CH-417

Optical methods in chemistry

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Cursus	Sem.	Type
Chimiste	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Introduction and application of photon based tools for chemical sciences: from basic concepts to optical and x-ray lasers

Content

Part I: Optical domain

- Introduction and historical perspective
- Ray, wave, and beam optics
- Electromagnetic waves and spectrum
- Photons and atoms
- The principles of lasers and amplification
- Laser systems and applications
- Laser spectroscopy
- Non-linear optics
- Ultrafast spectroscopy

Part II: X-ray domain

- X-rays and their interactions with matter
- Valence vs innershell spectroscopy
- X-ray diffraction and imaging
- Laboratory x-ray tools
- Synchrotron radiation sources
- Free-electron lasers

Keywords

Optics, Lasers, X-rays, Ultrafast, Spectroscopy, Diffraction

Learning Prerequisites

Recommended courses

Quantum chemistry, General physics

Learning Outcomes

By the end of the course, the student must be able to:

- Describe optical concepts in the wave and photon picture
- Design optical setups and experiments
- Explain laser amplification and laser systems
- Explain laboratory and accelerator based X-ray sources
- Work out / Determine geometric structure and elemental composition from x-ray data

Teaching methods

Lectures and exercises

Expected student activities

Work on exercises and course material at home

Assessment methods

Final grade consists out of 75% written final exam and 25% of the weekly exercise/homework

Supervision

Office hours	Yes
Assistants	Yes

Resources

Bibliography

Saleh Teich, Fundamentals of Photonics
Nielsen Mc Morrow, Elements of Modern X-ray Physics

Ressources en bibliothèque

- Elements of x-ray physics / Als-Nielsen
- Fundamentals of photonics / Teich

Moodle Link

- https://go.epfl.ch/CH-417