



LUND UNIVERSITY
Faculty of Science

SYLLABUS

Date
2015-03-10

Reg. Nr.
U 2014/683

Syllabus for Reading course on quantum optics, NAFY011 *Swedish title: Läs kurs i Kvantoptik*

The course syllabus was confirmed by the Faculty board for graduate studies on 2015-03-17. The course is in the third cycle and amounts to 10 credits.

This is a translation of the course syllabus approved in Swedish.

Learning outcomes

On completion of this course, the students shall be able to:

- Explain the quantum-mechanical description of the electromagnetic field.
- Explain the theoretical description of the interaction between the electromagnetic field and matter.
- Explain basic concepts of quantum information.
- Describe how methods of quantum optics are applied in experiments such as parametric oscillators and laser cooling.
- Reflect on the different aspects of coherence.
- Critically discuss the differences between a classic and quantum treatment of light.
- Independently acquire information from literature studies and present it in an adequate way.

Course content

The course treats the quantization of the electromagnetic field, the photon concept, the quantum-mechanical description of light-matter interaction, basic properties of lasers, quantum information, laser cooling, as well as a variety of applications in photonics. The choice of material follows modern textbooks such as *Introduction to Quantum Optics* by G. Grynberg, A. Aspect, and C. Fabre (Cambridge University Press, 2010). Additional literature will be provided to deepen specific topics.

Teaching

Teaching is based on weekly seminars (over two terms), where the participants present the weekly topic. All students shall regularly (about every four weeks) hand in their summary for the chapter discussed.

Assessment

Assessment is based on the presentations and the hand-ins.

Grading scale

Possible grades are Pass and Fail. For a passing grade, active participation in the seminar, the regular hand-in of summaries, and seminar presentations are required. If the student does not finish the entire course, one credit point is given for each passable hand-in and each seminar presentation.

Language

The course is given in English.