Nanophysics

Introducing

Description

Wave phenomena, interferences and diffraction. Particle phenomena. The dual nature of waves and particles, application to electron microscopy. Quantum physics
laws. Quantum effects and applications. Scanning tunnelling microscope, quantum wells and quantum dots, application to radioactivity, harmonic oscillator, vibrations of molecules and Infrared spectroscopy, kinetic momentum and its application to molecular rotation spectroscopy, spin and its applications in NMR and MRI. Atomic and molecular orbitals. X-rays . Lasers. Crystalline solids, concept of energy bands, application
in semiconductor electronic devices.

Objectives

At the end of this module, the student will have understood and be able to explain :
The fundamentals of wave propagation and quantum physics that are necessary for the understanding of modern electronic devices and analytical techniques
The principle of analytical techniques commonly used in laboratories and the underlying molecular mechanisms of quantum physics

The student will be able to:
Formulate in his own words some nano-scale mechanisms and give concrete examples of micro and nano-devices together with well-known analytical methods using these mechanisms

Master elementary phenomena of nano-scale physics
Select the best method for a specific characterisation on the basis of the acquired concepts.
Carry out some nano-scale characterisation methods
Link mathematical formalism of quantum physics to real applications
Grasp the necessary approximations that are required in quantum physics
Bring together these different concepts to assimilate them, extract them from their context in order to apply them to real situations.

Necessary prerequisites

L1 level in Mechanics, Electrostatics, Optics and Mathematics.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse