UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Theoretical Physics I

2223-1-F1701Q080

Aims

Introduction to the Theory of Quantum Field of fundamental interactions

Contents

Relativistic quantum field theory

Detailed program

Relativistic wave equations
Klein-Gordon equation
Dirac equation, negative energies, covariance
NR limit and gyromagnetic factor of the electron
Bilinear covariants and properties
Operators P, T, C
Difficulties of a relativistic quantum mechanics
Necessity of a field theory
Simmetries and conservation laws
Noether's theorem
Internal and external symmetries
Energy momentum and angular momentum tensors
The Electromagnetic field
Maxwell equations
Gauge invariance

Quantization in the Coulomb gauge
Dipole transition, spontaneous emission
EM field in the presence of charges, Thomson scattering
Fields quantization
The Klein-Gordon and the Dirac field
Particles and antiparticles
Commutation and anticommutation laws
Spin-Statistic Theorem
Feynman propagator
Covariant Perturbation Theory
The S-Matrix
Dyson series
Wick theorem
Perturbative expansion for QED
Feynman diagrams
Relativistic kinematics, phase space, cross section
First order processes, Coulomb, Bhaba and e+e-??+?- scattering, Bremsstrahlung

Prerequisites

Deep knowledge of Classical, Quantum and Relativistic Mechanics and of Classical Electromagnetism

Teaching form

Lectures

Textbook and teaching resource

F. Mandl, G. Shaw, Quantum Field Theory, II Ed.
M.D. Schwartz, Quantum Field Theory and The Standard Model
L.D. Landau, E.M. Lifshitz - Course of Theoretical Physics, vol. IV, Quantum Electrodynamics
M.E. Peskin, D.V. Schroeder, An Introduction to Quantum Field Theory
G.B Chen, D. Derbes, D. Griffiths, B. Hill, R. Sohn, Y.S. Ting(Eds.) - Lectures of Sidney Coleman on quantum field theory; World Scientific

Semester

First

Assessment method

Oral exam on the topics of the course

Office hours

On request

Sustainable Development Goals

QUALITY EDUCATION