M2 "Lasers, Optics, Matter" 2018/2019

Nonlinear optics

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12/9: Nonlinear susceptibilities *(FH)*

- *Introduction*
- Reminder linear optics, notations
- Maxwell equations, micro ⇒ macro : constitutive relations
- Nonlinear susceptibilities (propriétés, symétries)

TD 1 : Anharmonic oscillator *(MCSK)*

19/9 :

- Local field correction
- Light-matter energy transfer

Nonlinear propagation equation *(FH)*

- Plane wave, isoptropic medium

TD2 : Tensor symmetries *(IZ)* or Optics of anisotropic media *(MCSK)*

26/09 : 2nd order nonlinearities *(IZ)*

- Second harmonic generation
- Optical parametric phenomena

03/10 :

TD 3/4 : Optimization of second harmonic intensity *(IZ)*

10/10 : Parametric fluorescence *(IZ)*

TD 5 : Third harmonic generation in focused conditions *(MCSK)*

17/10 : Quantum calculation of response functions and susceptibilities *(FH)*

- Liouville equation
- Time-dependent perturbations
- Feynmann diagrams
- Nonliner susceptibility
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TD 6 : Nonresonant chi2 calculation *(MCSK)*

24/10 : Time-resolved spectroscopy *(FH)*

- Rotating-wave approximation
- Absorption : population in the excited state
- Pump-probe experiment

Spectroscopie 2D *(FH)*

- Introduction
- Basic cases

7/11 : Third-order phenomena *(FH)*

- Effet Kerr, self-focussing
- Two-photon absorption
- Two-beam coupling

TD 7 : Resonant Raman *vs* fluorescence *(MCSK)*

14/11 : Short pulses *(FH)*

- Propagation equation
- GVD
- Self-phase modulation
- Soliton

21/11 : Diffusions *(FH)*

- Diffusion Raman spontanée
- Diffusion Raman stimulée
- CARS

28/11 :

TD 8 : Phase conjugation mirror *(IZ)*

TD 9 : Two-photon absorption *(IZ)*