

TEACHING GUIDE ON
ADVANCED QUANTUM FIELD THEORY

MASTER MODULE	SEMESTER	CREDITS	COURSE TYPE
Particle Physics and Astrophysics	1	6	Optative
PROFESSOR(S)	CONTACT DETAILS		
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	TUTORIALS TIMETABLE		
	www.ugr.es/~fteorica/Docencia/Tutorias.html		
MASTER DEGREE			
University Master in Physics: Radiations, Nanotechnology, Particles and Astrophysics, University of Granada			
TEACHING DATES AND TIMES			
PRE-REQUISITES FOR REGISTRATION			
Basic knowledge of Field theory and particles, Quantum mechanics and Mathematical methods for physics			
BRIEF CONTENTS DESCRIPTION			
Introduction to the most relevant theoretical aspects of particle physics			
PROGRAM			
PART I. BASIC FORMALISM. PATH INTEGRALS. - Introduction. Review of canonical quantization. - Path integral in quantum mechanics. - Functional quantization of scalar fields. - Interacting fields. Perturbation theory and Feynman diagrams. - Functional quantization of fermionic fields. - Functional quantization of the electromagnetic field.			



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- Effective action and Schwinger-Dyson equations.
- LSZ formula. Optical theorem. Unstable particles. Dispersion relations.

PART II. SYMMETRIES

- Noether theorem and Ward identities.
- Spontaneous breaking of global symmetries.
- Gauge theories.
- Quantization of gauge theories. BRST symmetry.
- Spontaneous breaking of local symmetries.
- Anomalies.
- Monopoles and instantons.

PART III. RENORMALIZATION

- Divergences and regularization.
- Renormalization.
- Renormalizability. Effective theories.
- Wilsonian renormalization group flows.
- Renormalization group equation in renormalizable theories.
- Evolution of couplings. Asymptotic behaviour.

BIBLIOGRAPHY

- M.E. Peskin and D.V. Schroeder, *An Introduction to Quantum Field Theory*, Addison-Wesley (2010).
- M.D. Schwartz, *Quantum Field Theory and the Standard Model*, Cambridge University Press (2014).
- T. Banks, *Modern Quantum Field Theory*, Cambridge University Press (2008).
- S. Weinberg, *The Quantum Theory of Fields*, vol. I y II, Cambridge University Press (1995).
- S. Pokorski, *Gauge Field Theories*, Cambridge University Press (1987).
- T.P. Cheng and L.F. Li, *Gauge theory of elementary particle physics*, Oxford University Press (1984).
- C. Itzykson and J.B. Zuber, *Quantum Field Theory*, McGraw-Hill (1980).
- Aitchison and Hey, *Gauge theories in particle physics*, Taylor and Francis (2003).
- Srednicki, *Quantum field theory*, Cambridge University Press (2007).



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