UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Applications of Materials for Ionizing Radiation Detection

2526-1-FSM02Q011

Aims

The detection of ionizing radiation such as X-ray, ?-ray, ?-particle, and neutrons has been widely required in many industrial areas, such medical, environmental, aerospace….
Starting from an overview of the interaction of ionizing radiation with matter, which highlights the dependence on energy and the type of target material, the course provides the basic concepts of nuclear physics and dosimetry. As such, they represent the common and essential foundation to highlight the requirement of material properties for high performance ionizing radiation detection. Additionally, the course trains students to apply the theoretical knowledge acquired to solve real-world problems.
By the end of the course, the student knows the fundamental laws governing the interaction of ionising radiation with matter, as well as their significance and scope of application (Knowledge and understanding). Furthermore, the student is able to apply the acquired knowledge in the modeling, analysis, and solution of practical problems encountered in experimental sessions (Applied knowledge and understanding) and is capable of identifying the most suitable method for tackling different types of problems (Independent judgment). During the course, the student also acquires an adequate scientific language that allows them to communicate the learned concepts rigorously and appropriately (Communication skills). Finally, at the end of the course, the student recognizes the importance of a quantitative and rigorous description of physical quantities and the formal description of their relationships, thus acquiring a scientific approach essential for studying asome applications based on the mechanisms between ionizing radiation and materials (Learning skills).

Contents

Fundamental nuclear physics. Radioactivity. Sources of ionizing radiation. Energy transfer from radiation to materials. Dosimetry. Application of experimental techniques based on the interaction radiation-matter.

Detailed program

Important topics are:

- Interaction cross sections (classical);
- mechanisms for interaction of photons, neutrons and charged particles;
- fundamental on dosimetry, defects induced by radiation;
- Experimental techniques for the study of the effects of the interaction radiation-matter on the physical properties of the materials with particular focus on semiconductors and scintillators, representing the two primary classes of radiation detector materials that are of interest;
- Ionizing radiation detectors, scintillators properties and key characteristics, dosimeters.
- Quantum confinement and scintillation: intrinsic and extrinsic processes
- Fabrication and testing of quantum dot nanoscintillators and composites beyond the plastic paradigm.

Students during the course will attend research laboratories where they will be able to carry out experimental activities concerning the luminescence techniques applied in the dosimetry field and the X-ray Fluorescence technique applied in the material charactherisation.

Prerequisites

Basic knowledge of physics of matter

Teaching form

The course provides:

- 23 two-hour lectures, in person (Delivered Didactics);
- 7 two-hour experimental activities in person (Delivered Didatics);
- 4 two-hour of discussion with the students, interactive in nature (Interactive Didatics)

Lectures will be given in English supported by video projection of text, schemes, diagrams, pictures and movies.

Textbook and teaching resource

Slides and "ad hoc" textbook provided by the professor

Semester

Second semester (March-June)

Assessment method

The assessment is based on a final oral examination. based on:

• A discussion about the topics treated during the lessons ;
• A discussion on the experimental activity carried out in the laboratory, also on the basis of the written report.
• A short presentation on a topic covered in the lectures chosen by the student.

During the exam, the instructor evaluates the student's level of learning, critical thinking ability, and communication skills relevant to the specific field. There will be no intermediate tests.

Office hours

8 - 18
Appointments between professor and students can be agreed by e-mail.

Sustainable Development Goals

QUALITY EDUCATION | AFFORDABLE AND CLEAN ENERGY | INDUSTRY, INNOVATION AND INFRASTRUCTURE