GS_Quantum_UE_Many-body quantum mechanics

Level
Baccalaureate +4

ECTS
3 credits

Component
UFR PhITEM (physique, ingénierie, terre, environnement, mécanique)

Semester
Printemps

> **Teaching language(s):** English

> **Open to exchange students:** Yes

> **Code d'export Apogée:** PAX8NQAH

Presentation

Description

This course gives an introduction to the concepts of many-body quantum mechanics. It describes the quantum statistics of bosons and fermions, and the quantum properties of systems composed of many identical particles. The main theoretical ingredient for this purpose is the creation and annihilation operators of quantum particles, in what is sometimes called the "second quantization formalism".

Content

- **Chapter 1: Quantum statistics and theoretical tools in quantum mechanics**
  Density operator
  Bosons, Fermions, quantum statistics
  Quantum states of identical particles
- **Chapter 2: Bosons and light-matter interactions**
  Electromagnetic field quantization, field creation and annihilation operators
  Fock states, coherent states
  Jaynes-Cummings Hamiltonian and vacuum Rabi oscillations
  Bose-Einstein condensation and Gross-Pitaevski equation
- **Chapter 3: Fermionic systems**
  Introduction to fermionic creation and annihilation operators

Fermi sea: electrons and holes
Hartree-Fock approximation
Hubbard model
Cooper pairs, Bogoliubov transformation

Course parts

CM   Lectures (CM)   26h

Period : Semester 8

Useful info

Campus

> Grenoble - University campus