UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Applications of Materials for Ionizing Radiation Detection

2425-1-FSM01Q011

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 about the interaction of ionizing radiation with matter, pointing out the dependence on energy and type of target material, the aim is to highlight the requirement of material properties for high performance ionizing radiation detection.
The course provides knowledge about the energy transfer from ionizing radiation, both charged and uncharged particles (photons and neutrons), to matter and it introduces some applications based on the mechanisms between ionizing radiation and materials.

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. Scintillation with nanoscale materials, fundamentals and applied aspects.

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