

Rapport for emne FYS4145

Stadiuminfo:	Utkast (S1)
Sist endret:	17.02.2026 Christian Thorn (chrthorn)
Opprettet i EpN:	Ja

Generelt

Emnekodeforslag	FYS4145
Versjonskodeforslag	1
Tilknyttede campuser	
Studienivå	Høyere grads nivå (500)
Administrativt sted	185.15.04.00 Fysisk institutt
Studieansvarlig sted	185.15.04.00 Fysisk institutt
Vekting	10.0
Vektingstype	Studiepoeng
Navn - bokmål	Kvanteoptikk
Navn - nynorsk	
Navn - engelsk	Quantum Optics
Første undervisningstermin	2026 HØST
Siste undervisningstermin	
Første eksamenstermin	2026 HØST
Siste eksamenstermin	
Språk	Engelsk

Rapportering

Tilknyttede studieprogram

Vurdering

Antall forsøk lovlig	3
Gjelder fra termin	
Oppgave/avhandling	N
Vekt. på kar.utskrift	J
Kar. på kar.utskrift	J
Krev und.oppt første	J
Krev und.oppt alltid	N

Undervisning

Antall forsøk lovlig	
Gjelder fra termin	
Påkrevd Ja-svar	N
Beregn kval undervisningsmelding	J
Påkrevet akt.ønske	J
Ventelistenr	N
Aut. undervisningsmelding	N
Påkrevd fremmøte	NULL
Venteliste	N

Etteranmelding

Direktepåmelding via StudentWeb

Påmelding

Påmelding via StudentWeb - søknad

Undervisningstermin beskrivelse**Undervisningstermin**

StudentWeb

Oppmelding	J
Privatistmelding	N
Kontroll Fkrav	NULL
Enkeltemneopptak i Studentweb	NULL
Vurd.meld språk	NULL
Merknad Studentweb	
Merknad Studentweb - nynorsk	
Merknad Studentweb - engelsk	

Emneinfo**Kort om emnet**

Engelsk:

The course covers the quantum aspects of light. Starting from the quantization of the electromagnetic field, it introduces quantum states of radiation (Fock, coherent, and squeezed states), their detection (photodetection, homodyne and heterodyne measurements), and their coherence and photon-statistics properties.

It then develops phase-space methods (P, Q, and Wigner representations) and the theory of open quantum systems (master equations and quantum Langevin equations), applying these tools to parametric amplification, lasing (gain, threshold and linewidth), and light-matter interaction in cavity/circuit QED and optomechanical systems.

Hva lærer du?

Engelsk:

After completing the course you will be able to:

- quantize the electromagnetic field and characterize key radiation states: derive the mode quantization and use ladder operators to describe Fock, coherent, and squeezed states and their observable signatures.
- analyze quantum-optical measurements and detection schemes: model photodetection and compute measurement outcomes for direct detection, homodyne, and heterodyne setups, including quantum noise and standard limits.
- evaluate coherence and photon statistics using correlation functions: calculate and interpret correlation functions and relate them to coherence, linewidth, bunching/antibunching, and photon counting statistics.
- use phase-space methods to represent and compute properties of quantum states: work with P-, Q-, and Wigner functions to obtain moments, visualize nonclassicality, and connect to semiclassical limits.
- model open-system light-matter dynamics and apply to canonical devices: formulate and solve basic master-equation/quantum-Langevin descriptions of gain and loss, and apply them to lasing, parametric amplification, and cavity/circuit QED and optomechanical systems.

Opptak til emnet

Engelsk:

Students admitted at UiO must apply for courses in Studentweb. Students enrolled in other Master's Degree Programmes can, on application, be admitted to the course if this is cleared by their own study

programme.

Nordic citizens and applicants residing in the Nordic countries may apply to take this course as a single course student.

If you are not already enrolled as a student at UiO, please see our information about admission requirements and procedures for international applicants.

Anbefalte forkunnskaper

Engelsk:

- emne:FYS2140
- emne:FYS3110

Undervisning

Engelsk:

The first lecture is mandatory. If you are unable to attend, the Department of Physics has to be informed no later than the same day (studieinfo@fys.uio.no), or else you will lose your place in the course.

The teaching is given throughout the semester:

- 3 hours per week, with a combination of frontal lectures and group work.

A group project must be approved before you can take the final exam.

See rules for mandatory activities.

Eksamen

Engelsk:

- Final oral exam which counts 100 % towards the final grade.

This course has mandatory exercises that must be approved before you can sit the final exam.

Hjelpemidler til eksamen

Engelsk:

No examination support material is allowed.

Karakterskala

Engelsk:

Grades are awarded on a scale from A to F, where A is the best grade and F is a fail. Read more about the grading system.

Adgang til ny eller utsatt eksamen

Engelsk:

Students who can document a valid reason for absence from the regular examination are offered a postponed examination at the beginning of the next semester.

Re-scheduled examinations are not offered to students who withdraw during, or did not pass, the original examination

Undervisningssemester

Engelsk:

If the course is offered, a minimum of four students is required for ordinary lectures to take place. If less than four students participate, an exam will be given, but one should not expect ordinary teaching.