UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO INTERATENEO DI FISICA

**COURSE OF STUDY** *Physics (LM-17)*

**ACADEMIC YEAR** *2023-2024*

**ACADEMIC SUBJECT** *Particle and Radiation Detector Laboratory*

| **General information** | |
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| Year of the course | 2nd |
| Academic calendar (starting and ending date) | 1st semester: September – December 2023 |
| Credits (CFU/ECTS): | 6 |
| SSD | FIS/01 |
| Language | ENGLISH |
| Mode of attendance | Compulsory |

| **Professor/ Lecturer** | |
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| Name and Surname | Francesco Loparco |
| E-mail | francesco.loparco@uniba.it |
| Telephone | 080/5442339 |
| Department and address | Dipartimento di Fisica “M. Merlin”, Stanza R74 |
| Virtual headquarters (Microsoft Teams code) | - |
| Tutoring (time and day) | On request |

| **Work schedule** | | | |
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| **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 | |

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| **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 |

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

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

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

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