UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO INTERATENEO DI FISICA

COURSE OF STUDY *Physics (LM-17)*

ACADEMIC YEAR *2024-2025*

ACADEMIC SUBJECT *Particle and Radiation Detector Laboratory*

General information	
Year of the course	2nd
Academic calendar (starting and ending date)	1st semester: September – December 2024
Credits (CFU/ECTS):	6
SSD	FIS/01
Language	ENGLISH
Mode of attendance	Compulsory

Professor/ Lecturer	
Name and Surname	Francesco Loparco
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Department and address	Dipartimento di Fisica “M. Merlin”, Stanza R74
Virtual headquarters (Microsoft Teams code)	-
Tutoring (time and day)	On request

Work schedule			
Total	**Lectures**	**Hands on (Laboratory, working groups, seminars, field trips)**	**Out-of-class study hours/ Self-study hours**
Hours			
150	24	45	81
CFU/ECTS			
6	3	3	

Learning Objectives	The student should learn how to operate various classes detectors and some data analysis techniques commonly used in high-energy physics
Course prerequisites	Basic knowledge of detector physics

Teaching strategy	Lectures. Laboratory experiences. Hands-on data analysis sessions.

Expected learning outcomes	
Knowledge and understanding on:	• Understanding the scientific method, the nature, and the methods of research in Physics • Knowledge of advanced mathematical tools commonly used in basic and applied research fields • Knowledge of the technologies required in experimental physics • Knowledge of advanced instrumentation in experimental physics • Interactions of particles and radiation with matter • Principles of operation of several classes of detectors • Strategies for data analysis
Applying knowledge and understanding on:	• Ability to identify the essential elements of a phenomenon • Ability to use analogy to apply known solutions to new problems (problem solving) • Ability to use analytical and numerical mathematical computation tools

	• Ability to use electronic and computer technologies and their application to experimental data acquisition • Use of different types of detectors and implementation of appropriate experimental set-ups • Performing detector calibrations • Development of appropriate tools for data analysis
Soft skills	• ***Making informed judgments and choices*** o Ability to work with increasing levels of autonomy, including taking responsibility in project planning and managing facilities. o Awareness of safety issues in laboratory activities o choice of appropriate detectors for different applications • ***Communicating knowledge and understanding*** o Competence in communication in Italian and English in advanced fields of Physics o Writing lab reports and communicating scientific results o Team working abilities • ***Capacities to continue learning*** o Acquisition of basic knowledge tools for continuous learning and knowledge updates o Implementation of experimental techniques in high-energy physics

Syllabus	
Contents	Laboratory experiences with high-energy particle detectors: plastic and crystal scintillators, scintillating fibres, lead-glass calorimeters, silicon pixel detectors. Development of data analysis software using the C++ and/or python languages and the CERN ROOT toolkit.
Books and bibliography	Radiation Detection and Measurement, G. F. Knoll, ed. Wiley
Additional materials	Slides provided by the teacher

Assessment and feedback	
Methods of assessment	Laboratory reports and oral exam
Evaluation criteria	**Knowledge and understanding** • Principles of operation of the detectors used in the laboratory experiences • Implementation of experimental set-ups **Applying knowledge and understanding** • Analysis of the data taken in the laboratory experiences **Autonomy of judgment** • Interpretation of the experimental results **Communicating knowledge and understanding** • Ability of discussing experimental techniques **Communication skills** • Clarity and use of appropriate language **Capacities to continue learning** • Ability of developing data analysis tools
Criteria for assessment and attribution of the final mark	Lab reports (20%) and oral exam (80%)
Additional information	