PhD course in Physics, Astrophysics, and Applied Physics - Università degli Studi di Milano
PhD cicle 40 (2024-2025)

All lectures will be given in English.

Course title	Advanced Topics in Particle Physics
Teacher in charge of the course	Andreazza Attilio
List of the teachers of the course *[surname/name; affiliation; e-mail]*	Andreazza Attilio; University of Milan; attilio.andreazza@mi.infn.it Serafini Luca; INFN-Milan section; luca.serafini@mi.infn.it Turra Ruggero; INFN Milan section; ruggero.turra@mi.infn.it
Training objectives	Provide a framework of advanced notions used in experimental particle physics: accelerators, detectors and statistical methods.
Prerequisites *[please insert details and also **state whether the course has advanced contents** suitable for students with prior knowledge of the topics or is also suitable for students without prior knowledge]*	General knowledge of the Standard Model of particle physics, classical electrodynamics, basics of statistics.
Detailed course program	Introduction to Particle Accelerators: Physics and Technology challenges - History of the evolution of particle accelerators: ideas, technologies and applications; - Transverse and longitudinal beam dynamics basics and issues; - Accelerators for physics, human health and industry; - Colliders for extreme microscopy while pushing the energy frontier. Particle Detectors - Position sensitive silicon and gaseous detectors; - Calorimetry for particle physics; - Reconstruction of physical quantities like momentum, energy, particle identification… in particle physics measurements; - Selected physics measurements at present and future accelerators. Statistical analysis with exercises - Hypothesis testing, Likelihood method; - Estimation of confidence levels.
Examination modalities	The examination consists in the production of a short essay on an experimental technique, exercises on statistica methods and an interview on the basics of accelerator physics
Preliminary schedule *[please indicate the weeks when the lectures will be given]*	September 1-13 2025