

## SUBJECT TEACHING GUIDE

G1777 - Particle Physics

Double Degree in Physics and Mathematics  
Degree in Physics

Academic year 2021-2022

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	FRANCISCO MATORRAS WEINIG
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Other lecturers	JONATAN PIEDRA GOMEZ JORGE DUARTE CAMPDERROS CELIA FERNANDEZ MADRAZO

### 3.1 LEARNING OUTCOMES

- Basic concepts in Particle Physics
  - Main characteristics of the fundamental interactions between elementary particles
  - Passage of particle through matter and its application to particle detection.
  - Particle detectors and data analysis techniques
  - Particle accelerator techniques
  - Experimental results supporting the Standard Model of particle physics
  - Outline of main extensions of the SM

#### 4. OBJECTIVES

1. Understand the basics of the Standard Model of Particle Physics
2. Understand the physics foundations and techniques of particle acceleration and detection
3. Get to know the current experiments and trends 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 Particle accelerators
3	QCD, jets and gluons Strong interaction as gluon exchange Strong coupling constant Confinement and asymptotic freedom
4	Weak interaction: weak interaction as a gauge theory, Weimberg-Salam model Experimental evidences WS for leptons. WS for quarks, CKM matrix Higgs boson
5	Beyond the SM neutrino masses dark matter supersimmetry

#### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Written Exam	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 an exam in June/July.				
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

