SCHEDA DELL' INSEGNAMENTO DI TEORIA QUANTISTICA DEI CAMPI

QUANTUM FIELD THEORY

Corso di Studio Magistrale in Fisica | [x] **Insegnamento** | [ ] **Laurea Magistrale** | **A.A. 2018/2019**

Docente: GENNARO MIELE ☎**081-676496** **email: gennaro.miele@unina.it**

SSD FIS/02 **CFU** 8 **Anno di corso (I, II)** I **Semestre (I , II)** II

Insegnamenti propedeutici previsti:

Prerequisiti (max 4 righi, Arial 9)

Meccanica Quantistica , Elettrodinamica Classica

Conoscenza e capacità di comprensione (max 4 righi, Arial 9)

Lo scopo del corso è fornire una conoscenza dettagliata della Meccanica quantistica dei sistemi ad infiniti gradi di libertà in regime relativistico, delle metodiche per trattare le divergenze presenti nelle teorie in interazione e del formalismo dell'integrazione funzionale.

Conoscenza e capacità di comprensione applicate (max 4 righi, Arial 9)

Alla fine del corso lo studente saprà ricavare le ampiezze di scattering e le relative sezioni d'urto per teorie in interazione come $\lambda\phi^4$ e QED anche ad ordini perturbativi non banali.

PROGRAMMA (in italiano, min 10, max 15 righi, Arial 9, raggruppando i contenuti al massimo in 10 argomenti)

Symmetries and Group Theory: Elements of Group Theory; SO(2); Representations of SO(2) and U(1); Representations of SO(3) and SU(2); Representations of SO(N); Spinors; Lorentz Group; Representations of Poincaré Group. [K] pp.33 - 58
The Klein- Gordon field: Elements of classical field theory; KG field as Harmonic Oscillators; KG field in space-time; The propagator of KG field. [P&S] pp .13-33
The Dirac Field: The Dirac Equation; Quantization of the Dirac Field, Continuous and Discrete Symmetries of Dirac Field. The propagator of Dirac field. [P&S] pp .35-71
Interacting Fields and Feynman Diagrams: Perturbation Theory;Perturbation expansion and the correlations functions. Wick's Theorem; Feynman diagrams; Cross section and the S-matrix; $\lambda\phi 4$ Theory. [P&S] pp. 77 - 126
Quantizing Electromagnetic field Quantization in the Coulomb Gauge, Gupta-Blauler quantization; The propagator of the e.m. field. [K] pp. 106 - 114
Elementary Processes in QED QED; e+ e- -> μ+ μ- ; Compton scattering. [P&S] pp. 131 - 169
Radiative Corrections: Introduction Soft Bremsstrahlung; The Electron vertex; [P&S] pp. 175 - 208
Radiative Corrections: Formal developments Field strength renormalization; the LSZ reduction formula; The optical Theorem; The Ward-Takahashi Identity; Renormalization of the Electric charge. [P&S] pp. 211 - 256
Functional Methods Functional quantization of scalar, electromagnetic and spinor field; Symmetries in the functional formalism. [P&S] pp. 275 - 312
Systematics of renormalization Counting of Ultraviolet Divergences; Renormalized Perturbation Theory; Renormalization of $\lambda\phi 4$ and QED. [P&S] pp. 315 - 344
Renormalization and symmetry Spontaneous Symmetry Breaking; The effective Action; The effective action as a generating functional; Goldstone's Theorem. [P&S] pp. 347 – 388
The renormalization group Wilson's approach to renormalization theory; The Callan-Symanzik Equation; Evolution of coupling constants. [P&S] pp. 393 – 424

CONTENTS (in English, min 10, max 15 lines, Arial 9)

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MATERIALE DIDATTICO (max 4 righi, Arial 9)

- **[P&S] M.E Peskin & D.V. Schroeder, An Introduction to Quantum Field Theory, Westview Press, 1995**
- **[K] Michio Kaku, Quantum Field Theory: A Modern Introduction, Oxford University Press, New York, London, 1993**

FINALITA' E MODALITA' PER LA VERIFICA DI APPRENDIMENTO

a) **Risultati di apprendimento che si intende verificare:**
Conoscenze approfondite sulla Meccanica Quantistica Relativistica ed in particolar modo sulla Integrazione Funzionale.
b) **Modalità di esame:**

L'esame si articola in prova	**Scritta e orale**		**Solo scritta**	**X**	**Solo orale**	
Discussione di elaborato progettuale						
Altro, specificare						