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 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
- Basic principles and microcanonical and canonical distributions,
- Application examples,
- 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, David Zarzoso, Loic Le Goff, Muriel Roche, Luis Aleman-Castaneda, Julien Fade, Frédéric Schwander, Nicolas Sandeau, 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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