UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Radiation Detectors

2122-1-F1701Q088

Aims

The course is aimed at a review on the photon and particle detection techniques, up to energies around 20 MeV, in use in radiation measurements in different fields of experimental physics and applied physics.

Contents

Recalls on radiation-matter interactions, radioactivity, basic principles of gas and semiconductor detectors as well as scintillators. General properties of ionizing radiation detectors. Neutron interactions with matter and their detection. Alpha, beta and gamma spectroscopy. Signal shaping and processing. Background problems and detector shieldings

Detailed program

Brief recall of radiation interaction with matter and of radiation sources.

Counting statistics and error propagation. Optimization of counting experiments, limits of detectability and distribution of time intervals.

General properties of radiation detectors: spectra, counting curves and plateau; efficiency; energy, time and position resolution; dead time.

Gas detectors: ionization chambers, proportional counters, Geiger counters.

Scintillators: general approach of detection with scintillators, general characteristics of inorganic, organic, plastic scintillators. Photodiodes and photocells, photomultipliers.

General considerations on radiation spectroscopy with scintillators. Response functions.

Semiconductor detectors: Ge, Si and other solid state detectors.

Bolometers.

Neutron interaction with matter and their detection.

Signal shaping and processing: device impedances, coaxial cables, shaping

Nuclear electronic devices: basic units for signal shape processing, counting, timing studies.

Multichannel pulse analysis.

Background problems and detector shielding

Prerequisites

All the Physics topics encountered during the Undergraduate Physics Classes, in particular Electromagnetism, in vacuum and in material, Special Relativity, Structure of Matter and the Introduction to Nuclear Physics.

Teaching form

Classroom-taught Lessons (4 CFU) and lab practicing with nuclear electronics instrumentation (2 CFU)

Textbook and teaching resource

G.F. Knoll, "Radiation Detection and Measurement", 4th ed., Wiley & Sons

Slides of the lessons are available online.

Semester

First semester

Assessment method

Oral examination using open questions.

Starting from a very general and broad question the student is required to answer in a complete way with a clear and well organized exposition. During the speech, details will be asked. The ability to correlate the different notions acquired during the course will be checked, to control the level of mastery of the subject achieved.

The colloquium lasts typically 1 hour

Office hours

The rendez-vous must be agreed in advance with a phone call or by email