FSK3601 Quantum Photonics 7.5 credits

Kvantfotonik

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

Establishment

Course syllabus for FSK3601 valid from Spring 2019

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Graduate students with background in quantum physics and optics.

Language of instruction

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

Intended learning outcomes

Thorough understanding of the generation, manipulation and detection of quantum entanglement. Practical work in the lab to observe quantum entanglement and additional quantum effects (Hong Ou Mandel effect, Hanburry Brown Twiss interferometer, Quantum Eraser).

Course contents

History and theory of quantum entanglement. Study of the experimental requirements for the measurement and manipulation of quantum entanglement. Hands-on experiments to measure quantum entanglement in the lab and redaction of a complete report. Perform additional experiments in quantum photonics with pairs of entangled photons: detection efficiency measurements, the Hanbury-Brown Twiss interferometer, the Hong Ou Mandel effect, Michelson interferometry with single photons.

Disposition

Lectures on the history and theory of quantum entanglement, starting with the 1935 EPR paper, demonstration of Bell's inequalities, Bell's states, different applications of quantum entanglement (quantum cryptography, quantum teleportation, absolute efficiency measurements). The technology to generate and detect quantum entanglement.

Course literature

Scientific articles provided.

Equipment

A complete setup to generate and measure quantum entanglement will be provided.

Examination

- INL1 - Assignments, 1.0 credits, grading scale: G
- LAB2 - Laboratory work, 2.5 credits, grading scale: G
- SEM1 - Seminar, 1.5 credits, grading scale: G
- LAB1 - Laboratory work, 2.5 credits, grading scale: G

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

- Oral presentation and discussion of one article for every student

- Thorough report on laboratory demonstration of quantum entanglement
- Extra experimental report: perform and report additional quantum measurement (Hong Ou Mandel, Hanburry Brown Twiss or Quantum Eraser)
- Hand in assignment on quantum entanglement measurement

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.