Faculty of Science

FYST17, Physics: Modern Experimental Particle Physics, 7.5 credits

Fysik: Modern experimentell partikelfysik, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2008-06-11 to be valid from 2008-06-11, autumn semester 2008.

General Information

The course is an elective course for advanced studies for a Degree of Master of Science (120 credits) in physics ..

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students should have acquired the following knowledge and skills upon completion of the course:

- Advanced knowledge of current problems in experimental particle physics.
- Advanced knowledge of the experimental program at Large Hadron Collider (LHC) on CERN.
- Descriptive knowledge of several modern front line experiments in particle physics.
- Understanding of current and future trends in modern experimental particle physics.
- Ability to analyse the relevance and research potential of particle physics experiments.
- Ability to interpret scholarly journals within the subject area of the course.

- Ability to suggest an applicable approach or solution for a stated problem within the subject area of the course.
- Ability to independently search and acquire information necessary for a review or an analysis of a given problem within the subject area of the course.
- Ability to communicate results of project work orally and participate in discussions at presentations of the other students' project work.

Course content

The course consists of 2 parts: modern front line research, and experiments and methods, about total 7.5 ECTS.
The course addresses current problems in particle and astroparticle physics and focuses on current and planned experiments in the subject area. The course covers the following questions:

- Current front line research

o Particle physics: the standard model, precision measurements; CP-violation; beyond the standard model (dark matter, supersymmetry, additional dimensions etc.); heavy ion physics
o Neutrino physics: neutrino oscillations; neutrino masses; cosmic neutrinos
o The search for dark matter
o Astroparticle physics: ultra high energy cosmic radiation (gamma radiation, charged particles, neutrinos, antiparticles)
o Searches for gravitons: interferometry

- Experiments and methods

o Experiments at the Large Hadron Collider: the accelerator: collisions, cross-sections; experiments (ALICE, ATLAS, CMS, LHCb); problems in proton-proton collisions (the standard model, Higgs, supersymmetry, additional dimensions, CP-violation); the heavy ion program; superLHC
o Linear colliders: accelerators: collisions, cross-sections (ILC, CLIC); experiments; problems (the standard model, Higgs, supersymmetry, additional dimensions)
o Muon collider: accelerators: collisions, cross-sections; experiments; problems
o Neutrino experiments: accelerator-based; reactor-based; detection of atmospheric neutrinos and solar neutrinos
o Detection of the dark matter: underground detectors
o Astro-particle physics experiments: earth-based; satellites
o Searches for gravitons: interferometry experiment

Course design

The teaching consists of lectures, exercises and project work. Participation in exercises and project work etc is compulsory.

Assessment

Examination takes place in writing (exercises and examination at the end of the course) and orally (presentation of project work during the course). Students who do not pass the regular exam can be offered a new possibility shortly after the regular exam.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, passed examination, passed written assignments, passed presentation of the project report and participation in all compulsory parts are required.
The final grade is determined by combining the results of the different parts of the examination. In the combination, the different parts are given weights according to their relative importance.

Entry requirements

For admission to the course, English B is required and knowledge equivalent to FYSC01, Physics 3, Quantum Physics, 30 credits. The following courses are recommended before or in parallel with the course: FYSN11 Physics experiments in research and society, 5 credits, FYSN15 Experimental tools, 5 credits and FYTN04 Theoretical particle physics, 5 credits.

Further information

The course may not be included in a higher education qualification together with FYS225 10 p.

Subcourses in FYST17, Physics: Modern Experimental Particle Physics

Applies from V08

0801 Experimental Particle Physics, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction