Physics

ECTS credits
4 credits

In brief

Course langage: French

Presentation

Prerequisites

Level of the end of the preparatory class.

Learning objectives

- To enable students to assimilate the fundamental postulates of quantum physics and to understand, in particular, microscopic physics in probabilistic terms.
- To master the notions of statistical physics and the foundations of classical and quantum statistical distributions, thermodynamic and chemical potentials.
- To understand the evolution of scientific thought from a history of ideas approach, halfway between empiricism and speculation.
- To be able to identify the implications for engineering sciences.

Description of the programme

Quantum physics part :
- Limits of the classical approach
- Wave-corpuscle duality
- Probabilistic description, fundamental postulates and measurement
- Description of angular, orbital and spin momentum
- The fermion/boson distinction
- Entanglement and non-locality

These concepts will be illustrated with concrete examples, such as the hydrogen atom, the harmonic oscillator, the tunnel effect and quantum dots.

Statistical physics part :
- Recall of probability for physics,
- Random walks and diffusion - Construction of fundamental equations,
- Basic principles and microcanonical and canonical distributions,
- Application examples,
- Elements on grand canonical and quantum distributions,
- First notions on phase transitions.

Generic central skills and knowledge targeted in the discipline

- Familiarise the student with an unusual conceptual framework, as it is different from the intuitions we form on our macroscopic scale;
- Learn to deal with non-determinism in physics and engineering;
- To know fundamental concepts of physics that are useful in many scientific and technical fields.
This course also provides students with the opportunity to practice:
-1 Identify the crucial parameters determining the solution of a problem;
-2 Invent original solutions;
-3 Demonstrate mathematical rigour when solving a problem;
-4 Integrate a relatively complex mode of reasoning.

How knowledge is tested

Continuous assessment (CC):
CC1 ("Quantum Physics" part): 2 writings that contribute for 50% of the final mark.
CC2 (part "Statistical Physics"): 2 writings that contribute to 50% of the final mark.

Bibliography

Quantum physics part: course handouts. Griffith's book. Solutions to tutorials and others available on Moodle.
Statistical physics part: books in the centre de documentation. Some documents for the tutorials.

Teaching team

Thomas Durt, Philippe Réfrégier, Georges Bérardi, Frédéric Galland, Lili Kimmoun, Muriel Roche, Frédéric Schwander, Nicolas Sandeau, Julien Fade, Marc Jaeger.

Total des heures		**72h**
CM	Master class	34h
TD	Directed work	20h
AA		18h

Useful info

Name responsible for EU

Lead Instructor
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