SH2203 Experimental Particle Physics 7.5 credits

Experimentell 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 SH2203 valid from Spring 2011

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

Subatomic Physics (SH2103) or similar.

Language of instruction

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

Intended learning outcomes

Particle physics probes the structure and interactions of matter at the smallest possible distances. The aim of this course is to give a non-mathematical but complete introduction to the concepts of particle physics with particular emphasis is placed on the experimental techniques used to extract information about the subatomic world. After completing this course, you should be able to:

- Classify the fundamental subatomic particles by their possible interactions.
- Use Feynman diagrams and conservation rules to analyse interactions qualitatively.
- Identify the key features of the interactions and synthesise these to describe the Standard Model of particle physics.
- Explain how particles can be detected and their properties determined by exploiting their interactions with matter. Demonstrate the limitations of different detection techniques.
- Develop particle detection systems by combining detection methods.
- Combine your theoretical knowledge of particle interactions with your more practical knowledge of detection techniques to understand the construction of contemporary experiments.
- Perform dimensional analysis to investigate physical relationships in particle physics
- Interpret data from figures published in the scientific literature and use this to perform calculations and develop conclusions.
- Reflect on the current 'open questions' in particle physics and the experiments planned to address these issues.
- Select and critically research a particle physics sub-topic of your choice and present your work to other members of the class during the student seminar day.

Course contents

The course discusses the smallest constituents of matter and their interactions. The main focus is on the experimental and phenomeological aspects. The content covers:

- Matter and interaction particles.

- The electromagnetic, charged and neutral current weak and strong interactions .

- Gauge symmetries and conservation rules.

- The production and acceleration of particles in the laboratory.

- Interaction of particles with matter.

- Single particle detectors, particle shower detectors and detector systems.

- Electron-positron collisions.

- Proton-(anti-)proton collisions. Electron-proton and heavy ion colliders.

- Non-accelerator particle physics and the link to cosmology.

- Particle physics in the future - beyond the Standard Model.

The course contains one laboratory exercise.

Disposition

Home assignements (5 hp)

Seminar (1.5 hp)

Laboratory exercise (1hp)

Course literature

To be defined before the start of course.

Examination

- INL1 - Assignments, 5.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.0 credits, grading scale: P, F
- PRO1 - Seminar, 1.5 credits, grading scale: A, B, C, D, E, FX, 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.

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.