Translation of Curriculum Statement for Graduate Level (Third-level) Education

Physics with a specialization in Elementary Particle Physics
Swedish title: Fysik med inriktning mot elementarpartikelfysik

TNFYSI04

Swedish Curriculum adopted by the Board of the Faculty of Science and Technology (Board for Third-level Education) on 2008-07-02. Translation approved on 2010-08-10.

The Curriculum Statement for Third-level Education consists of three parts: a general part, this subject specialized curriculum statement, and each doctoral student's individual study plan.

Objective
Based on the basic education in the disciplinary domain the education should give additional understanding within the most important parts of the subject and advanced knowledge in at least one sub-area. Through supervision and thesis, the doctoral student should be made well prepared for a critical and independent research activity or for another work where high demands are made on advanced subject understanding and research experience.

The doctoral student shall also be able to present her/his own goals and results orally and in writing to different target groups in English and, in the case of Swedish-speaking doctoral students, in Swedish.

Subject description
Elementary particle physics explores the smallest particles of matter; quarks and leptons and the different vector bosons that mediate the electroweak and strong interaction between the particles. The experimentally observed characteristics of the quarks, the leptons and the vector bosons are described with high precision by the Standard Model of the Particle Physics. According to this theory, there is one more, not yet observed, particle, the Higgs boson, whose existence is required to explain the masses of the particles. There are other theories i.a. supersymmetry, which give a more unified description of the electroweak and strong interaction (Grand Unification) than the Standard model, and which through further development, may
eventually be generalized to comprise also the gravitational interaction. These other theories predict the existence of many more, not yet observed, particles, such as other Higgs bosons and supersymmetric particles. Experimental particle physics research develops and uses new, advanced particle detectors and new, very high-energy particle colliders and powerful data analysis methods to search for new particles. Also cosmic radiation is used for specific complementary measurements. The expectation is that discoveries of new particles should lead to a more general and uniform descriptions (of which supersymmetry constitutes one example) of the smallest components of matter and their interactions, and thereby also to an increased understanding of the nature of the Dark Matter in universe and of the processes that led to the origin and development of the elementary particles at the time of the creation of universe (Big Bang). The activities comprise both theoretical and experimental research. Experimental elementary particle physics research projects are in general carried out as international research teamwork at large international research laboratories.

Eligibility

Basic Eligibility
The basic eligibility for third level education is described in the general part of the curriculum statement.

Special Eligibility
Those are eligible for education at third level in Elementary Particle Physics who have passed tests in courses in physics or in courses in fields relevant to the specialisation, comprising at least 90 higher education credits or those who outside the country have acquired the equivalent knowledge.

Admission
Applicants for third level program in Elementary Particle Physics must submit an application to the head of the Department of Physics and Astronomy. Admissions to places in graduate programs take place normally once or twice a year.

In connection with the admission it must be stated how it is planned to finance both the personal salary of the doctoral student, and the costs for her/his research work.
Program structure

In connection with the admission, each doctoral student and her/his supervisor shall draw up an individual study plan after consultation with the professor in charge of the third level program. The plan is to be approved by the head of the department (by delegation of the Faculty Board), in connection with the admission.

The individual study plan shall be reviewed jointly by the doctoral student and her/his supervisor, annually, and be provided with a summary of the achieved results and the plans for the coming year. Significant changes and any disagreement on the individual study plan shall be reported to the head of the department or, if deemed necessary, to the Board for Third-level Education.

Courses

Within the education for third-cycle studies, different kinds of courses may be included, such as lectures, literature studies, practical exercises, field studies, etc. Courses should give a broader understanding of the subject as a complement to the specialist competence that is won in the research. Most of the courses that are included in the individual study plan are usually selected from the supply of postgraduate courses of the physics section and are chosen in consultation with the supervisor. Courses that are included among those that have given eligibility to the third-circle level may not be included in the individual study plan.

The range of courses offered is revised continuously. A selection of the following courses should be included in the education:

Elementary Particle Physics
Relativistic Quantum Mechanics
Quantum Field Theory
Symmetry and Group Theory
Frontiers in Particle Physics
QCD at Colliders
Accelerator Physics and Technology
Ionizing Radiation and Detectors.
Statistical and Monte Carlo methods in Physics.
Requirements for doctoral degree
The requirements for doctoral degree consist of on one hand passed examinations in the courses included in the approved individual study plan of each doctoral student, and on other hand passed public defense of the doctoral thesis. The program leading to the doctoral degree amounts to 240 higher education credits (four years of full-time studies), of which the thesis part amounts to a minimum of 120 higher education credits and the course part to a minimum of 60 higher education credits.

Requirements for licentiate degree
A stage of at least 120 higher education credits (two years of full-time studies) in the third level program may be completed with a licentiate degree. The requirements for this are that the doctoral student both has passed the examinations included in the program stage and has got an academic paper amounting to a minimum of 60 higher education credits passed. The course part amounts to a minimum of 30 higher education credits.

Other
As the research in elementary particle physics is carried out through large international teamwork it is necessary that the doctoral student can communicate and absorb the extensive scholarly information flow in English.