PHYS-648 **Nonlinear Optics in Waveguides**

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Cursus	Sem.	Type
Microsystems and Microelectronics		Opt.
Photonics		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Oral presentation
Workload	60h
Hours	**28**
Courses	21
Exercises	7
Number of positions	

Frequency

Every 3 years

Remark

Next time Fall 2028

Summary

This doctoral level course will present an overview of nonlinear optical effects in waveguides/optical fibers.It will be focused on third order nonlinear effects which occurs in centrosymmetric media.

Content

This doctoral level course will present an overview of nonlinear optical effects in waveguides. It includes:

- The review of properties of waveguides and the presentation of the difference sources of optical nonlinearites
- The description of nonlinearities of the third order: the optical Kerr effect, self phase modulation, modulation instability, solitons, four wave mixing, parametric amplification, supercontinuum generation
- The description of inelastic scatterings: spontaneous Brillouin and Raman scatterings
- Advanced applications: supercontinuum generation, optical combs ...

Keywords

Photonics, nonlinear optics, waveguides, optical fibers, frequency conversion

Learning Prerequisites

Required courses

Solid knowledge in electromagnetics, in optics and waveguiding

Learning Outcomes

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

- Assess / Evaluate the nonlinear behavior of integrated waveguides and microresonator
- Explain how nonliear effects occur and how they can be controlled and exploited
- Derive and use governing equations behind basic nonlinaer processes
- Present in a clear manner the main resutls of a resaerch paper and put them in context with the content seen in class

Assessment methods

Examination will take place in the from of an oral presentation, probably in a group depending on the number of participant, based on a research paper and specific topic given in class, followed by questions on the topic. All students have to attend the presentations which are part of the class.

Resources

Websites

- http://All information will be put on Moodle.

Moodle Link

- https://go.epfl.ch/PHYS-648