



QUANTUM OPTICS

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| Enrollment year | 2020/2021 |
| Academic year | 2020/2021 |
| Regulations | DM270 |
| Academic discipline | FIS/03 (MATERIAL PHYSICS) |
| Department | DEPARTMENT OF PHYSICS |
| Course | |
| Curriculum | Fisica della materia |
| Year of study | 1° |
| Period | 1st semester (05/10/2020 - 20/01/2021) |
| ECTS | 6 |
| Lesson hours | 48 lesson hours |
| Language | Italian |
| Activity type | ORAL TEST |
| Teacher | MACCONE LORENZO (titolare) - 6 ECTS |
| Prerequisites | Quantum Mechanics and electromagnetism (at undergraduate level). The first part of the course will be devoted to a revision of all the necessary notions, also to fix the notation that will be used in the course. |
| Learning outcomes | Gaining a “physical intuition” on Quantum Mechanics using Quantum Optics as a tool to that aim; training for research (acquisition of working knowledge): calculation and simulation techniques, analysis and mathematical description of experimental devices, estimation theory. |
| Course contents | <p>The first lecture of the course will introduce the whole course, so all interested students are welcome to that lecture.</p> <ol style="list-style-type: none">1. Revision of quantum mechanics (to fix the notation and the formal system), revision of classical electromagnetism.2. Quantization of the free electromagnetic field and matterfield interactions through the minimal coupling Hamiltonian. |

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| | <p>3. Algebraic methods for quantum mechanics.</p> <p>4. Quantum states of radiation.</p> <p>5. Quantum interference and quantum superposition (various topical quantum optics experiments will be analyzed).</p> <p>6. Open quantum systems (Master equations and CPmaps).</p> <p>7. Detection theory in quantum optics.</p> <p>Further details and the course register can be found on the course web site: http://otticaquantistica.it/people/maccone/otticaq/</p> |
| Teaching methods | <p>The lectures are blackboardlectures (no powerpoint). Some of the more advanced topics are optional and will not be requested at the exam unless the student chooses to be evaluated on them. Interactions (questions, observations and feedback) are encouraged.</p> |
| Reccomended or required readings | <p>Scully, Zubairy, "Quantum Optics", Cambridge University Press; Gerry, Knight, "Introductory Quantum Optics", Cambridge University Press;</p> <p>Further elaborations: Mandel, Wolf, "Optical Coherence and Quantum Optics", Cambridge University Press. (All the above texts are present in the department library.)</p> |
| Assessment methods | <p>Oral examination.</p> <p>The exam will reveal the comprehension of the subject matter and the capacity of autonomous elaboration and of presentation. The pure memorization of the subject is strongly discouraged and will be negatively evaluated.</p> <p>Please contact the teacher to fix the examination date.</p> |
| Further information | <p>The course web site contains the detailed topics of each lecture and all practical announcements:</p> <p>http://otticaquantistica.it/people/maccone/otticaq</p> <p>Contact the teacher for any necessities.</p> <p>The lectures given in the academic year 15/16 are available online at: http://otticaquantistica.it/people/maccone/otticaq/quantum-optics-videos/</p> |
| Sustainable development goals - Agenda 2030 | <p>\$Ibl legenda sviluppo sostenibile</p> |