

# Syllabus

for course at advanced level

**Quantum Optics**

**Kvantoptik**

**7.5 Higher Education**

**Credits**

**7.5 ECTS credits**

<b>Course code:</b>	FK7047
<b>Valid from:</b>	Autumn 2019
<b>Date of approval:</b>	2017-01-16
<b>Changed:</b>	2019-01-14
<b>Department</b>	Department of Physics
<b>Main field:</b>	Physics
<b>Specialisation:</b>	A1N - Second cycle, has only first-cycle course/s as entry requirements

## Decision

This course plan has been established by the Board of Science at Stockholm University on 2017-01-16.

## Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to passed courses (excluding introductory courses) of 45 credits in mathematics and 60 credits in physics, where the courses Quantum Mechanics, 7.5 credits (FK5020) and Atomic and Molecular Physics, 7.5 credits (FK5023) should be included, or equivalent courses. Also admission to the course requires knowledge equivalent to Swedish upper secondary course English B/English 6.

## Course structure

Examination code	Name	Higher Education Credits
HELA	Quantum Optics	7.5

## Course content

The course explores the experimental methods and techniques of quantum optics with special emphasis on quantum information applications as well as an overview of experimental techniques used in quantum optics. These include single photon generation and detection, quantum measurements, quantum noise, quantum correlations, atom-light interaction, and experimental realizations of quantum cryptography and quantum teleportation.

## Learning outcomes

Upon completion of the course, the students are expected to be able to:

- describe fundamental quantum optics phenomena and apply the underlying physical principles of today's quantum optics and quantum information experiments
- formulate and treat mathematical descriptions of fundamental phenomena and experiments in quantum optics.

## Education

The education consists of lectures and laboratory work.

Participation in the laboratory work is compulsory. An examiner may rule that a student is not obliged to participate in certain compulsory education if there are special grounds for this after consultation with the relevant teacher.

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

### **Forms of examination**

a. The student's knowledge will be tested by a written and oral exam in combination with written and oral reports of the laboratory work.

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.

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).

### **Limitations**

The course may not be included in examinations in combination with course Quantum Optics, 7.5 credits (FK7017) or equivalent.

### **Misc**

The course can be included as part of the master's programs offered at the Physics department, but is also offered 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.