



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Elements of Particle Physics

2324-3-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

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.

#### Detailed program

#### Prerequisites

Special Relativity, Classical Electromagnetism and non relativistic Quantum Mechanics.

### **Teaching form**

Lessons and exercise sessions

### **Textbook and teaching resource**

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

### **Semester**

Second semester

### **Assessment method**

Oral exam

### **Office hours**

To be defined with teachers

### **Sustainable Development Goals**

QUALITY EDUCATION

---