Introduction to atomic and molecular physics - course description

General information

Course name	Introduction to atomic and molecular physics
Course ID	13.2-WF-FizD-IAMP-S17
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2018/2019

Course information

Semester	2
ECTS credits to win	7
Course type	obligatory
Teaching language	english
Author of syllabus	• Anatol Nowicki

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Class	30	2	-	-	Credit with grade

Aim of the course

The aim of the course is to teach the students methods and applications of quantum mechanics in description of matter-matter interactions; at the scale of one or a few atoms and energy scales around several electron volts. In particular we present the approximated methods, method of self consistent field and variational methods in atomic physics.

Prerequisites

Quantum mechanics and Classical electrodynamics courses.

Scope

LECTURE: One-electron atoms. Eigenvalues, quantum numbers, degeneracy, Zeeman effect, spin. The orbit-spin interaction. Identical particles, Pauli rule Multielectron atoms. Hartree-Fock theory, the self consistent field. The periodic table. Optical excitations, atomic spectra. Molecules, Born-Oppenheimer theory, LCAO MO theory. Molecular spectra, rotation, vibration-rotation and electron spectra. Raman effect.
CLASS: A hydrogen atom, quantum numbers, atom orbitals, spin. Multielectron atoms, the periodic table. The orbit-spin interaction, atomic spectra. Molecules spectra.

Teaching methods

Conventional lectures, calculate class.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Skill of theoretical interpretation of experimental facts		• an exam - oral, descriptive, test and other • an ongoing monitoring during classes	• Lecture • Class
Application of mathematical methods in solving physical problems		• an exam - oral, descriptive, test and other • an ongoing monitoring during classes	• Lecture • Class

Assignment conditions

LECTURE: The exam
CLASS: Credits of exercises

Recommended reading

[1] W. Kołos, J. Sadlej, Atom i cząsteczka, WNT, Warszawa 2007.
[2] J. Ginter, Wstęp do fizyki atomu, cząsteczki i ciała stałego, PWN, Warszawa 1986.
[3] I. Białynicki-Birula, M. Cieplak, J. Kamiński, Teoria kwantów, PWN, Warszawa 1991.

[4] W. Kołos, Chemia kwantowa, PWN, Warszawa 1980.
[5] L. Schiff, Mechanika kwantowa, PWN, Warszawa 1977.

Further reading

Notes

Modified by dr hab. Piotr Lubiński, prof. UZ (last modification: 28-06-2018 17:59)