COURSE OF STUDY *Physics (LM-17)*

ACADEMIC YEAR *2024-2025*

ACADEMIC SUBJECT *Interacting Quantum Fields*

General information	
Year of the course	1st
Academic calendar (starting and ending date)	2nd semester: March - May 2025
Credits (CFU/ECTS):	6
SSD	FIS/02
Language	English
Mode of attendance	Recommended, not compulsory

Professor/ Lecturer	
Name and Surname	Antonio Marrone
E-mail	antonio.marrone@uniba.it
Telephone	+39 080 5443461
Department and address	Physics Department, via Amendola 173, Bari
Virtual room	
Office Hours (and modalities: e.g., by appointment, on line, etc.)	On request

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	40	15	95
CFU/ECTS			
6	5	1	

Learning Objectives	Understanding the concept of interactions between fields
Course prerequisites	Free Quantum Field Theory

Teaching strategie	Lessons on the board
Expected learning outcomes in terms of	
Knowledge and understanding on:	• Understanding the scientific method, the nature, and the methods of research in Physics • Knowledge of quantum field theory • Knowledge of the interacting quantum fields • Understanding the concept of interactions between fields
Applying knowledge and understanding on:	• Ability to identify the essential elements of a phenomenon • Ability to use analogy to apply known solutions to new problems (problem solving) • Ability to use analytical and numerical mathematical computation tools • Implementation of a symmetry in physical models for interacting particles
Soft skills	• *Making informed judgments and choice* o Ability to work with increasing levels of autonomy, including taking responsibility in project planning and managing facilities.

	o Ability to proceed autonomously in the study of quantum field theories ● *Communicating knowledge and understanding* o Competence in communication in Italian and English in advanced fields of Physics o Ability to express the acquired knowledge properly ● *Capacities to continue learning* o Acquisition of basic knowledge tools for continuous learning and knowledge updates o Ability to study independently from texts and scientific literature
Syllabus	
Content knowledge	The S-Matrix expansion - Wick's Theorem – Feynman diagrams in configuration space - Feynman diagrams in momentum space - Feynman rules for QED – QED processes in lowest order – Bhabha scattering – Compton scattering – Scattering by an external field – Bremsstrahlung – The infrared divergence – The second-order radiative corrections – The photon self-energy – The electron self-energy – External line renormalization – The vertex modification – Regularization - Applications
Texts and readings	F. Mandl, G. Shaw, Quantum Field Theory, Wiley; 2 edition Also J.D.Bjorken, S.D. Drell, Relativistic Quantum Fields, Mcgraw-Hill College
Notes, additional materials	Some notes of the teacher
Repository	*Teams*

Assessment	
Assessment methods	Oral test
Assessment criteria	Adequate comprehension and global knowledge of concepts and arguments described throughout the course.
Final exam and grading criteria	*Vote/30*
Further information	