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Descrizione fisica	1 online resource (xii, 271 pages) : digital, PDF file(s)
Collana	Cambridge lecture notes in physics ; ; 15
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Nota di bibliografia	Includes bibliographical references (p. 261-266) and index.
Nota di contenuto	QED, QCD, and confinement -- Scalar field -- Path-integral and lattice regularization -- Path integral in quantum mechanics -- Regularization by discretization -- Analytic continuation to imaginary time -- Spectrum of the transfer operator -- Latticization of the scalar field -- Transfer operator for the scalar field -- Fourier transformation on the lattice -- Free scalar field -- Particle interpretation -- Back to real time -- O(n) models -- Goldstone bosons -- O(n) models as spin models -- Phase diagram and critical line -- Weak-coupling expansion -- Renormalization -- Renormalization-group beta functions -- Hopping expansion -- Luscher-Weisz solution -- Numerical simulation -- Real-space renormalization group and universality -- Universality at weak coupling -- Triviality and the Standard Model -- Gauge field on the lattice -- QED action -- QCD action -- Lattice gauge field -- Gauge-invariant lattice path integral -- Compact and non-compact Abelian gauge theory -- Hilbert space and transfer operator -- The kinetic-energy operator -- Hamiltonian for continuous time -- Wilson loop and Polyakov line -- U(1) and SU(n) gauge theory -- Potential at weak coupling -- Asymptotic freedom -- Strong-coupling expansion -- Potential at strong coupling -- Confinement versus screening --

Glueballs -- Coulomb phase, confinement phase -- Mechanisms of confinement -- Scaling and asymptotic scaling, numerical results -- Fermions on the lattice -- Naive discretization of the Dirac action -- Species doubling -- Wilson's fermion method.

Sommario/riassunto

This book provides a concrete introduction to quantum fields on a lattice: a precise and non-perturbative definition of quantum field theory obtained by replacing continuous space-time by a discrete set of points on a lattice. The path integral on the lattice is explained in concrete examples using weak and strong coupling expansions. Fundamental concepts such as 'triviality' of Higgs fields and confinement of quarks and gluons into hadrons are described and illustrated with the results of numerical simulations. The book also provides an introduction to chiral symmetry and chiral gauge theory, as well as quantized non-abelian gauge fields, scaling and universality. Based on the lecture notes of a course given by the author, this book contains many explanatory examples and exercises, and is suitable as a textbook for advanced undergraduate and graduate courses.