UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nuclear and Subnuclear Physics

2122-3-E3001Q048

Aims

We provide a modern introduction to elementary particle physics and nuclear physics building on special relativity and non relativistic quantum mechanics .

Contents

Elementary particles and relativistic kinematics. Experimental techniques for particle detection. Symmetries in particle physics. Electromagnetic interactions. Strong interactions and color charges. Lepton, quarks and hadrons. Weak interactions and the discovery of massive gauge bosons. Nuclei. Radioactive decays and nuclear models.

Detailed program

Point particles and elementary particles. Relativistic kinematics and covariant formalism. Natural units. Decays and scattering. Cross section and decay amplitudes. Particle interactions with matter. Particle detectors. Classical and quantum electrodynamics (QED). Gauge symmetry, discrete and continuous symmetries in QED. Parity and C-parity. Feynman diagrams and scattering in QED. Strong interactions. Quark and color charge. The gauge symmetry of QCD. Asymptotic freedom and confinement. Flavor symmetry and the 3 quark model. Mesons and baryons. Weak interactions. Elicity and chirality. The experiments of Wu and Goldhaber. The electroweak theory. The discovery of weak neutral currents and massive bosons. General properties of the nuclei. Nuclear forces. Nuclear models and reactions. General properties of radioactive decays. Decay chains and secular equilibrium. Natural radioactivity and applications. Alpha decays. Gamma decays. Beta decays.

Prerequisites

Non relativistic quantum mechanics and special relativity

Teaching form

lectures (8 CFU)

Textbook and teaching resource

F. Terranova, A Modern Primer in Particle and Nuclear Physics, Oxford University Press, 2021 (available from 20 october 2020). G. Krane, Introductory Nuclear Physics, Wiley, 1988 (3rd edition)

Semester

second semester

Assessment method

oral exam on Particle Physics and Nuclear Physics

Office hours

on demand