

Nonlinear optics and optics in anisotropic media (3 ECTS)

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This course deals with the notion of polarization of waves propagating in an anisotropic medium. It will focus on the effects of non-linear propagation: generation of new frequencies, parametric oscillators, nonlinear index. A few examples will be chosen from a wide range of applications: spectroscopy, multiphoton absorption, spatial solitons.

- **Polarization of light in anisotropic media**
 - Uniaxial anisotropic medium
 - Propagation of a plane wave
 - Double refraction
 - Birefringent plates
 - Applications : use of polarimetry for constraints measurements
 - Electro-optic and acousto-optic modulations of light

- **Nonlinear optics:**
 - Basics of nonlinear optics
 - Definition of susceptibility
 - Propagation equation

- **Second order nonlinear optics**
 - Phase matching obtained, by birefringence (crystals), by symmetry breaking (surface), modal...
 - Harmonic generation, frequency doubling
 - Parametric effect, OPO, OPA

- **Third order nonlinear optics**
 - Nonlinear index
 - Self focusing
 - Phase conjugation
 - Spatial soliton

- **Application of nonlinear optics**
 - surface dichroism

- **Coherent Anti-stokes Raman Spectroscopy**
 - Multiphoton absorption, two-photon absorption