UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Elements of Particle Physics

2425-3-E3001Q088

Aims

This course introduces the experimental and conceptual foundations of elementary particles and fundamental interactions Physics, by means of monographic examples of significant measurements, critical reading of historical publications and discussion of problems and exercises.

Contents

Introduction to the experimental methods and the first discoveries.
Symmetries.
Electroweak interactions.
The origin of mass.

Detailed program

1. Introduction: nomenclature, parameters, observable quantities, decay processes, scattering processes, interferences, discrete, local and global symmetries, experimental methods.
2. Particles: Discovery of antimatter, discovery of the muon, discovery of mesons, discovery of the 1st and 2nd neutrinos, Deep Inelastic Scattering (from Rutherford to partons), number of families.
3. Symmetries: Measurement of positron parity, parity violation (Goldhaber and the pion decay) and V-A, weak neutral currents, universality, proton (non) decay, CP violation, matter-antimatter asymmetry.
4. Electroweak interactions: Measurement of the electromagnetic coupling constant, measurement of the weak coupling constant, measurement of the vacuum expectation value of the Higgs field (g-2, GF and mZ).
5. Origin of the mass: Dirac and Majorana mass, discovery and characterization of the Higgs boson, neutrino

mass, missing mass.

Prerequisites

Special Relativity, Classical Electromagnetism and non relativistic Quantum Mechanics.

Teaching form

Lessons and exercise sessions.
All activities will be held in presence, instructionally.

Textbook and teaching resource

Donald Perkins, "Introduction to High Energy Physics", Cambridge University Press, 4th edition

Semester

Second semester

Assessment method

The exam is oral and includes:

1. discussion of the solution of one of the 10 exercises chosen by the student among those proposed on the e-learning site in the Idefix section. It is required that the written solution of the 10 chosen exercises be taken to the exam;
2. discussion of a subject of the programme carried out during the course, at the choice of the student;
3. discussion of other topics of the programme carried out during the course.

Office hours

To be defined with the teachers

Sustainable Development Goals

QUALITY EDUCATION