Fetter And Walecka Many Body Solutions

This textbook is for a course in advanced solid-state theory. It is aimed at graduate students in their third or fourth year of study who wish to learn the advanced techniques of solid-state theoretical physics. The method of Green's functions is introduced at the beginning and used throughout. Indeed, it could be considered a book on practical applications of Green's functions, although I prefer to call it a book on physics. The method of Green's functions has been used by many theorists to derive equations which, when solved, provide an accurate numerical description of many processes in solids and quantum fluids. In this book I attempt to summarize many of these theories in order to show how Green's functions are used to solve real problems. My goal, in writing each section, is to describe calculations which can be compared with experiments and to provide these comparisons whenever available. The student is expected to have a background in quantum mechanics at the level acquired from a graduate course using the textbook by either L. I. Schiff, A. S. Davydov, or I. Landau and E. M. Lifshiftz. Similarly, a prior course in solid-state physics is expected, since the reader is assumed to know concepts such as Brillouin zones and energy band theory. Each chapter has problems which are an important part of the lesson; the problems often provide physical insights which are not in the text. Sometimes the answers to the problems are provided, but usually not.

The book contains pedagogical articles on the dominant non-stochastic methods of microscopic many-body theories: Density functional theory, coupled cluster theory, and correlated basis functions methods in their widest sense. Further articles introduce students to applications of these methods in front -- line research such as Bose-Einstein condensates, the nuclear many-body problem, and the dynamics of quantum liquids. These keynote articles are supplemented by experimental reviews on intimately connected topics of current relevance. The book addresses the striking lack of pedagogical reference literature in the field that allows researchers to acquire the requisite physical insight and technical skills. The volume should, therefore, not only researchers to acquire the requisite physical insight and technical skills. The volume should, therefore, not only serve as a collection of information relevant to those who attended the school, but it provides be useful reference material to a broad range of theoretical physicists in condensed matter and nuclear theory.

This book bridges a gap between two major communities of Condensed Matter Physics, Semiconductors and Superconductors, that have thrived independently. Using an original perspective that the key particles of these materials, excitons and Cooper pairs, are composite bosons, the authors raise fundamental questions of current interest: how does the Pauli exclusion principle wield its power on the fermionic components of bosonic particles at a microscopic level and how this affects their macroscopic physics? What can we learn from Wannier and Frenkel excitons and from Cooper pairs that helps us understand "bosonic condensation" of composite bosons and its difference from Bose-Einstein condensation of elementary bosons? The authors begin with a solid mathematical and physical foundation to derive excitons and Cooper pairs. They further introduce Shiva diagrams as a graphic support to grasp the many-body physics induced by fermion exchange in the absence of fermion-fermion interaction - a novel mechanism not visualized by standard Feynman diagrams. Advanced undergraduate or graduate students in physics with no specific background will benefit from this book. The developed concepts and formalism should also be useful for current research on ultracold atomic gases and exciton-polaritons, and quantum information.

In their prior Dover book, the authors provided a self-contained account of classical mechanics; this supplement/update offers a bridge to contemporary mechanics. Topics include nonlinear continuous systems. 2006 edition.

Field Theories in Condensed Matter Physics

Equilibrium Theory

Many-Particle Physics

Dirkfest '92 - A Symposium In Honor Of J D Walecka's Sixtieth Birthday

A Contemporary Approach

The Many-Body Problem in Quantum Mechanics

Study Edition

This book provides an introduction to many-body methods for applications in quantum chemistry. These methods, originating in field-theory, offer an alternative to conventional quantum-chemical approaches to the treatment of the many-electron problem in molecules. Starting with a general introduction to the atomic and molecular many-electron problem, the book then develops a stringent

formalism of field-theoretical many-body theory, culminating in the diagrammatic perturbation expansions of many-body Green's functions or propagators in terms of Feynman diagrams. It also introduces and analyzes practical computational methods, such as the field-tested algebraic-diagrammatic construction (ADC) schemes. The ADC concept can also be established via a wave-function based procedure, referred to as intermediate state representation (ISR), which bridges the gap between propagator and wave-function formulations. Based on the current rapid increase in computer power and the development of efficient computational methods, quantum chemistry has emerged as a potent theoretical tool for treating ever-larger molecules and problems of chemical and physical interest. Offering an introduction to many-body methods, this book appeals to advanced students interested in an alternative approach to the many-electron problem in molecules, and is suitable for any courses dealing with computational methods in quantum chemistry.

Intended for graduates in physics and related fields, this is a self-contained treatment of the physics of many-body systems from the point of view of condensed matter. The approach, quite traditionally, covers all the important diagram techniques for normal and superconducting systems, including the zero-temperature perturbation theory, and the Matsubara, Keldysh, and Nambu-Gorov formalisms. The aim is not to be exhaustive, but to present just enough detail to enable students to follow the current research literature or to apply the techniques to new problems. Many of the examples are drawn from mesoscopic physics, which deals with systems small enough that quantum coherence is maintained throughout the volume, and which therefore provides an ideal testing ground for many-body theories. '

Modern experimental developments in condensed matter and ultracold atom physics present formidable challenges to theorists. This book provides a pedagogical introduction to quantum field theory in many-particle physics, emphasizing the applicability of the formalism to concrete problems. This second edition contains two new chapters developing path integral approaches to classical and quantum nonequilibrium phenomena. Other chapters cover a range of topics, from the introduction of many-body techniques and functional integration, to renormalization group methods, the theory of response functions, and topology. Conceptual aspects and formal methodology are emphasized, but the discussion focuses on practical experimental applications drawn largely from condensed matter physics and neighboring fields. Extended and challenging problems with fully worked solutions provide a bridge between formal manipulations and research-oriented thinking. Aimed at elevating graduate students to a level where they can engage in independent research, this book complements graduate level courses on many-particle theory.

Quantum Field Theory of Many-Body Systems
Many-Body Quantum Theory in Condensed Matter Physics
From the Origin of Sound to an Origin of Light and Electrons
Second Edition
Quantum Theory of Many-Body Systems
A Guide to Feynman Diagrams in the Many-Body Problem

This book provides an introduction to the body of theory shared by several branches of modern optics--nonlinear optics, quantum electronics, laser physics, and quantum optics--with an emphasis on quantum and statistical aspects. It is intended for well prepared undergraduate and graduate students in physics, applied physics, electrical engineering, and chemistry who seek a level of preparation of sufficient maturity to enable them to follow the specialized literature.

The book is an introduction to quantum field theory applied to condensed matter physics. The topics cover modern applications in electron systems and electronic properties of mesoscopic systems and nanosystems. The textbook is developed for a graduate or advanced undergraduate course with exercises which aim at giving students the ability to confront real problems.

The application of field theoretic techniques to problems in condensed matter physics has generated an array of concepts and mathematical techniques to attack a range of problems such as the theory of quantum phase transitions, the quantum Hall effect, and quantum wires. While concepts such as the renormalization group, topology, and bosonization h

"This book is a revised and updated version of the most comprehensive text on nuclear physics, first published in 1995. It maintains the original goal of providing a clear, logical, in-depth and unifying treatment of modern nuclear theory, ranging from the nonrelativistic many-body problem to the standard model of the strong, electromagnetic, and weak interactions. In addition, new chapters on the theoretical and experimental advances made in nuclear physics in the past decade have been incorporated." "This book is designed to provide graduate students with a basic understanding of modern nuclear and hadronic physics needed to explore the frontiers of the field. Researchers will benefit from the updates on developments and the bibliography."--Jacket.

Excitons and Cooper Pairs
Propagator Description of Quantum Mechanics in Many-body Systems
Condensed Matter Field Theory
Two Composite Bosons in Many-Body Physics
Theoretical Mechanics of Particles and Continua
Course of Theoretical Physics

This comprehensive textbook on the quantum mechanics of identical particles includes a wealth of valuable experimental data, in particular recent results from direct knockout reactions directly related to the single-particle propagator in many-body theory. The comparison with data is incorporated from the start, making the abstract concept of propagators vivid and accessible. Results of numerical calculations using propagators or Green's functions are also presented. The material has been thoroughly tested in the classroom and the introductory chapters provide a

seamless connection with a one-year graduate course in quantum mechanics. While the majority of books on many-body theory deal with the subject from the viewpoint of condensed matter physics, this book emphasizes finite systems as well and should be of considerable interest to researchers in nuclear, atomic, and molecular physics. A unified treatment of many different many-body systems is presented using the approach of self-consistent Green's functions. The second edition contains an extensive presentation of finite temperature propagators and covers the technique to extract the self-energy from experimental data as developed in the dispersive optical model.The coverage proceeds systematically from elementary concepts, such as second quantization and mean-field properties, to a more advanced but self-contained presentation of the physics of atoms, molecules, nuclei, nuclear and neutron matter, electron gas, quantum liquids, atomic Bose-Einstein and fermion condensates, and pairing correlations in finite and infinite systems, including finite temperature.

Self-contained treatment of nonrelativistic many-particle systems discusses both formalism and applications in terms of ground-state (zero-temperature) formalism, finite-temperature formalism, canonical transformations, and applications to physical systems. 1971 edition.

Superb introduction for nonspecialists covers Feynman diagrams, quasi particles, Fermi systems at finite temperature, superconductivity, vacuum amplitude, Dyson's equation, ladder approximation, and more. "A great delight." — Physics Today. 1974 edition.

Single-volume account of methods used in dealing with the many-body problem and the resulting physics. Single-particle approximations, second quantization, many-body perturbation theory, Fermi fluids, superconductivity, many-boson systems, more. Each chapter contains well-chosen problems. Only prerequisite is basic understanding of elementary quantum mechanics. 1967 edition.

Physical Kinetics

The Physics of Quantum Fields

A Supplement to Theoretical Mechanics of Particles and Continua

Introduction to Many-Body Physics

Photon-Atom Interactions

Extended Density Functionals in Nuclear Structure Physics

The approach to physical kinetics is closely integrated with that of other branches of physics as presented in the companion volumes of this series. The major part of the contents is concerned with a systematic development of the theory of plasmas, the authority being firmly rooted in the pioneer work of Landau. Although the main scope concerns fully ionized gaseous plasmas, corresponding results are also given for partially ionized plasmas, relativistic plasmas, degenerate or non-ideal plasmas and solid state plasmas. Problems (with answers) are to be found in the text. This work completes the Course of Theoretical Physics begun over 20 years ago

Quantum Theory of Many-Particle SystemsCourier Corporation

In a certain sense this book has been twenty-five years in the writing, since I first struggled with the foundations of the subject as a graduate student. It has taken that long to develop a deep appreciation of what Gibbs was attempting to convey to us near the end of his life and to understand fully the same ideas as resurrected by E.T. Jaynes much later. Many classes of students were destined to help me sharpen these thoughts before I finally felt confident that, for me at least, the foundations of the subject had been clarified sufficiently. More than anything, this work strives to address the following questions: What is statistical mechanics? Why is this approach so extraordinarily effective in describing bulk matter in terms of its constituents? The response given here is in the form of a very definite point of view-the principle of maximum entropy (PME). There have been earlier attempts to approach the subject in this way, to be sure, reflected in the books by Tribus [Thermostat ics and Thermodynamics, Van Nostrand, 1961], Baierlein [Atoms and Information Theory, Freeman, 1971], and Hobson [Concepts in Statistical Mechanics, Gordon and Breach, 1971].

Aimed at graduate students and researchers, this book covers the key aspects of the modern quantum theory of solids, including up-to-date ideas such as quantum fluctuations and strong electron correlations. It presents in the main concepts of the modern quantum theory of solids, as well as a general description of the essential theoretical methods required when working with these systems. Diverse topics such as general theory of phase transitions, harmonic and anharmonic lattices, Bose condensation and superfluidity, modern aspects of magnetism including resonating valence bonds, electrons in metals, and strong electron correlations are treated using unifying concepts of order and elementary excitations. The main theoretical tools used to treat these problems are introduced and explained in a simple way, and their applications are demonstrated through concrete examples.

New Vistas in Nuclear Dynamics

Methods of Quantum Field Theory in Statistical Physics

Quantum Many-particle Systems

Quantum Field Theory Ii

Nonlinear Mechanics

The 1985 Summer School on Nuclear Dynamics, organized by the Nuclear Physics Division of the Netherlands' Physical Society, was the sixth in a series that started in 1963. This year's topic has been nuclear dynamics rather than nuclear structure as in the foregoing years. This change reflects a shift in focus to nuclear processes at higher energy, or, more generally, to nuclear processes under less traditional circumstances. For many years nuclear physics has been restricted to the domain of the ground state and excited states of low energy. The boundaries between nuclear physics and high-energy physics are rapidly disappearing, however, and the future will presumably show that the two fields of research will contribute to one another. With the advent of a new generation of heavy-ion and electron accelerators research activities on various new aspects of nuclear dynamics over a wide range of energies have become possible. This research focuses in particular on nonnucleonic degrees of freedom and on nuclear matter under extreme conditions, which require the explicit introduction of quarks into the description of nuclear reactions. Mean-field formulations are no longer adequate for the description of nucleus nucleus collisions at high nucleon energies as the nucleon-nucleon collisions begin to dominate. Novel dynamical theories are being developed, such as those based upon the Boltzmann equation or hadrodynamic models. The vitality of nuclear physics was clearly demonstrated by the enthusiastic lecturers at this summer school. They presented a series of clear and thorough courses on the subjects above.

Deterministic simulation of the particle transport in semiconductor devices is an interesting alternative to the common Monte Carlo approach. In this book, a state-of-the-art technique called the multigroup approach is presented and applied to a variety of transport problems in bulk semiconductors and semiconductor devices. High-field effects as well as hot-phonon phenomena in polar semiconductors are studied in detail. The mathematical properties of the presented numerical method are studied, and the method is applied to simulating the transport of a two-dimensional electron gas formed at a semiconductor heterostructure. Concerning semiconductor device simulation, several diodes and transistors fabricated of silicon and gallium arsenide are investigated. For all of these simulations, the numerical techniques employed are discussed in detail.This unique study of the application of direct methods for semiconductor device simulation provides the interested reader with an indispensable reference on this growing research area.

An introduction to the application of Feynman diagram techniques for researchers and advanced undergraduate students in condensed matter theory and many-body physics.

Quantum field theory provides the theoretical backbone to most modern physics. This book is designed to bring quantum field theory to a wider audience of physicists. It is packed with worked examples, witty diagrams, and applications intended to introduce a new audience to this revolutionary theory.

Introduction to Modern Methods of Quantum Many-body Theory and Their Applications

Basic Aspects of the Quantum Theory of Solids

Green's Functions and Condensed Matter

Techniques and Applications

Many-Body Methods for Atoms, Molecules and Clusters

A New Field-Theoretical Approach

Presentation of the basic theoretical formulation of Green's functions, followed by specific applications: transport coefficients of a metal, Coulomb gas, Fermi liquids, electrons and phonons, superconductivity, superfluidity, and magnetism. 1984 edition.

The book reviews several theoretical, mostly exactly solvable, models for selected systems in condensed states of matter, including the solid, liquid, and disordered states, and for systems of few or many bodies, both with boson, fermion, or anyon statistics. Some attention is devoted to models for quantum liquids, including superconductors and superfluids. Open problems in relativistic fields and quantum gravity are also briefly reviewed. The book ranges almost comprehensively, but concisely, across several fields of theoretical physics of matter at various degrees of correlation and at different energy scales, with relevance to molecular, solid-state, and liquid-state physics, as well as to phase transitions, particularly for quantum liquids. Mostly exactly solvable models are presented, with attention also to their numerical approximation and, of course, to their relevance for experiments. Contents:Low-Order Density MatricesSolvable Models for Small Clusters of FermionsSmall Clusters of BosonsAnyon Statistics with ModelsSuperconductivity and SuperfluidityExact Results for an Isolated Impurity in a SolidPair Potential and Many-Body Force Models for LiquidsAnderson Localization in Disordered SystemsStatistical Field Theory: Especially Models of Critical ExponentsRelativistic FieldsTowards Quantum GravityAppendices Readership: Graduate students and researchers in condensed matter theory.

This book gives a comprehensive account of relativistic many-body perturbation theory, based upon field theory. After some introductory chapters about time-independent and time dependent many-body perturbation theory (MBPT), the standard techniques of S-matrix and Green’s functions are reviewed. Next, the newly introduced covariant-evolution-operator method is described, which can be used, like the S-matrix method, for calculations in quantum electrodynamics (QED). Unlike the S-matrix method, this has a structure that is similar to that of MBPT and therefore can serve as basis for a unified theory. Such an approach is developed in the final chapters, and its equivalence to the Bethe-Salpeter equation is demonstrated. Possible applications are discussed and numerical illustrations given.

Advances in the study of dynamical systems have revolutionized the way that classical mechanics is taught and understood. Classical Dynamics, first published in 1998, is a comprehensive textbook that provides a complete description of this fundamental branch of physics. The authors cover all the material that one would expect to

find in a standard graduate course: Lagrangian and Hamiltonian dynamics, canonical transformations, the Hamilton-Jacobi equation, perturbation methods, and rigid bodies. They also deal with more advanced topics such as the relativistic Kepler problem, Liouville and Darboux theorems, and inverse and chaotic scattering. A key feature of the book is the early introduction of geometric (differential manifold) ideas, as well as detailed treatment of topics in nonlinear dynamics (such as the KAM theorem) and continuum dynamics (including solitons). The book contains many worked examples and over 200 homework exercises. It will be an ideal textbook for graduate students of physics, applied mathematics, theoretical chemistry, and engineering, as well as a useful reference for researchers in these fields. A solutions manual is available exclusively for instructors.

Field Theory of Non-Equilibrium Systems
Many-body Theory Exposed!
Multigroup Equations for the Description of the Particle Transport in Semiconductors
Foundations of Statistical Mechanics
Quantum Many-Body Physics in a Nutshell
The Nuclear Many-Body Problem

The experimental and theoretical investigation of nuclei far from the valley of beta-stability is the main subject of modern nuclear structure research. Although the most successful nuclear structure models are purely phenomenological, they nevertheless exploit basic properties of QCD at low energies. This book focuses on the current efforts to bridge the gap between phenomenology and the principles derived from QCD using the extended density functional approach which is based on the successful DFT methods to tackle similarly complex interacting systems in molecular and condensed matter physics. Conceived as a series of pedagogical lectures, this volume addresses researchers in the field as well as postgraduate students and non-specialized scientists from related areas who seek a high-level but accessible introduction to the subject.

This book explains the fundamental concepts and theoretical techniques used to understand the properties of quantum systems having large numbers of degrees of freedom. A number of complimentary approaches are developed, including perturbation theory; nonperturbative approximations based on functional integrals; general arguments based on order parameters, symmetry, and Fermi liquid theory; and stochastic methods.

For most of the last century, condensed matter physics has been dominated by band theory and Landau's symmetry breaking theory. In the last twenty years, however, there has been the emergence of a new paradigm associated with fractionalisation, topological order, emergent gauge bosons and fermions, and string condensation. These new physical concepts are so fundamental that they may even influence our understanding of the origin of light and fermions in the universe. This book is a pedagogical and systematic introduction to the new concepts and quantum field theoretical methods (which have fuelled the rapid developments) in condensed matter physics. It discusses many basic notions in theoretical physics which underlie physical phenomena in nature. Topics covered are dissipative quantum systems, boson condensation, symmetry breaking and gapless excitations, phase transitions, Fermi liquids, spin density wave states, Fermi and fractional statistics, quantum Hall effects, topological and quantum order, spin liquids, and string condensation. Methods covered are the path integral, Green's functions, mean-field theory, effective theory, renormalization group, bosonization in one- and higher dimensions, non-linear sigma-model, quantum gauge theory, dualities, slave-boson theory, and exactly soluble models beyond one-dimension. This book is aimed at teaching graduate students and bringing them to the frontiers of research in condensed matter physics.

This two-part text fills what has often been a void in the first-year graduate physics curriculum. Through its examination of particles and continua, it supplies a lucid and self-contained account of classical mechanics — which in turn provides a natural framework for introducing many of the advanced mathematical concepts in physics. The text opens with Newton's laws of motion and systematically develops the dynamics of classical particles, with chapters on basic principles, rotating coordinate systems, lagrangian formalism, small oscillations, dynamics of rigid bodies, and hamiltonian formalism, including a brief discussion of the transition to quantum mechanics. This part of the book also considers examples of the limiting behavior of many particles, facilitating the eventual transition to a continuous medium. The second part deals with classical continua, including chapters on string membranes, sound waves, surface waves on nonviscous fluids, heat conduction, viscous fluids, and elastic media. Each of these self-contained chapters provides the relevant physical background and develops the appropriate mathematical techniques, and problems of varying difficulty appear throughout the text.

Quantum Field Theory for the Gifted Amateur
Relativistic Many-Body Theory
Theoretical Nuclear and Subnuclear Physics
Quantum Theory of Many-Particle Systems
An Introduction
Feynman Diagram Techniques in Condensed Matter Physics

This book provides a comprehensive and pedagogical account of the various methods used in the quantum theory of finite systems, including molecular, atomic, nuclear, and particle phenomena. Covering both background material and advanced topics and including nearly 200 problems, Quantum Theory of Finite Systems has been designed to serve primarily as a text and will also prove useful as a reference in research. The first of the book's four parts introduces the basic mathematical apparatus: second quantization, canonical transformations, Wick theorems and the resulting diagram expansions, and oscillator models. The second part presents mean field approximations and the recently developed path integral methods for the quantization of collective modes. Part three develops perturbation theory in terms of both time-dependent Feynman diagrams and time-independent Goldstone diagrams. A fourth part discusses variational methods based on correlated wavefunctions, including spin correlations. The approximation schemes are formulated for fermions and bosons at eigher zero or non-zero temperature. Although the formalism developed applies to both finite and infinite systems, the book stresses those aspects of the theory that are specific to the description of finite systems. Thus special attention is given to mean field approximations, the ensuing broken symmetries, and the associated collective motions such as rotations. Conversely, some specific features of systems with infinite numbers of degrees of freedom (such as the thermodynamic limit, critical phenomena, and the elimination of ultraviolet divergencies) are deliberately omitted. Jean-Paul Blaizot and Georges Ripka are associated with the Centre d'Etudes Nucleaires de Saclay.

"The coverage proceeds in a systematic way from elementary concepts, such as second quantization and mean-field properties, to a more advanced but self-contained presentation of the physics of atoms, molecules, nuclei, nuclear and neutron matter, electron gas, quantum liquids, atomic Bose-Einstein and fermion condensates, and pairing correlations in finite and infinite systems."--BOOK JACKET.

A modern, graduate-level introduction to many-body physics in condensed matter, this textbook explains the tools and concepts needed for a research-level understanding of the correlated behavior of quantum fluids. Starting with an operator-based introduction to the quantum field theory of many-body physics, this textbook presents the Feynman diagram approach, Green's functions and finite-temperature many-body physics before developing the path integral approach to interacting systems. Special chapters are devoted to the concepts of Fermi liquid theory, broken symmetry, conduction in disordered systems, superconductivity and the physics of local-moment metals. A strong emphasis on concepts and numerous exercises make this an invaluable course book for graduate students in condensed matter physics. It will also interest students in nuclear, atomic and particle physics.

The physics of non-equilibrium many-body systems is one of the most rapidly expanding areas of theoretical physics. Traditionally used in the study of laser physics and superconducting kinetics, these techniques have more recently found applications in the study of dynamics of cold atomic gases, mesoscopic and nano-mechanical systems. The book gives a self-contained presentation of the modern functional approach to non-equilibrium field-theoretical methods. They are applied to examples ranging from biophysics to the kinetics of superfluids and superconductors. Its step-by-step treatment gives particular emphasis to the pedagogical aspects, making it ideal as a reference for advanced graduate students and researchers in condensed matter physics.

Exactly Solvable Models in Many-Body Theory

Classical Dynamics

Quantum Theory of Finite Systems

Order and Elementary Excitations

The ideal textbook for a one-semester introductory course for graduate students or advanced undergraduates This book provides an essential introduction to the physics of quantum many-body systems, which are at the heart of atomic and nuclear physics, condensed matter, and particle physics. Unlike other textbooks on the subject, it covers topics across a broad range of physical fields—phenomena as well as theoretical tools—and does so in a simple and accessible way. Edward Shuryak begins with Feynman diagrams of the quantum and statistical mechanics of a particle; in these applications, the diagrams are easy to calculate and there are no divergencies. He discusses the renormalization group and illustrates its uses, and covers systems such as weakly and strongly coupled Bose and Fermi gases, electron gas, nuclear matter, and quark-gluon plasmas. Phenomena include Bose condensation and superfluidity. Shuryak also looks at Cooper pairing and superconductivity for electrons in metals, liquid 3He, nuclear matter, and quark-gluon plasma. A recurring topic throughout is topological matter, ranging from ensembles of quantized vortices in superfluids and superconductors to ensembles of colored (QCD) monopoles and instantons in the QCD vacuum. Proven in the classroom, Quantum Many-Body Physics in a Nutshell is the ideal textbook for a one-semester introductory course for graduate students or advanced undergraduates. Teaches students how quantum many-body systems work across many fields of physics Uses path integrals from the very beginning Features the easiest introduction to Feynman diagrams available Draws on the most recent findings, including trapped Fermi and Bose atomic gases Guides students from traditional systems, such as electron gas and nuclear matter, to more advanced ones, such as quark-gluon plasma and the QCD vacuum

This textbook grew out of lecture notes the author used in delivering a quantum field theory (QFT) course for students (both in high energy physics and condensed matter) who already had an initial exposure to the subject.It begins with the path integral method of quantization presented in a systematic and clear-cut manner. Perturbation theory is generalized beyond tree level, to include radiative corrections (loops). Renormalization procedures and the Wilsonian renormalization group (RG flow) are discussed, asymptotic freedom of non-Abelian gauge theories is derived, and some applications in Quantum Chromodynamics (QCD) are considered, with a brief digression into the Standard Model (SM). The SM case requires a study of the spontaneous breaking of gauge symmetry, a phenomenon which would be more appropriate to call 'Higgsing of the gauge bosons.' Other regimes attainable in gauge theories are explained as well. In the condensed matter part, the Heisenberg and Ising model are discussed. The present textbook differs from many others in that it is relatively concise and, at the same time, teaches students to carry out actual calculations which they may encounter in QFT-related applications.

A gentle introduction to the physics of quantized fields and many-body physics. Based on courses taught at the University of Illinois, it concentrates on the basic conceptual issues that many students find difficult, and emphasizes the physical and visualizable aspects *of the subject. While the text is intended for students with a wide range of interests, many of the examples are drawn from condensed matter physics because of the tangible character of such systems. The first part of the book uses the Hamiltonian operator language of traditional quantum mechanics to treat simple field theories and related topics, while the Feynman path integral is introduced in the second half where it is seen as indispensable for understanding the connection between renormalization and critical as well as non-perturbative phenomena.*