FYST17

Syllabus for Modern Experimental Particle Physics 7.5 ECTS credits

1. Fundamental information
Ratified by the Education Committee of the Faculty of Science -2006. The syllabus is valid from 01-07-2007. The course is at the advanced level.

2. General information
The course is part of the main field of study in Physics at the Faculty of Science. The course is optional in a Master's degree in Science, with a major in Physics. The course is also given as a single subject course. The language of instruction is English.

3. Learning outcomes
Having successfully completed the course, students should have acquired the following knowledge and understanding:

- Advanced knowledge of current experimental particle physics problems.
- Advanced knowledge of experimental programme at the Large Hadron Collider (LHC) at CERN.
- Descriptive knowledge of several modern front-line particle physics experiments.
- Understanding of current and future directions in modern experimental particle physics.
- Ability to assess relevance and research potential of a particle physics experiment.
- Ability to interpret scientific publications within the field of the course.
- Ability to propose a suitable approach or a solution for a given problem in the field of the course.
- Ability to independently seek and acquire the necessary scientific information for a review or an assessment of a given topic within the course.
- Ability to orally communicate project results and to participate in discussions of other presentations.

4. Course contents
The course consists of 2 major parts: Current Front-line Research and Experiments and Methods, representing 7.5 credits together.

The course will address current research topics in particle and astroparticle physics, and will focus on aspects of running and future experiments in the area. The covered subjects are:

- Current front-line research
    - Particle physics: Standard Model, precision measurements; CP-violation; Beyond the Standard Model (Higgs searches, Supersymmetry, extra dimensions etc); Heavy ions
    - Neutrino physics: Neutrino oscillations; Neutrino masses; Cosmic neutrinos
    - Direct searches for Dark Matter
    - Astroparticle physics: Ultra-high energy cosmic radiation (gamma-rays, charged particles, neutrinos, antiparticles)
    - Graviton searches: Interferometers
- Experiments and methods

- Large Hadron Collider experiments: Accelerator: collisions, cross-sections; Experiments (ALICE, ATLAS, CMS, LHCb); Research topics with proton-proton collisions (Standard Model, Higgs, Supersymmetry, extra dimensions, CP-violation); Heavy ions programme; SuperLHC
- Linear colliders: Accelerators: collisions, cross-sections (ILC, CLIC); Experiments; Research topics (Standard Model, Higgs, Supersymmetry, extra dimensions)
- Muon colliders: Accelerators: collisions, cross-sections; Experiments; Research topics
- Neutrino experiments: Accelerator-based; Reactor-based; Atmospheric and Solar neutrino detection
- Direct dark matter detection: Underground detectors
- Astroparticle experiments: Ground-based; Satellites
- Graviton searches: Interferometry experiments

5. Teaching and assessment
Teaching consists of lectures, exercises and project work. Exercises and project work, and the course elements associated with these are compulsory.

Assessment takes the form of written tests (exercises and final examination) and oral presentations of project work during the course and at the end of the course.

Students who fail the ordinary tests will have an opportunity to take another test in close proximity to the ordinary test.

6. Grades
Students are graded for the course according to the following levels: Passed with distinction, Passed, and Failed (Science Faculty) and 5,4,3 and Failed (technical faculty).

In order to pass the course the student is required to have passed the written test, have acceptable hand-in exercises, have acceptable project presentation and to have participated in all compulsory course elements.

The final grade for the course is determined by the aggregated results of the different parts of the requirements, being the weighted sum of the achievements, with proportions defined on basis of the relative importance of each.

Students who wish to supplement the ordinary grade with an ECTS-grade should request this from the responsible teacher.

7. Entrance qualifications
The following are required for admission to the course: courses corresponding to FYSA31/FYS023 High Energy Physics, 6 ECTS. The following are recommended prior or in parallel to taking this course: FYSN11 Physics Experiments in Research and Society, 7.5 ECTS, FYSN15 Experimental Tools, 7.5 ECTS and FYTN04 Theoretical Particle Physics, 7.5 ECTS.

8. Literature

According to a list established by the department, available at least five weeks before the start of the course, see the web-page for the course at the Department of Physics, Experimental High Energy Physics Department at http://www.hep.lu.se/education.html.

9. Further information
The course cannot be credited as part of a degree along with FYS225 (the former course), 5 credits.