

Physique quantique et statistique

Lecturer

Jean-Marc SPARENBERG (Coordinator)

Course mnemonic

PHYS-H200

ECTS credits

5 credits

Language(s) of instruction

French

Course period

Second term

Course content

Particles and forces. Wave-particle duality. Schrödinger equation in one and three dimensions. Postulates and their interpretation. Orbital angular momentum. Hydrogen atom. Particle systems. Pauli principle. Spin. Structure of atoms. Molecules. Nuclei. Electromagnetic transitions. Canonical ensemble. Maxwell distribution. Fermi-Dirac statistics and Bose-Einstein. Planck distribution. Applications to atomic and molecular gas.

Technological applications: laser, diffraction grating, polarizer, quantum computing, semiconductors, tunneling microscope.

Objectives (and/or specific learning outcomes)

Understanding basic notions of quantum and statistical physics and being able to put them in practice to solve simple problems.

Situating the origins of quantum physics in science history and being aware of its main technological applications today.

Pre-requisites and co-requisites

Pre-requisites courses

PHYS-H1002 | Physique générale II | 5 crédits

Co-requisites courses

MATH-H1001 | Eléments d'algèbre et d'analyse | 5 crédits, MATH-H1002 | Analyse I | 5 crédits and MATH-H2000 | Analyse II | 8 crédits

Courses having this one as pre-requisit

CHIM-H310 | Chimie physique moléculaire | 5 crédits, CHIM-H316 | Matériaux et chimie inorganique : mise en oeuvre et analyse | 10 crédits, PHYS-H300 | Physique des semi-

conducteurs et de l'état solide | 5 crédits and PHYS-H301 | Mécanique quantique I | 5 crédits

Teaching method and learning activities

Lectures and exercises.

References, bibliography and recommended reading

J.-L. Basdevant et J. Dalibard, Mécanique Quantique (Éditions de l'École Polytechnique, 2005)

J.-L. Basdevant and J. Dalibard, Quantum Mechanics (Springer, 2005)

M. Kumar, Quantum: Einstein, Bohr and the Great Debate About the Nature of Reality (Icon Books, 2009)

M. Kumar, Le grand roman de la physique quantique (Lattès, 2011)

F. S. Crawford Jr., Ondes, Berkeley: cours de physique, volume 3 (Armand Colin, 1972)

F. S. Crawford Jr., Waves, Berkeley Physics Course, volume 3 (McGraw-Hill, 1965)

E. H. Wichmann, Physique quantique, Berkeley: cours de physique, volume 4 (Armand Colin, 1974)

E. H. Wichmann, Quantum Physics, Berkeley Physics Course, volume 4 (McGraw-Hill, 1967)

F. Schwabl, Quantum Mechanics (Springer, 2009)

C. Cohen-Tannoudji, B. Diu et F. Laloë, Mécanique quantique I et II (Hermann, 1977)

B. H. Bransden and C. J. Joachain, Introduction to Quantum Mechanics (Longman, 1989)

F. Reif, Physique statistique, Berkeley: cours de physique, volume 5 (Armand Colin, 1972)

F. Reif, Statistical Physics, Berkeley Physics Course, volume 5 (McGraw-Hill, 1967)

B. Diu, C. Guthmann, D. Lederer et B. Roulet, Éléments de Physique Statistique (Hermann, 1997)

Other information

Contact(s)

jmspar@ulb.ac.be

Evaluation method(s)

Other

Evaluation method(s) (additional information)

Written exams (theoretical and practical).

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

1st session: January: multiple choice written examination (20%);
June: theoretical and practical written examination (80%).

2nd session: August: theoretical and practical written examination (100%).

Main language(s) of evaluation

French

Programmes

Programmes proposing this course at the
Brussels School of Engineering

BA-IRCI | **Bachelor in Engineering Sciences** | option Bruxelles/unit 2

