


5.00 credits

30.0 h

Q2

Teacher(s)	Génévriez Matthieu ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Having followed LPHYS 2141 is an asset.
Main themes	Classical and quantum description of light-matter interaction, Floquet theory, dressed state model, coherent and squeezed states, statistical properties of light.
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p><b>a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)</b>                      AA 1.1, AA 1.2, AA 1.5, AA1.6, AA 3.1, AA3.2, AA 3.3, AA 3.4, AA 4.2, AA 5.2, AA 5.4, AA 8.1</p> <p><b>b. Specific learning outcomes of the teaching unit</b></p> <p><sup>1</sup> At the end of this teaching unit, the student will be able to :</p> <ol style="list-style-type: none"> <li>1. handle the description of laser-matter interaction using perturbative and non perturbative approaches ;</li> <li>2. apply the dressed state model to various laser-atom interaction processes ;</li> <li>3. use the quantification of light to describe coherent and squeezed states.</li> </ol>
Evaluation methods	Oral exam during which the student presents a work, the subject of which has been specified during the last lecture.
Teaching methods	Lectures and exercises to be prepared at home before they are discussed during the lectures. Reading and presentation of recent scientific articles. Flipped classroom.
Content	Light-atom interaction: <ol style="list-style-type: none"> <li>1. Classical model.</li> <li>2. Semi-classical model                             <ol style="list-style-type: none"> <li>1. 1. Time-dependent and time-independent perturbation theory</li> <li>2. Interaction between discrete states and with a continuum</li> <li>3. Floquet theory</li> </ol> </li> <li>3. Quantum model                             <ol style="list-style-type: none"> <li>1. 1. Field quantization</li> <li>2. Coherent states and squeezed states</li> <li>3. Statistical properties of light</li> <li>4. Light-atom interaction</li> <li>5. Dressed state model</li> </ol> </li> </ol>
Inline resources	Different items (slides and appendices) will be made available online via the MoodleUCL portal.
Bibliography	G. Grynberg, A. Aspect, C. Fabre, <b>Introduction to Quantum Optics</b> , Cambridge University Press, 2010. M. Fox, <b>Quantum Optics, an introduction</b> , Oxford Master Series in Atomic, Optical, and Laser Physics, 2006. M. Fox, <b>Optique quantique. Une introduction</b> , trad. B. Piraux, De Boeck Université, 2011. M.O. Scully & M.S. Zubairy « Quantum Optics », Cambridge University Press, 1997. C. Cohen-Tannoudji, Bernard Diu, Franck Laloë, <b>Mécanique quantique – Tome III</b> , CNRS Editions, EDP Sciences - Collection : Savoirs actuels, 2017. C. Cohen-Tannoudji, J. Dupont-Roc & G. Grynberg, <b>Processus d'interaction entre photons et atomes</b> , CNRS Édition, EDP Sciences, collection : Savoirs actuels, 2001.
Faculty or entity in charge	PHYS

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [60] in Physics	<a href="#">PHYS2M1</a>	5		
Master [120] in Physics	<a href="#">PHYS2M</a>	5		