

1. Record Nr.	UNINA9910955437603321
Autore	Zinn-Justin Jean
Titolo	Phase transitions and renormalization group / / Jean Zinn-Justin
Pubbl/distr/stampa	Oxford, : Oxford University Press, 2007
ISBN	0191527742 9780191527746
Edizione	[1st ed.]
Descrizione fisica	xii, 452 p
Collana	Oxford graduate texts
Disciplina	530.414
Soggetti	Phase transformations (Statistical physics) Renormalization (Physics)
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Contents -- 1 Quantum field theory and the renormalization group -- 1.1 Quantum electrodynamics: A quantum field theory -- 1.2 Quantum electrodynamics: The problem of infinities -- 1.3 Renormalization -- 1.4 Quantum field theory and the renormalization group -- 1.5 A triumph of QFT: The Standard Model -- 1.6 Critical phenomena: Other infinities -- 1.7 Kadanoff and Wilson's renormalization group -- 1.8 Effective quantum field theories -- 2 Gaussian expectation values. Steepest descent method -- 2.1 Generating functions -- 2.2 Gaussian expectation values. Wick's theorem -- 2.3 Perturbed Gaussian measure. Connected contributions -- 2.4 Feynman diagrams. Connected contributions -- 2.5 Expectation values. Generating function. Cumulants -- 2.6 Steepest descent method -- 2.7 Steepest descent method: Several variables, generating functions -- Exercises -- 3 Universality and the continuum limit -- 3.1 Central limit theorem of probabilities -- 3.2 Universality and fixed points of transformations -- 3.3 Random walk and Brownian motion -- 3.4 Random walk: Additional remarks -- 3.5 Brownian motion and path integrals -- Exercises -- 4 Classical statistical physics: One dimension -- 4.1 Nearest-neighbour interactions. Transfer matrix -- 4.2 Correlation functions -- 4.3 Thermodynamic limit -- 4.4 Connected functions and cluster properties -- 4.5 Statistical models: Simple examples -- 4.6 The Gaussian model -- 4.7 Gaussian model: The

continuum limit -- 4.8 More general models: The continuum limit --
 Exercises -- 5 Continuum limit and path integrals -- 5.1 Gaussian path
 integrals -- 5.2 Gaussian correlations. Wick's theorem -- 5.3 Perturbed
 Gaussian measure -- 5.4 Perturbative calculations: Examples --
 Exercises -- 6 Ferromagnetic systems. Correlation functions -- 6.1
 Ferromagnetic systems: Definition -- 6.2 Correlation functions. Fourier
 representation.
 6.3 Legendre transformation and vertex functions -- 6.4 Legendre
 transformation and steepest descent method -- 6.5 Two- and four-
 point vertex functions -- Exercises -- 7 Phase transitions: Generalities
 and examples -- 7.1 Infinite temperature or independent spins -- 7.2
 Phase transitions in infinite dimension -- 7.3 Universality in infinite
 space dimension -- 7.4 Transformations, fixed points and universality
 -- 7.5 Finite-range interactions in finite dimension -- 7.6 Ising model:
 Transfer matrix -- 7.7 Continuous symmetries and transfer matrix --
 7.8 Continuous symmetries and Goldstone modes -- Exercises -- 8
 Quasi-Gaussian approximation: Universality, critical dimension -- 8.1
 Short-range two-spin interactions -- 8.2 The Gaussian model: Two-
 point function -- 8.3 Gaussian model and random walk -- 8.4
 Gaussian model and field integral -- 8.5 Quasi-Gaussian
 approximation -- 8.6 The two-point function: Universality -- 8.7
 Quasi-Gaussian approximation and Landau's theory -- 8.8 Continuous
 symmetries and Goldstone modes -- 8.9 Corrections to the quasi-
 Gaussian approximation -- 8.10 Mean-field approximation and
 corrections -- 8.11 Tricritical points -- Exercises -- 9 Renormalization
 group: General formulation -- 9.1 Statistical field theory. Landau's
 Hamiltonian -- 9.2 Connected correlation functions. Vertex functions
 -- 9.3 Renormalization group: General idea -- 9.4 Hamiltonian flow:
 Fixed points, stability -- 9.5 The Gaussian fixed point -- 9.6 Eigen-
 perturbations: General analysis -- 9.7 A non-Gaussian fixed point: The
 ϵ -- ϵ -- expansion -- 9.8 Eigenvalues and dimensions of
 local polynomials -- 10 Perturbative renormalization group: Explicit
 calculations -- 10.1 Critical Hamiltonian and perturbative expansion --
 10.2 Feynman diagrams at one-loop order -- 10.3 Fixed point and
 critical behaviour -- 10.4 Critical domain.
 10.5 Models with $O(N)$ orthogonal symmetry -- 10.6 Renormalization
 group near dimension 4 -- 10.7 Universal quantities: Numerical results
 -- 11 Renormalization group: N -component fields -- 11.1
 Renormalization group: General remarks -- 11.2 Gradient flow -- 11.3
 Model with cubic anisotropy -- 11.4 Explicit general expressions: RG
 analysis -- 11.5 Exercise: General model with two parameters --
 Exercises -- 12 Statistical field theory: Perturbative expansion -- 12.1
 Generating functionals -- 12.2 Gaussian field theory. Wick's theorem
 -- 12.3 Perturbative expansion -- 12.4 Loop expansion -- 12.5
 Dimensional continuation and regularization -- Exercises -- 13 The
 ϵ -- ϵ -- $[\sup(4)]$ field theory near dimension 4 -- 13.1
 Effective Hamiltonian. Renormalization -- 13.2 Renormalization group
 equations -- 13.3 Solution of RGE: The ϵ -- ϵ -- expansion
 -- 13.4 Effective and renormalized interactions -- 13.5 The critical
 domain above $T_{\text{sub}(c)}$ -- 14 The $O(N)$ symmetric ϵ -- ϵ -- $[\sup(2)][\sup(2)]$ field theory in the large N limit -- 14.1 Algebraic
 preliminaries -- 14.2 Integration over the field ϵ -- ϵ -- : The
 determinant -- 14.3 The limit $N \epsilon$ -- ϵ -- ϵ -- :
 The critical domain -- 14.4 The ϵ -- ϵ -- $[\sup(2)][\sup(2)]$ field
 theory for $N \epsilon$ -- ϵ -- ϵ -- 14.5 Singular part of
 the free energy and equation of state -- 14.6 The ϵ -- ϵ -- ϵ --
 ϵ -- ϵ --) and ϵ -- ϵ -- $[\sup(2)] \epsilon$ -- ϵ -- $[\sup(2)]$
 $[\sup(2)]$ two-point functions -- 14.7 Renormalization group and

corrections to scaling -- 14.8 The $1/N$ expansion -- 14.9 The exponent at order $1/N$ -- 14.10 The non-linear ϵ -- ϵ model -- 15 The non-linear ϵ -- ϵ model on the lattice -- 15.1 The non-linear ϵ -- ϵ model on the lattice -- 15.2 Low-temperature expansion -- 15.3 Formal continuum limit -- 15.4 Regularization. 15.5 Zero-momentum or IR divergences -- 15.6 Renormalization group -- 15.7 Solution of the RGE. Fixed points -- 15.8 Correlation functions: Scaling form -- 15.9 The critical domain: Critical exponents -- 15.10 Dimension 2 -- 15.11 The ϵ -- ϵ field theory at low temperature -- 16 Functional renormalization group -- 16.1 Partial field integration and effective Hamiltonian -- 16.2 High-momentum mode integration and RGE -- 16.3 Perturbative solution: ϵ -- ϵ theory -- 16.4 RGE: Standard form -- 16.5 Dimension 4 -- 16.6 Fixed point: ϵ -- ϵ expansion -- 16.7 Local stability of the fixed point -- Appendix -- A1 Technical results -- A2 Fourier transformation: Decay and regularity -- A3 Phase transitions: General remarks -- A4 $1/N$ expansion: Calculations -- A5 Functional renormalization group: Complements -- Bibliography -- Index -- A -- B -- C -- D -- E -- F -- G -- H -- I -- K -- L -- M -- N -- O -- P -- Q -- R -- S -- T -- U -- V -- W.

Sommario/riassunto

The renormalization group is one of most important theoretical concepts that has emerged in physics during the twentieth century. It explains important properties of fundamental interactions at the microscopic scale, as well as universal properties of continuous macroscopic phase transitions.
