



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Relativitetsteori Theory of Relativity

FMFF30, 4,5 credits, G2 (First Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED F/Pi

Date of Decision: 2023-04-18

General Information

Main field: Technology.

Elective for: E4, F2, Pi2

Language of instruction: The course will be given in Swedish

Aim

Aim of the course is to introduce to the theory of relativity and its ideas. Basic concepts such as time and space are treated, and we interpret the geometry in four-dimensional space-time. The Lorentz transformation is introduced to give the invariants a central role. Particle kinematics and dynamics is applied to atomic, nuclear and particle physics, and furthermore some electromagnetic phenomena are discussed.

The course gives the possibility to study and reflect the fascinating phenomenology of relativity. Emphasis is put on the understanding of concepts. The students are encouraged to actively discuss, explain and reflect the content of the course. The course aims at inspiring the students by establishing connections to fundamental philosophical issues as well as problems in physics and technology.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- know the foundations of relativistic mechanics as well as have a geometric understanding of four-dimensional space-time.
- know applications within physics and technology which require relativity for a full understanding.
- have an overview of the basics in relativity needed to understand the standard model in

particle physics.

Competences and skills

For a passing grade the student must

- be able to carry out calculations in simple applications.
- have developed competence in analyzing problems in relativity with mathematical methods.
- be able to describe and discuss the most important physical phenomena involving relativity.
- be able to explain basic theoretical and mathematical concepts to analyze phenomena.
- understand not too difficult scientific articles about relativity.
- be able to use information from other sources to solve new problems.

Contents

Concept of time and space. Measurement of time intervals and distances. Lorentz transformation. Invariants. Conservation laws as consequences of invariants. Applications within atomic, nuclear and particle physics. Brief heuristic discussion of general relativity.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: The exam is written: the students are asked to individually work on problems which require explanations in essay-style or calculations. Grades are given according to the exam results.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: Basic mathematics and mechanics.

The number of participants is limited to: No

The course might be cancelled: If the number of applicants is less than 12.

The course overlaps following course/s: FMF061

Reading list

- Lecture notes.

Contact and other information

Course coordinator: Marcus Dahlström, marcus.dahlstrom@matfys.lth.se

Course homepage: <http://www.matfys.lth.se/education/FMFF30>

Further information: The course is given as lectures and exercises. In addition, some special applications are discussed in special exercises. Some elements may be taught and assessed in English. This includes a maximum of 1 hp, in the form of laboratory sessions or written assignments.