

1. Record Nr.	UNINA9910629295503321
Autore	Nishijima Kazuhiko
Titolo	Quantum field theory : by Academician Prof. Kazuhiko Nishijima - a classic in theoretical physics / / Kazuhiko Nishijima ; Masud Chaichian, Anca Tureanu, editors
Pubbl/distr/stampa	Dordrecht, The Netherlands : , : Springer, , [2023] ©2023
ISBN	94-024-2190-4
Descrizione fisica	1 online resource (571 pages)
Disciplina	530.143
Soggetti	Quantum field theory
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Foreword -- Preface to the English Edition -- Preface of the Author -- Contents -- 1 Elementary Particle Theory and Field Theory -- 1.1 Classification of Interactions and Yukawa's Theory -- 1.2 The Muon as the First Member of the Second Generation -- 1.3 Quantum Electrodynamics -- 1.4 The Road from Pions to Hadrons -- 1.5 Strange Particles as Members of the Second Generation -- 1.6 Non-conservation of Parity -- 1.7 Second Generation Neutrinos -- 1.8 Democratic and Aristocratic Hadrons-The Quark Model -- 2 Canonical Formalism and Quantum Mechanics -- 2.1 Schrödinger's Picture and Heisenberg's Picture -- 2.2 Hamilton's Principle -- 2.3 Equivalence Between the Canonical Equations and Lagrange's Equations -- 2.4 Equal-Time Canonical Commutation Relations -- 3 Quantization of Free Fields -- 3.1 Field Theory Based on Canonical Formalism -- 3.1.1 Canonical Commutation Relations -- 3.1.2 Euler-Lagrange Equations -- Example: Klein-Gordon Equation -- 3.1.3 Hamiltonian -- Example: Hamiltonian for Real Scalar Field -- 3.2 Relativistic Generalization of the Canonical Equations -- 3.3 Quantization of the Real Scalar Field -- 3.4 Quantization of the Complex Scalar Field -- 3.5 Dirac Equation -- 3.6 Relativistic Transformations of Dirac's Wave Function -- 3.7 Solutions of the Free Dirac Equation -- 3.8 Quantization of the Dirac Field -- 3.9 Charge Conjugation -- 3.10 Quantization of the Complex Vector Field -- 4 Invariant Functions and Quantization of Free Fields --

4.1 Unequal-Time Commutation Relations for Real Scalar Fields -- 4.2 Various Invariant Functions -- 4.3 Unequal-Time Commutation Relations of Free Fields -- 4.4 Generalities of the Quantization of Free Fields -- 5 Indefinite Metric and the Electromagnetic Field -- 5.1 Indefinite Metric -- 5.2 Generalized Eigenstates -- 5.3 Free Electromagnetic Field in the Fermi Gauge. 5.4 Lorenz Condition and Physical State Space -- 5.5 Free Electromagnetic Field: Generalization of Gauge Choices -- 6 Quantization of Interacting Systems -- 6.1 Tomonaga-Schwinger Equation -- 6.2 Retarded Product Expansion of the Heisenberg Operators -- 6.3 Yang-Feldman Expansion of the Heisenberg Operators -- 6.4 Examples of Interactions -- 7 Symmetries and Conservation Laws -- 7.1 Noether's Theorem for Point-Particle Systems -- 7.2 Noether's Theorem in Field Theory -- 7.3 Applications of Noether's Theorem -- 7.4 Poincaré Invariance -- 7.5 Representations of the Lorentz Group -- 7.6 Spin of a Massless Particle -- 7.7 Pauli-Gürsey Group -- 8 S-Matrix -- 8.1 Definition of the S-Matrix -- 8.2 Dyson's Formula for the S-Matrix -- 8.3 Wick's Theorem -- 8.4 Feynman Diagrams -- 8.5 Examples of S-Matrix Elements -- 8.5.1 Compton Scattering -- 8.5.2 Pion Decay to Muons -- Two-Photon Decay of 0 -- 8.6 Furry's Theorem -- 8.7 Two-Photon Decays of Neutral Mesons -- 9 Cross-Sections and Decay Widths -- 9.1 Møller's Formulas -- 9.2 Examples of Cross-Sections and Decay Widths -- 9.3 Inclusive Reactions -- 9.4 Optical Theorem -- 9.5 Three-Body Decays -- 10 Discrete Symmetries -- 10.1 Symmetries and Unitary Transformations -- 10.2 Parity of Antiparticles -- 10.3 Isospin Parity and G-Conjugation -- 10.4 Antiunitary Transformations -- 10.5 CPT Theorem -- 11 Green's Functions -- 11.1 Gell-Mann-Low Relation -- 11.2 Green's Functions and Their Generating Functionals -- 11.3 Different Time-Orderings in the Lagrangian Formalism -- 11.4 Matthews' Theorem -- 11.5 Example of Matthews' Theorem with Modification -- 11.6 Reduction Formula in the Interaction Picture -- 11.7 Asymptotic Conditions -- 11.8 Unitarity Condition on the Green's Function -- 11.9 Retarded Green's Functions -- 12 Renormalization Theory -- 12.1 Lippmann-Schwinger Equation. 12.2 Renormalized Interaction Picture -- 12.3 Mass Renormalization -- 12.4 Renormalization of Field Operators -- 12.5 Renormalized Propagators -- 12.6 Renormalization of Vertex Functions -- 12.7 Ward-Takahashi Identity -- 12.8 Integral Representation of the Propagator -- 12.8.1 Integral Representation -- 12.8.2 Self-Energy -- 12.8.3 Integral Representation of the Electromagnetic Field Propagator -- 12.8.4 Goto-Imamura-Schwinger Term -- 13 Classification of Hadrons and Models -- 13.1 Unitary Groups -- 13.1.1 Representations of a Group -- 13.1.2 Direct Product Representation -- 13.1.3 Lie Groups -- 13.1.4 Orthogonal Group $O(n)$ -- 13.1.5 Unitary Group $U(n)$ -- 13.1.6 Special Unitary Group $SU(2)$ -- 13.2 The Group $SU(3)$ -- 13.2.1 Generators of $SU(3)$ -- 13.2.2 I -, U -, and V -Spin -- 13.2.3 Three-Body Quark Systems -- 13.2.4 Mass Formulas -- 13.2.5 Baryon Magnetic Moments -- 13.2.6 $SU(3)$ -Invariant Interactions -- 13.2.7 Casimir Operator -- 13.3 Universality of π -Meson Decay Interactions -- 13.4 Beta-Decay -- 13.5 Universality of the Fermi Interaction -- 13.6 Quark Model in Weak Interactions -- 13.7 Quark Model in Strong Interactions -- 13.7.1 Mass Formula -- 13.7.2 Magnetic Moments -- 13.8 Parton Model -- 14 What Is Gauge Theory? -- 14.1 Gauge Transformations of the Electromagnetic Field -- 14.2 Non-Abelian Gauge Fields -- 14.3 Gravitational Field as a Gauge Field -- 15 Spontaneous Symmetry Breaking -- 15.1 Nambu-Goldstone Particles -- 15.2 Sigma Model -- 15.3 The Mechanism of Spontaneous

Symmetry Breaking -- 15.4 Higgs Mechanism -- 15.5 Higgs
 Mechanism with Covariant Gauge Condition -- 15.6 Kibble's Theorem
 -- 15.6.1 Adjoint Representation -- 15.6.2 Kibble's Theorem -- 16
 Weinberg-Salam Model -- 16.1 Weinberg-Salam Model -- 16.2
 Introducing Fermions -- 16.3 GIM Mechanism -- 16.4 Anomalous
 Terms and Generation of Fermions -- 16.5 Grand Unified Theory.
 17 Path-Integral Quantization Method -- 17.1 Quantization of a Point-
 Particle System -- 17.2 Quantization of Fields -- 18 Quantization of
 Gauge Fields Using the Path-Integral Method -- 18.1 Quantization of
 Gauge Fields -- 18.1.1 A Method to Specify the Gauge Condition --
 18.1.2 The Additional Term Method -- 18.2 Quantization of the
 Electromagnetic Field -- 18.2.1 Specifying the Gauge Condition --
 18.2.2 The Additional Term Method -- 18.2.3 Ward-Takahashi Identity
 -- 18.2.4 Gauge Transformations for Green's Functions -- 18.3
 Quantization of Non-Abelian Gauge Fields -- 18.3.1 A Method to
 Specify the Gauge Condition -- 18.3.2 The Additional Term Method --
 18.3.3 Hermitization of the Lagrangian Density -- 18.3.4 Gauge
 Transformations of Green's Functions -- 18.4 Axial Gauge -- 18.5
 Feynman Rules in the α -Gauge -- 19 Becchi-Rouet-Stora
 Transformations -- 19.1 BRS Transformations -- 19.2 BRS Charge --
 19.3 Another BRS Transformation -- 19.4 BRS Identity and Slavnov-
 Taylor Identity -- 19.5 Representations of the BRS Algebra -- 19.6
 Unitarity of the S-Matrix -- 19.7 Representations of the Extended BRS
 Algebra -- 19.8 Representations of BRS Transformations for Auxiliary
 Fields -- 19.9 Representations of BRSNO Algebras -- 20
 Renormalization Group -- 20.1 Renormalization Group for QED -- 20.2
 Approximate Equations for the Renormalization Group -- 20.2.1
 Approximation Neglecting Vacuum Polarization -- 20.2.2
 Approximation Taking into Account Vacuum Polarization -- 20.3
 Ovsianikov's Equation -- 20.4 Linear Equations for the Renormalization
 Group -- 20.5 Callan-Symanzik Equation -- 20.6 Homogeneous
 Callan-Symanzik Equation -- 20.7 Renormalization Group for Non-
 Abelian Gauge Theories -- 20.8 Asymptotic Freedom -- 20.8.1
 Electron-Positron Collision -- 20.8.2 Bjorken Scaling Law -- 20.9
 Gauge Dependence of Green's Functions -- 21 Theory of Confinement.
 21.1 Gauge Independence of the Confinement Condition -- 21.2
 Sufficient Condition for Colour Confinement -- 21.3 Colour
 Confinement and Asymptotic Freedom -- 22 Anomalous Terms and
 Dispersion Theory -- 22.1 Examples of Indefiniteness and Anomalous
 Terms -- 22.1.1 Vacuum Polarization -- 22.1.2 Goto-Imamura-
 Schwinger Term -- 22.1.3 Triangle Anomaly Term -- 22.1.4 Trace
 Anomaly Term -- 22.2 Dispersion Theory for Green's Functions -- 22.3
 Subtractions in Dispersion Relations -- 22.4 Heisenberg Operators --
 22.5 Subtraction Condition -- 22.6 Anomalous Trace Identity -- 22.7
 Triangle Anomaly Terms -- 22.7.1 Renormalization Condition -- The
 Set $\{P\}$ -- The Set $\{W\}$ -- The Set $\{A\}$ -- The Set $\{C\}$ -- The Set $\{D\}$
 -- The Set $\{B\}$ -- The Set $\{S\}$ -- 22.7.2 Ward-Takahashi Identity for
 C -- 22.7.3 Proof of the Adler-Bardeen Theorem Using the Callan-
 Symanzik Equation -- Postface -- References -- Index.
