

# Syllabus

for course at first level

**Nuclear and Particle Physics, Astrophysics and Cosmology**  
**Kärn- och partikelfysik, astrofysik och kosmologi**

**7.5 Higher Education  
Credits**  
**7.5 ECTS credits**

<b>Course code:</b>	FK5024
<b>Valid from:</b>	Autumn 2019
<b>Date of approval:</b>	2016-02-29
<b>Changed:</b>	2016-02-29
<b>Department</b>	Department of Physics
<b>Main field:</b>	Physics
<b>Specialisation:</b>	G2F - First cycle, has at least 60 credits in first-cycle course/s as entry requirements

## Decision

### Prerequisites and special admittance requirements

For access to the course knowledge and skills equivalent to the following courses is required:

- Mathematics for Natural Sciences I, 15 hp (MM2002)
- Mathematics for Natural Sciences II, 15 hp (MM4001)
- Mathematics II - Analysis, part A, 7.5 hp (MM5010)
- Mathematics II - Analysis, part B, 7.5 hp (MM5011)
- Classical Physics, 30 hp (FK3014)
- Quantum Mechanics, 7.5 hp (FK5020)
- Programming, numerical methods and statistics for physicists, 15 hp (FK4026) or both of the courses Physics with digital tools, 7.5 hp (FK4025) och Probability theory and statistics for teachers, 7.5 hp (MT1011)
- Electromagnetism and waves, 7.5 hp (FK5019)

### Course structure

Examination code	Name	Higher Education Credits
HELA	Nuclear and particle physics, astrophysics and cosmology	7.5

### Course content

The course describes:

Nuclear physics: properties of the atomic nuclei. Alpha-, beta- and gamma decay. Nuclear reactions. Ethical and social assessments.

Particle physics: Standard model for particle physics. Feynman diagrams to illustrate processes and estimations of cross sections.

Astrophysics and cosmology: Our place in the universe, something about stars, galaxies, and other astronomical objects and cosmic radiation. Early universe and the formation of elements, dark matter and dark energy.

### Learning outcomes

After having passed the course the student is expected to be able to:

- describe simple models of the construction of atomic nuclei and perform calculations on basic nuclear processes
- describe the standard model for particle physics
- draw Feynman diagrams and use them to estimate cross sections
- describe astronomical objects and describe the basic ideas of the cosmological standard model
- describe the evidence for the existence of dark matter and dark energy
- perform simple calculations within astrophysics and cosmology
- perform ethical and social assessments, especially related to nuclear physics.

### **Education**

The education consists of lectures, seminars and group work.

Participation in seminars and some group work is compulsory.

In the event of special circumstances, the examiner may, after consultation with the teacher concerned, grant a student exemption from the obligation to participate in certain compulsory instruction.

The course will be given in English if requested by any student enrolled.

### **Forms of examination**

a. The course is examined as follows: knowledge assessment takes the form of written exam and activity at the seminars.

If the instruction is in English, the examination may also be conducted in English.

b. Grades will be set according to a seven-point scale related to the learning objectives of the course:

A = Excellent

B = Very good

C = Good

D = Satisfactory

E = Adequate

Fx = Fail, some additional work required

F = Fail, much additional work required

c. The grading criteria will be distributed at the beginning of the course.

d. In order to pass the course, a minimum grade of E is required as well as participation in all compulsory education.

e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is still provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. A student who has received a passing grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the department board.

The course includes at least two examination opportunities per year when the course is given. At least one examination opportunity will be offered during a year when the course is not given.

f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

### **Interim**

Students may request that the examination be conducted in accordance with this course plan even after it has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan (and the revisions of the course literature).

### **Misc**

The course is included in the Bachelor programme in Physics and the education for teachers. It can also be studied as a separate course.

**Required reading**

The course literature is decided by the department board and published on the Department of Physics's website at least two months before the start of the course.