 2022.

Field of education: Science 100%

Department: Department of Physics

Position in the educational system

Elective course within the department's master programmes.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS) and 2) Physics, Master's Programme (N2PHY)

Main field of studies

Physics

Specialization

A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

Bachelor degree in physics, or similar, including courses in quantum mechanics, electromagnetic field theory, and subatomic physics. Knowledge of special and general relativity is strongly recommended.

Learning outcomes

The purpose of this course is to give an gentle introduction to string theory and the fundamental questions about nature that can only be answered using strings. This is done using a minimum of advanced mathematical methods.

Knowledge and understanding

After having passed the course 'String theory' the student should have acquired some understanding of the basic clash between General Relativity and Quantum Mechanics, and how this clash is resolved in string theory. The student should then have obtained a set of mathematical tools making it possible to compute various physical effects in string theory, and knowledge of how the gravitational force and the standard model of elementary particles are extracted from string theory and its so called D-branes. He/she should also be able to quantize the dynamical string theory and express it in terms of the infinite dimensional Virasoro algebra. Also very important is the expected ability to discuss and evaluate the good and weak points of string theory and its relation to physics in four-dimensional spacetime.

Course content

The course begins with an introductory discussion of the fundamental problems encountered when trying to understand our universe in terms of standard (quantum) field theory methods of elementary particle physics, and how string theory may solve them. String theory is then introduced and quantized in the most simple way possible and with a minimum of mathematics. Some of its properties are studied in particular its connection to higher dimensional physics and D-branes, a kind of dynamical surfaces. Dimensional reduction to four-dimensional spacetime is another central topic that is discussed. More advanced material like conformal field theory, low energy supergravity och scattering amplitudes are briefly mentioned but not studied in detail.

Form of teaching

The lectures cover the most relevant material of the course while computational methods and skills are developed by solving a number of home problems.

Language of instruction: English

Assessment

Home problems and a mandatory oral exam

If a student who has twice received a failing grade for the same examination component wishes to change examiner ahead of the next examination session, such a request should be made to the department in writing and should be approved by the department unless

there are special reasons to the contrary (Chapter 6 Section 22 of the Higher Education Ordinance). If a student has received a recommendation from the University of Gothenburg for study support for students with disabilities, the examiner may, where it is compatible with the learning outcomes of the course and provided that no unreasonable resources are required, decide to allow the student to sit an adjusted exam or alternative form of assessment. In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, but no more than two years after the course has ceased/been changed. The same applies to internships and professional placements (VFU), although this is restricted to just one additional examination session..

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.