

Master Physique fondamentale et applications

Nanophotonics

Informations

Composante : Faculté des Sciences

Responsables

Guillaume DEMESY
Nicolas BONOD
Brian STOUT

Langue(s) d'enseignement

Anglais

Contenu

Part 1: Periodic Nanophotonics (10h)

- Electromagnetic Prerequisites : Maxwell's equation in matter and constitutive relations, wave equations in 1D, 2D and 3D
- Modal analysis in Nanophotonics : dispersion relation
- Total/scattered field formulation of a typical Nanophotonic scattering problem
- Finite element computation of modal and direct nanophotonic problems
- Hands on 1: the dispersion relation of a photonic crystal
- Hands on 2: scattering by photonic crystal slabs and metasurfaces

Part 2: Resonant Nanophotonics & Metasurfaces (10h)

- Survey of plasmonics (Wood's anomalies, light absorbers)
- Pole and zero of the reflection coefficient
- Dispersion curves of SPP, Excitation of SPP (Kretschmann, Otto, Near field excitation), SPR biosensing
- Diffraction grating. Grating's law, Excitation of SPPs with gratings
- Basics of light scattering (Rayleigh & Mie scattering)
- Mie coefficients, polarizability of sub-wavelength sized particles
- LSPR : Plasmons on metallic nanospheres
- Near, intermediate and far fields scattered by electric dipoles
- Electric & magnetic Mie resonances on high refractive index particles
- Structural colors
- All-dielectric nanophotonics & Mie resonant nanophotonics
- Metasurfaces

Part 3: Nanophotonics (8h) : Green's functions, Density of States, Optical Antenna Theory

- Introduction to Green function theory
- Local Density of States and photonic Lamb shift (from Green functions)
- Spontaneous and stimulated emission of quantum emitters
- Optical antenna theory
- Decay rate enhancement, Photonic Lamb Shift

Compétences à acquérir

- Learn the physics and some computational aspects of today's Nanophotonics and some applications.
- Learn how to formulate and calculate Green functions and use them in optical antenna theory
- Learn how to calculate the poles of reflection coefficients and scattering coefficients, plot the dispersion relations

Modalités d'organisation

This course is a classical lecture with some computer work and practical work.

Bibliographie, lectures recommandées

Lukas Novotny, Principles of Nano-Optics, 2012, Cambridge
Jian-Ming Jin, Theory and Computation of Electromagnetic Fields, 2010,
John Wiley & Sons
S. Enoch, N. Bonod, (Eds.). (2012). Plasmonics: from basics to advanced
topics (Vol. 167). Springer.
Maier, S. A. (2007). Plasmonics: fundamentals and applications (Vol. 1, p.
245). New York: Springer.

Pré-requis obligatoires

Basic knowledge on electrodynamics and numerical analysis

VOLUME HORAIRE

- Volume total: 28 heures
- Cours magistraux: 28 heures

Codes Apogée

- SPFCU43J [ELP]

Pour plus d'informations

[Aller sur le site de l'offre de formation...](#)



Dernière modification le 18/06/2024