Technology
Arts Sciences
TH Köln

Course
NLO - Nonlinear optics

Version: 1 | Last Change: 29.09.2019 18:38 | Draft: 0 | Status: vom verantwortlichen Dozent freigegeben

General information

Long name	Nonlinear optics
Approving CModule	NLO_MaET
Responsible	Prof. Dr. Uwe Oberheide Professor Fakultät IME
Level	Master
Semester in the year	summer semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Uwe Oberheide Professor Fakultät IME
Requirements	Physics: wave propagation, phase velocity Laser technology: laser types, basic principle of stimulated emission Light-matter interaction: absorption, scattering, refractive index, birefringence
Language	German
Separate final exam	Yes

Final exam

Details

Checking the taxonomy levels of understanding and applying by describing elementary applications and interaction processes in an idealized application environment.
Checking the taxonomy levels analyzing and synthesizing on the basis of real application cases and the associated selection of the required optical components and processes according to the respective interaction processes determined

Minimum standard

50 % of the questions correctly answered

Exam Type

Checking the taxonomy levels of understanding and applying by describing elementary applications and interaction processes in an idealized application environment.

Checking the taxonomy levels analyzing and synthesizing on the basis of real application cases and the associated selection of the required optical components and processes according to the respective interaction processes determined

Lecture / Exercises

Learning goals

Knowledge

Optical frequency multiplication (crystal coherence lengths, phase matching,
quasi phase matching and periodic polarity)

Frequency mixing

Optical-parametric oscillation and amplification

Electro-, magneto- and acousto-optical effects

Q-switch, mode coupling, ultrashort pulse laser

Application of multiphoton processes

Photorefraction, stimulated Brillouin scattering, phase conjugating mirrors

Skills

Recognizing analogies of known linear physical processes (light-matter interaction at low intensity) and transferring them to nonlinear processes

Describe processes mathematically and transfer the result into physical effects

Transfer idealized systems to real systems and derive qualitative behavior

Describe and explain correlations of quantities (saturable absorption / multidimensional refractive index) and transfer them to real materials.

Analyze technical applications and problems, break them down into individual processes and solve them using known nonlinear interactions.

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	1
Exercises (shared course)	0
Tutorial (voluntary)	0

Separate exam

none

^ Seminar

Learning goals

Knowledge

Presentations on applications/processes based on the content of the course (transfer of course content to other applications).

Examples:

- spectral broadening in a femtosecond laser by self-phase modulation
- temporal measurement of ultrashort laser pulses
- compensation of imaging errors by the use of phase conjugating mirrors
- laser induced nuclear fusion
- multiphoton processes
- generation and application of higher harmonics
- optical parametric oscillators
- free-electron laser

Skills

Procurement of suitable literature/information

Familiarisation with new technical field of expertise

Use of english technical literature

Evaluation of available literature

Checking the relevance of information

Filtering out essential information and preparing it for the appropriate target group

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Seminar	1
Tutorial (voluntary)	0

Separate exam

Exam Type

discussion (interview) about special issues (szenario, project assignment, literature research)

Details

Presentation on a given topic with literature research

The presentation should be adapted to the previous knowledge of the students of the course and enable a discussion of the content.

Minimum standard

structured presentation of the most important points with a list of related sources