UMCS
Nanophotonics
Winter 2021/2022

Instructor Information:
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Course Web Page: See this page.

Course Content: The topics of this course will be:

- Part I:
  - Introduction to light's interaction with matter
  - Derivation of Wave Equation in matter from Maxwell's equations
  - Dielectric properties of insulators, semiconductors and metals (bulk)
  - Light interaction with nanostructures and microstructures (compared with λ)
- Part II:
  - Photonic Crystals
  - Electromagnetic effects in periodic media
  - Light localization, photonic crystal fibers
- Part III:
  - Metal optics (plasmonics) and nanophotonics
  - Light interaction with 0, 1, and 2 dimensional metallic nanostructures Guiding and focusing light to nanoscale
  - Transmission through subwavelength apertures
- Part IV: Metamaterials

Grading: The course grade will be based on participation in the classes and a final oral exam.

Objectives: To have an overview of the different advances in nanophotonics and their applications.

Prerequisites: Basic electromagnetism (Maxwell's equations), calculus.

The following points may be examined:

- Part I:
  - Derivation of Wave Equation in matter from Maxwell's equations
  - Refractive index and Snell's law
  - Dielectric properties (absorption and reflection)
  - Absorption in insulators and semiconductors
  - Relative permittivity for bulk metals
  - Physical process of the interaction of light with nanostructures and microstructures (compared with λ)
- Part II:
  - Photonic Crystals: Definition and eigenvalue equation
  - Superprism, superlens, and negative refraction effects
  - Light localization, photonic crystal fibers - advantages and disadvantages
- Part III:
  - Metal optics (plasmonics) and nanophotonics - advantages and disadvantages
  - Transmission through subwavelength apertures
  - Dispersion relation for bulk plasmon
  - Dispersion relation for surface plasmon