



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Elementi di Fisica delle Particelle

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  $m_Z$ ).
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

---