1. Record Nr. UNISA996203217303316

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Titolo	Gauge field theories [[electronic resource]] : an introduction with applications / / Mike Guidry
Pubbl/distr/stampa	New York, : Wiley, c1991
ISBN	1-281-76436-1 9786611764364 3-527-61735-3 3-527-61736-1
Descrizione fisica	1 online resource (624 p.)
Disciplina	530.1/435 530.1435
Soggetti	Gauge fields (Physics) Quantum field theory
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	"A Wiley-Interscience publication."
Nota di bibliografia	Includes bibliographical references (p. 579-592) and index.
Nota di contenuto	GAUGE FIELD THEORIES AN INTRODUCTION WITH APPLICATIONS; Contents; Part I: QUANTUM FIELD THEORY; 1. Relativistic Wave Equations; 1.1 Special Relativity and Spacetime; 1.2 Contravariant and Covariant Vectors; 1.3 Lorentz Transformations; 1.4 Klein-Gordon Equation; 1.5 Dirac Equation; 1.6 Prescriptions for Negative-Energy States; 1.7 Feynman Diagrams; 1.8 Loops, Trees, and Infinities; 1.9 Background and Further Reading; 2. Canonical Quantization of Local Field Theories; 2.1 Quantization in Discrete Mechanics; 2.2 General Properties of the Action; 2.3 Lagrangian Densities for Free Fields 2.4 Quantization of the Real Scalar Field2.5 Quantization of a Complex Scalar Field; 2.6 Quantization of the Dirac Field; 2.7 Quantization of the Electromagnetic Field; 2.8 Noether's Theorem; 2.9 Interactions between Fields; 2.10 Background and Further Reading; 3. Perturbation Theory and Evaluation of the S-Matrix; 3.1 Interaction Representation; 3.2 Definition of the S-Matrix; 3.3 Interaction Picture Fourier Expansions; 3.4 Reduction by Wick's Theorem; 3.5 Example: Self-coupled Scalar Field; 3.6 Differential Cross Sections; 3.7 Example: Spinor Electrodynamics; 3.8 Graphs That Are Excluded

3.9 Feynman Rules for Electrodynamics3.10 Background and Further Reading; 4. Path Integral Quantization; 4.1 Nonrelativistic Path Integral; 4.2 Path Integral for Field Theory; 4.3 Evaluation of Path Integrals; 4.4 Feynman Diagrams; 4.5 Grassmann Variables; 4.6 Fermions in the Path Integral; 4.7 Ghost Fields; 4.8 Background and Further Reading; Part II: GAUGE FIELD THEORIES; 5. Symmetry and Group Theory; 5.1 Introduction to the Theory of Groups; 5.2 Lie Groups and Lie Algebras; 5.3 Unitary Symmetries; 5.4 Topological Properties; 5.5 Background and Further Reading
6. Weak and Electromagnetic Interactions6.1 QED: Prototype Quantum Field Theory; 6.2 Phenomenology of the Weak Interactions; 6.3 Problems with the Fermi Phenomenology; 6.4 Renormalization in QED; 6.5 Renormalization and Weak Interactions; 6.6 Background and Further Reading; 7. Yang - Mills Fields; 7.1 Local Non-Abelian Gauge Invariance; 7.2 Properties of Yang - Mills Fields; 7.3 Path-Dependent Representations; 7.4 Path Integral Quantization; 7.5 Background and Further Reading; 8. Spontaneously Broken Symmetry and the Higgs Mechanism; 8.1 Classical Symmetry Modes; 8.2 A Simple Example
8.3 Goldstone Bosons8.4 The Higgs Mechanism; 8.5 Some General Remarks; 8.6 Background and Further Reading; 9. Standard Electroweak Model; 9.1 The Electroweak Gauge Group; 9.2 Standard Model for Leptonic Interactions; 9.3 Inclusion of Hadrons; 9.4 Critique of the Standard Theory; 9.5 Background and Further Reading; 10. The Strong Interactions and Quantum Chromodynamics; 10.1 Properties of Quarks; 10.2 Evidence for Gluons; 10.3 Deep Inelastic Lepton Scattering; 10.4 Partons; 10.5 The Quark-Parton Model; 10.6 Quantum Chromodynamics; 10.7 Background and Further Reading; 11. Grand Unified Theories
11.1 Evolution of Coupling Constants

Sommario/riassunto

Acquaints readers with the main concepts and literature of elementary particle physics and quantum field theory. In particular, the book is concerned with the elaboration of gauge field theories in nuclear physics; the possibility of creating fundamental new states of matter such as an extended quark-gluon plasma in ultra-relativistic heavy ion collisions; and the relation of gauge theories to the creation and evolution of the universe. Divided into three parts, it opens with an introduction to the general principles of relativistic quantum field theory followed by the essential ingredients of