


5 credits

30.0 h + 22.5 h

Q2

Teacher(s)	Lauzin Clément ;Urbain Xavier ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LPHY1222, LPHY1322 <i>The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.</i>
Main themes	Atomic and molecular physics introductory course
Aims	<p>a. Course contribution to the LO reference framework (programme LO)</p> <p>LO1: 1.1, 1.4, 1.7 LO2: 2.3, 2.4 LO3: 3.2, 3.4 LO4:4.1. LO5:5.1.</p> <p>b. Specific formulation of programme LOs for this course</p> <p>At the end of this course, the student will be able:</p> <ol style="list-style-type: none"> 1. To establish the electronic structure of an atom, in particular the terms and configurations. 2. To describe and apply the basic principles of atomic spectroscopy, including the selection rules. 3. To describe the Hartree-Fock method and configuration interaction, and apply them to the numerical calculation of binding energies and dipole matrix elements. 4. To correctly manipulate atomic databases in order to extract transition frequencies, lifetimes and branching fractions. 5. To describe the fundamental concepts in molecular physics, in particular the quantum description of molecular systems with the help of corresponding molecular Hamiltonians and Schrödinger's equations (dependent on and independent of time). 6. To interpret the various representations of these equations and discuss the approximate solutions, in particular the adiabatic and diabatic representations and the Born-Oppenheimer separation. 7. To interpret certain simple molecular dynamics and spectral analysis models. 8. To describe the electronic structure, vibrations and rotations of diatomic molecules. 9. To describe and apply the basic principles of rotation, vibration and electronic spectroscopy of diatomic molecules, including the bases for the selection rules. <p>-----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Evaluation methods	Written exams, closed questions, short or long developments. Solving problems with a numerical result
Teaching methods	Lectures, exercise sessions, software use, consultation of databases.
Content	<p>First section: atomic physics - Method: the structure of atoms and ions will be explained on the basis of a brief overview of the consequences of quantum mechanics and spectroscopy. - Hydrogen-like systems, quantum defect - Systems with many electrons: Hartree-Fock method - Central field and corrections, coupling schemes, isoelectronic series</p> <p>Second section: molecular physics - The Born-Oppenheimer approximation; separation of coordinates - Electronic states; molecular and atomic orbitals - Vibrational and rotational states - Diatomic molecule symmetries - Correlation diagrams - Radiative transitions; selection rules</p>
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	5	LPHYS1241	
Minor in Physics	LPHYS100I	5		