Advanced condensed matter physics and quantum many-body systems

Lecturer
Nathan GOLDMAN (Coordinator)

Course mnemonic
PHYS-F431

ECTS credits
5 credits

Language(s) of instruction
English

Course period
Second term

Course content

Introduction: second quantization and the Wick theorem The idealized systems: bosons confined by a potential, the fermi gaz The density matrix and mean-field methods for fermions and bosons. Supercondtivity, BCS and Hartee-Fock Bogoliubov de Gennes. The density functional theory. The random phase approximation.

Objectives (and/or specific learning outcomes)

The aim of the lectures is to introduce methods that are widely used to describe quantum systems where finite size effects are still dominant. Examples are taken from different area of physics: nculei, atoms, molecultes, metallic clusters, quantum dots, ...

Teaching method and learning activities

Blackboard. The students have to solve several applications to model hamiltonian during directed exercises.

References, bibliography and recommended reading

Ring and Schuck, The Nuclear Many-body problem, Springer Verlag 1980. J-P Blaizot and G. Ripka, Quantum theory of finite systems, MIT press 1986

Evaluation method(s)

Other

Evaluation method(s) (additional information)

Oral examination, including the presentation of a recent paper.

Determination of the mark (including the weighting of partial marks)

Based on the oral examination

Main language(s) of evaluation

French and English

Programmes

Programmes proposing this course at the faculty of Sciences

MA-PHYS | Master in Physics | finalité Research/unit 1 and finalité Teaching/unit 1

Programmes proposing this course at the Brussels School of Engineering

MA-IRPH | Master of science in Physical Engineering | finalité Professional/unit 2