UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nuclear and Subnuclear Physics Laboratory

1920-3-E3001Q065

Aims

Education to the use of nuclear instruments and methods with applications in particle physics, in environmental analysis and medical diagnostics.

Contents

Introduction to the base principles for ionizing radiation detection

Practical experiences on alpha radiation spectroscopy

Practical experiences on gamma radiation spectroscopy

Practical experiences on cosmic rays detection

Practical experiences with inorganic scintillators coupled to SiPM detectors for gamma radiation

Detailed program

Introduction to particle detection: particle sources, dosimetry, particle-matter interaction base principles, base principles of more standard particle detectors and signal processing, data acquisition and data analysis.

Practical experiences on Alpha, beta and gamma spectroscopy: optimization, calibration and characterization of solid state detectors; measurements of activities; measurements of the range-energy curve and of the specific

ionization of alpha particles;

measurements of gamma rays absorption and released energy, angle and time correlations in nuclear decays.

Characterization of cosmic rays at ground: time of flight, speed and lifetime of muons using plastic scintillators and coincidence/anticoincidence/veto techniques.

Gamma measurement with inorganic scintillating crystals coupled do SiPM detectors: characterization and comprehension of the specific properties of SiPM detectors, optimization of working points and parameters for data acquisition, gamma spectroscopy measurements comparing the performances of scintillating crystals made of different compounds.

Prerequisites

None

Teaching form

- Frontal introductory lessons fundamental to acquire the basics about the to the topics that will be developed during the practical experiences in the laboratory

- Assigning to 3 students groups of one single practical experience among those available, to be developed during the whole duration of the laboratory.

Textbook and teaching resource

- Handouts about the introductory lessons

- Reference book: G.F.Knoll, “Radiation Detection and Measurement”

- Practical guides for each experience

- Instrumental manuals

- Gamma/beta and alpha radiation tables

- Reports from previous years' students about the practical experiences

Semester

Frontal introductive lessons given collectively for all the students attending the course at the beginning of the first semester.

Practice at student's choice to be attended during the first or the second semester until saturation of availability.

Assessment method

- Direct interaction with students in the laboratory

- Final detailed report including data analysis about the practical experience done during the laboratory, to be given to the teacher at least one week before the oral examination

- Oral examination concerning the presented final report and the general topics about particle detection faced up both during the introductory lessons and during the practical work.

Office hours

Everyday, after checking via email the teacher availability