



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nuclear and Subnuclear Physics Laboratory

2021-3-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

- In the Covid-19 emergency period the introductory lessons, usually held in presence, will be asynchronous recorded lessons. They will be about the topics necessary for the development and understanding of the laboratory experiences and will be uploaded on the elearning page before the start of the first semester.
- Two or more web meetings to discuss doubts related to the topics explained in the introductory lessons.
- Test to evaluate the comprehension of the topics explained in the introductory lessons (each student will have to attend the test before starting the practical part of the laboratory).
- Assignment to groups of maximum 3 students of one experience among those available. The assigned experience will be carried out in the presence for the entire duration of the laboratory, or a semester of your choice (until saturation available places, or 21 in the first semester and 25 in the second);- 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

- Slides of 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

Asynchronous recorded introductory lessons available on the elearning page for all the students before 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 and via web
- 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. During the Covid-19 emergency period, oral exams will only be online. They will be carried out using the WebEx platform and on the e-learning page of the course there will be a public link for access to the examination of possible virtual spectators.

Office hours

Everyday, after checking via email the teacher availability
