SK2900 Quantum Photonics 7.5 credits

Kvantfotonik

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for SK2900 valid from Spring 2017

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Recommended prerequisites:
SK1102 Classical Physics, or similar course
SK1151 Quantum Physics, or similar course

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course, the student should be able to:

- Explain the operation of quantum optics experiment from the generation of non-classical states, their interaction to their detection as well as to perform measurements in a quantum optics lab.
- Explain the principles of quantum entanglement, single photon generation and manipulation, detection schemes, quantum repeaters.
- Discuss and perform measurements with the state-of-the-art research work in quantum photonics through hands-on work in a research lab, including quantum sources, circuits and detectors as well as with emerging quantum technologies and industries.

Course contents

This course combines theory and hands-on experiments in a research lab on quantum photonics: theory will be covered in lectures and students will perform measurements in the lab. In addition, articles will be discussed. We start with the history behind quantum entanglement and finish with the most recent advances in quantum photonics, including fundamentals and applications.

- History of quantum entanglement
- Generation schemes for non-classical light
- Entanglement in the solid state: concepts and measurements
- Single photon detection: fundamentals and applications
- Indistinguishable photons: building blocks for quantum information processing
- Quantum photonics applications: teleportation, lithography, cryptography, quantum repeaters
- Integrated quantum circuits: quantum optics on a chip

Course literature

Lecture notes
Key publications in the field
Assignements
Instructions and introducion to lab work

Course reference books
G. Grynberg, A. Aspect, C. Fabre, C. Cohen-Tannoudji, Introducion to Quantum Optics: From the Semi-classical Approach to Quantized Light, Cambridge University Press, 2010
B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, Wiley, 2012. M. Fox, Quantum Optics an introduction, Oxford University Press, 2006

Examination

- INL1 - Hand-in tasks, 1.0 credits, grading scale: P, F

- TEN1 - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory experiments, 2.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Written exam, 4 credits, grading scale A-F
Hand-in assignments, 1 credit, grading scal P/F
Passed lab experiments, 2,5 credits, grading scale P/F

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.