

PHYS-613

Nonlinear Spectroscopy

Roke Sylvie

Cursus	Sem.	Type
Photonics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Written
Workload	120h
Hours	36
Courses	36
Number of positions	25

Frequency

Every 2 years

Remark

Next time Spring semester 2026 to be confirmed

Summary

To provide an introduction into the field of nonlinear spectroscopy, and focus in particular on linear and nonlinear light scattering

Content

Review of Quantum Mechanical Principles / Atomic structure
 Linear light-matter interactions
 Group Theory and Symmetry
 Nonlinear Optical Interactions & Spectroscopy
 Surface nonlinear spectroscopy
 2D spectroscopy
 Nonlinear Light Scattering in 3D & 2D
 State of the Art

Keywords

nonlinear optics, spectroscopy, group theory, interfaces

Learning Prerequisites**Important concepts to start the course**

The level will be that of a masters' student in physics or chemistry. It is necessary to have some understanding of quantum physics/chemistry, and linear optics/spectroscopy. We will very briefly review some of the quantum chemistry and linear light/matter interaction, but it will be understood that students are familiar with the concepts.

Learning Outcomes

- Interpret linear spectroscopy and nonlinear spectroscopy experiments
- Perform nonlinear optical analysis
- Use group theory

Resources

Bibliography

- [1] Sylvie Roke, Lecture Notes on Nonlinear Spectroscopy (to be taken during the lecture by students)
- [2] P. W. Atkins and J. de Paula, Physical Chemistry 8th Edition, 2006, Oxford University Press
- [3] - Grant R. Fowles, Introduction to Modern Optics
- [4] - D. M. Bishop, Group Theory and Chemistry
- [5] - R. W. Boyd, Nonlinear Optics
- [6] - T. F. Heinz, Nonlinear surface electromagnetic phenomena
- [7] Selected papers as discussed during the course.

Ressources en bibliothèque

- [Nonlinear surface electromagnetic phenomena / Heinz](#)
- [Introduction to Modern Optics / Fowles](#)
- [Group Theory and Chemistry / Bishop](#)
- [Physical Chemistry / Atkins](#)
- [Nonlinear Optics / Boyd](#)

Moodle Link

- <https://go.epfl.ch/PHYS-613>