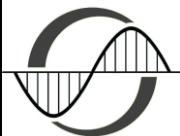




UNIVERSITÀ
degli STUDI
di CATANIA



DIPARTIMENTO DI FISICA E ASTRONOMIA
“ETTORE MAJORANA”

DOTTORATO DI RICERCA IN FISICA
CICLO XLI A.A. 2025/2026

ADVANCED TOPICS IN QUANTUM FIELD THEORY

3 CFU

Teaching staff

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Program of the course:

- Renormalization and renormalization group in quantum field theory. Callan-Symanzik and Wilson renormalization group (RG) equations.
- Dimensional regularization, zeta function regularization, Wilsonian renormalization. Fine tuning, counterterms and physical tuning. Naturalness.
- Theories with Spontaneous Symmetry Breaking. Unbroken phase and RG flow in the ultraviolet regime. Instabilities: the RG “microscope”. Renormalization in the broken phase. Tree level renormalization and Maxwell construction.

Bibliography:

- Notes provided by the teacher.
- M.E. Peskin, D.V. Schroeder, An Introduction to Quantum Field Theory, Addison Wesley.
- S. Pokorski, Gauge Field Theories, Cambridge University Press.
- T. Muta, Foundation of Quantum Chromodynamics, World Scientific.