60037 - Interaction of radiation and matter

Información del Plan Docente

Academic Year	2018/19
Subject	60037 - Interaction of radiation and matter
Faculty / School	100 - Facultad de Ciencias
Degree	538 - Master's in Physics and Physical Technologies
ECTS	5.0
Year	1
Semester	First semester
Subject Type	Optional
Module	---

1.General information

1.1.Aims of the course

Interaction of Radiation and Matter is a standard master course of physics in many international universities. It is devoted to provide the basis of the radiation mechanisms based on quantum and relativistic principles. What is the leading color of the light emitted by an accelerated charged particle? How an excited atom emits and absorbs photons? These questions will be solved in the course, together with more recent developments associated to new materials, the emission of synchrotron radiation, Cerenkov radiation and high energy astrophysics, as well as applications to other branches of physics.

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

A continued evaluation will take into account the personal work of the students throughout the course. The students will provide solutions to a series of problems proposed at the end of the different sections of the course. The evaluation of the quality of their written answers to these problems will comprise70% of the final mark.

A special problem will be assigned to each student. The solution of this problem, which can be worked out during the whole semester, will account for the 30% of the final mark.

60037 - Interaction of radiation and matter

The course has been primarily designed for students who are able to attend the lectures on site. However, there will also be an evaluation test for those students who are either unable to attend these lectures or who fail in their first evaluation. The test will consist in solving some questions connected with the contents of the course.

The test will consist of 4 questions related to the main concepts discussed in the course. The student will be given three hours to solve the questions. It will be evaluated from 0 to 10 and the result will count as 100% of the final mark.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It favors the acquisition of a theoretical specialization in the interactions between radiation and matter. The main activities training course include: lectures, problem solving and discussions (3 + 1 ECTS); study and presentation of selected articles from the field (1 ECTS). These activities allow students to actively participate in the learning process as well as acquire the desired knowledge in theory and applications of the interaction of radiation with the matter and become familiar with problem-solving skills.

4.2.Learning tasks

The course includes the following learning tasks:

1. Lectures on the theory of radiation and matter (3 ECTS).
2. Tutorial sessions for problem solving and discussion (1 ECTS).
3. Study, oral presentations and discussion of selected articles (1 ECTS).
4. Student autonomous work.

4.3.Syllabus

The course will address the following topics:

1. Introduction.
2. Relativistic Electrodynamics.
3. Lorentz symmetry and spin.
4. Radiation Theory. Synchrotron Radiation.
5. Bremsstrahlung. Cerenkov Effect.
6. Review of Relativistic Quantum Mechanics: Klein-Gordon y Dirac equations.
7. Gauge Invariance.
8. Dirac equation symmetries. Parity, time reversal and charge conjugation.
9. Symmetries. Antiparticles.
10. Relativistic atomic spectra.
11. Quantum Electrodynamics.
12. Scattering Amplitudes and Perturbation theory.
13. Fermi golden rule. Compton effect.
14. Non-Relativistic matter-radiation interactions.
15. Rayleigh and Photoelectric Effects.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science http://ciencias.unizar.es/

60037 - Interaction of radiation and matter

4.5.Bibliography and recommended resources