FSI3030 Relativity Theory 7.5 credits

Relativitetsteori

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FSI3030 valid from Spring 2009

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Vector Analysis.
Electromagnetic Theory.
Mathematical Methods in Physics.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completed course, the PhD student should be able to:

- use tensor notation in relativity theory.
- apply the concepts of length contraction and time dilation as well as use Lorentz transformations.
- solve simple kinematical problems.
- analyze Maxwell's equations and use their relativistic invariance.
- compute basic quantities in differential geometry.
- analyze Einstein's field equations as well as know and use some important solutions to these.
- report some experimental tests of general relativity.
- have knowledge about cosmological models.

Course contents

I. Special relativity

Repetition of tensor notation. The meaning of relativity theory. Einstein's postulates. Geometry of the Minkowski space and Lorentz transformations. Length contraction and time dilation. The twin paradox and proper time. Energy and momentum in special relativity. Maxwell's equations and their relativistic covariance.

II. Basic differential geometry

Local coordinates on manifolds. Covariant and contravariant vectors and tensors. (Pseudo-)Riemannian metric. Covariant derivative (Levi-Civita connection and Christoffel symbols). Parallel transport. Curvature of spacetime.

III. General relativity

The principle of equivalence. Gravitational redshift and light deflection. The Schwarzschild spacetime and experimental tests of general relativity. Einstein's field equations. Introduction to cosmological models.

Course literature

Ta-Pei Cheng: Relativity, Gravitation and Cosmology, Oxford University Press (2005)

Examination

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

A written exam.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.