SUBJECT TEACHING GUIDE

G1777 - Particle Physics

Double Degree in Physics and Mathematics
Degree in Physics

Academic year 2022-2023

1. IDENTIFYING DATA				
Degree	Double Degree in Physics and Mathematics Degree in Physics		Type and Year	Optional. Year 5 Optional. Year 4
Faculty	Faculty of Sciences			
Discipline	Subject Area: Physics of Elementary Particles Mention in Fundamental Physics			
Course unit title and code	G1777 - Particle Physics			
Number of ECTS credits allocated	6	Term	Semester based (2)	
Web				
Language of instruction	English		Mode of delivery	Face-to-face

Department	DPTO. FISICA MODERNA
Name of lecturer	JONATAN PIEDRA GOMEZ
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Other lecturers	JORGE DUARTE CAMPDERROS CELIA FERNANDEZ MADRAZO

3.1 LEARNING OUTCOMES
- The standard model of particle physics. Fundamental forces. Symmetries.
- Radiation-matter interaction. Design of sensors and detectors.
- Basic detectors. Application to cosmic radiation.
- Accelerator experiments. Particle collisions.
- Areas of work in an experiment.
- Open problems, proposed models, and experimental developments.

4. OBJECTIVES
Understand the standard model of particle physics
Understand the physics foundations and techniques of particle acceleration and detection
Know the current experiments and trend in particle physics

6. COURSE ORGANIZATION	
CONTENTS	
1	Introduction and overview of basic concepts, Dirac equation, antiparticles, Feynman diagrams, cross sections and branching fractions
2	Experimental techniques, particle detectors and particle accelerators
3	QCD, jets and gluons, strong interaction, confinement and asymptotic freedom
4	Weak interaction as a gauge theory, the Weinberg-Salam model for leptons and quarks, CKM matrix, Higgs boson
5	Beyond the SM, neutrino masses, dark matter, supersymmetry

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Written exam Laboratory Exercises and participation in class	Written exam	No	Yes	40,00
Laboratory	Laboratory evaluation	No	No	40,00
Exercices and participation in class	Work	No	Yes	20,00
TOTAL				100,00
Observations				
Re-assessment through the extraordinary exam for students failing the recoverable parts, with a 60% of the total weight.				
Observations for part-time students				
Time-scheduling of lab practices will be adapted to facilitate participation of part-time students.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Particle Physics, BR Martin & G. Shaw, Ed Wiley,
Particle Detectors, C. Grupen, Cambridge