FSI3300 Theoretical Particle Physics 7.5 credits

Teoretisk partikelfysik

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

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

Establishment

Course syllabus for FSI3300 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

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:

- know and describe the standard model of particle physics.
- compute decay rates and cross-sections with help of relativistic kinematics.

- use symmetries to restrict the form of the S-matrix, for example, isospin, discrete symmetries, and spacetime symmetries.
- give an account of and describe the static properties of the hadrons from the quark model.
- know the basic principles of the electroweak theory.
- have knowledge about how deep inelastic scattering shows the existence of quarks in the nucleons.
- know about basic neutrino physics and describe neutrino oscillations.

Course contents

Introductory survey. Conservation laws. Basic reaction theory. Feynman diagrams. Lorentz invariance. One particle states. Binary reactions. Determination of mass. Scattering theory (the S-matrix, decay rate, scattering cross-section). Symmetries. Time-reversal. Space-reflection. Charge conjugation. The tensor method for determination of spin and parity of particles. Isospin. Strangeness. The quark model. Color. Hadron spectroscopy. Quarkonium. Electroweak interaction of quarks. The Higgs mechanism. Deep inelastic scattering. Neutrino physics. Neutrino oscillations.

Specific prerequisites

Relativity Theory.
Advanced Quantum Mechanics.
Relativistic Quantum Physics (recommended).

Course literature

There is no unambiguous textbook, but several books can be used:

- W.N. Cottingham and D.A. Greenwood, **An Introduction to the Standard Model of Particle Physics**, 2nd ed., Cambridge (2007)
- D. Griffiths, **Introduction to Elementary Particles**, Wiley (1987)
- F. Halzen and A.D. Martin, **Quarks and Leptons**, Wiley (1984)
- Q. Ho-Kim and X.-Y. Pham, **Elementary Particles and Their Interactions - Concepts and Phenomena**, Springer (1998)
- A. Seiden, **Particle Physics - A Comprehensive Introduction**, Addison-Wesley (2005)
- H. Snellman, **Elementary Particle Physics**, KTH (2004)

Examination

- TEN1 - Exam, 7.5 credits, grading scale: P, F

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.

Other requirements for final grade

Hand in assignments and an oral 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.