Curricular Unit
Advanced physics topics I

Module
Introduction to plasmonics and photonics in nanostructures: from classical to quantum regimes

Type
Tutorial course

Contact hours
18 hours

Professor in charge
Ariel Guerreiro

Summary of contents

Part 1 – Theoretical and mathematical foundations
Macroscopic and microscopic equations of Maxwell, constitutive relations, boundary conditions, Debye potentials, Green functions and Dyadic Green functions, numerical methods.

Part 2 - Optical properties of bulk materials
Fundaments of optical response theory, radiation-matter interaction, dielectric and plasmonic models of radiation-matter interaction.

Part 3 – Optical properties of nanostructures (linear theory)
Nonlocal response theory, polaritons and plasmons in the bulk and surface of nanostructures, optical properties of metal-dielectric optical metamaterials, optical properties of photonic-crystals.

Part 4 – Optical nonlinear properties of nanostructures
Intrinsic nonlinearities in nanostructures (optics and plasmonics), surface-enhanced nonlinearities, nonlinear optics with metamaterials.

Part 5 – Quantum optical properties of nanostructures
Single photon sources and ressonators, current developments in quantum optics and photonics in mesoscale sytems and opto-mechanical systems.

References
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K. Cho, Optical respon of nanostructures, Springer (2003).
C. Wenshan and V. Shalaev, Optical metamaterials, Springer (2010).
K. Sakoda, Optical properties of photonic crystals, Springer (2001).
D. Press, Nature 456, 218-221 (2008)
Kern et al., Nano Lett. 11, 452-487 (2011)
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Evaluation
Written report

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