

# Quantum Theory Of Many Body Systems Techniques And

Eventually, you will definitely discover a supplementary experience and feat by spending more cash. still when? accomplish you take that you require to get those all needs following having significantly cash? Why dont you attempt to get something basic in the beginning? Thats something that will lead you to understand even more all but the globe, experience, some places, once history, amusement, and a lot more?

It is your enormously own get older to operate reviewing habit. accompanied by guides you could enjoy now is **Quantum Theory Of Many Body Systems Techniques And** below.

**The Quantum Mechanics of Many-Body Systems** - D.J. Thouless 2014-01-15

"Unabridged republication of the second edition of the work, originally published in the Pure and applied physics series by Academic Press, Inc., New York, in 1972"--Title page verso.

Quantum Physics - Florian Scheck 2014-07-08

Scheck's Quantum Physics presents a comprehensive introductory treatment, ideally suited for a two-semester course. Part One covers the basic principles and prime applications of quantum mechanics, from the uncertainty relations to many-body systems. Part Two introduces to relativistic quantum field theory and ranges from symmetries in quantum physics to electroweak interactions. Numerous worked-out examples as well as exercises, with solutions or hints, enables the book's use as an accompanying text for courses, and also for independent study. For both parts, the necessary mathematical framework is treated in adequate form and detail. The book ends with appendices covering mathematical fundamentals and enrichment topics, plus selected biographical notes on pioneers of quantum mechanics and quantum field theory. The new edition was thoroughly revised and now includes new sections on quantization using the path integral method and on deriving generalized path integrals for bosonic and fermionic fields.

**Introduction to Many-Body Physics** - Piers Coleman 2015-11-26

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.

**Quantum Physics of Light and Matter** - Luca Salasnich 2017-02-24

This compact but exhaustive textbook, now in its significantly revised and expanded second edition, provides an essential introduction to the field quantization of light and matter with applications to atomic physics and strongly correlated systems. Following an initial review of the origins of special relativity and quantum mechanics, individual chapters are devoted to the second quantization of the electromagnetic field and the consequences of light field quantization for the description of electromagnetic transitions. The spin of the electron is then analyzed, with particular attention to its derivation from the Dirac equation.

Subsequent topics include the effects of external electric and magnetic fields on the atomic spectra and the properties of systems composed of many interacting identical particles. The book also provides a detailed explanation of the second quantization of the non-relativistic matter field, i.e., the Schrödinger field, which offers a powerful tool for the investigation of many-body problems, and of atomic quantum optics and entanglement. Finally, two new chapters introduce the finite-temperature functional integration of bosonic and fermionic fields for the study of macroscopic quantum phenomena: superfluidity and superconductivity. Several solved problems are included at the end of each chapter, helping readers put into practice all that they have learned.

Fundamentals of Many-body Physics - Wolfgang Nolting 2009-03-02

The goal of the present course on "Fundamentals of Theoretical Physics" is to be a direct accompaniment to

the lower-division study of physics, and it aims at providing the physical tools in the most straightforward and compact form as needed by the students in order to master theoretically more complex topics and problems in advanced studies and in research. The presentation is thus intentionally designed to be sufficiently detailed and self-contained – sometimes, admittedly, at the cost of a certain elegance – to permit individual study without reference to the secondary literature. This volume deals with the quantum theory of many-body systems. Building upon a basic knowledge of quantum mechanics and of statistical physics, modern techniques for the description of interacting many-particle systems are developed and applied to various real problems, mainly from the area of solid-state physics. A thorough revision should guarantee that the reader can access the relevant research literature without experiencing major problems in terms of the concepts and vocabulary, techniques and deductive methods found there. The world which surrounds us consists of very many particles interacting with one another, and their description requires in principle the solution of a corresponding number of coupled quantum-mechanical equations of motion (Schrödinger equations), which, however, is possible only in exceptional cases in a mathematically strict sense. The concepts of elementary quantum mechanics and quantum statistics are therefore not directly applicable in the form in which we have thus far encountered them. They require an extension and restructuring, which is termed "many-body theory".

**Quantum Kinetic Theory** - Michael Bonitz 2015-11-20

This book presents quantum kinetic theory in a comprehensive way. The focus is on density operator methods and on non-equilibrium Green functions. The theory allows to rigorously treat nonequilibrium dynamics in quantum many-body systems. Of particular interest are ultrafast processes in plasmas, condensed matter and trapped atoms that are stimulated by rapidly developing experiments with short pulse lasers and free electron lasers. To describe these experiments theoretically, the most powerful approach is given by non-Markovian quantum kinetic equations that are discussed in detail, including computational aspects.

**Nonequilibrium Many-Body Theory of Quantum Systems** - Gianluca Stefanucci 2013-03-07

The Green's function method is one of the most powerful and versatile formalisms in physics, and its nonequilibrium version has proved invaluable in many research fields. This book provides a unique, self-contained introduction to nonequilibrium many-body theory. Starting with basic quantum mechanics, the authors introduce the equilibrium and nonequilibrium Green's function formalisms within a unified framework called the contour formalism. The physical content of the contour Green's functions and the diagrammatic expansions are explained with a focus on the time-dependent aspect. Every result is derived step-by-step, critically discussed and then applied to different physical systems, ranging from molecules and nanostructures to metals and insulators. With an abundance of illustrative examples, this accessible book is ideal for graduate students and researchers who are interested in excited state properties of matter and nonequilibrium physics.

Many-Body Quantum Theory in Condensed Matter Physics - Henrik Bruus 2004-09-02

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.

Many-body Theory Exposed! - Willem Hendrik Dickhoff 2008

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.

**Quantum Physics in One Dimension** - Thierry Giamarchi 2004

This volume presents in a pedagogical yet complete way correlated systems in one dimension. After an introduction to the basic concepts of correlated systems, it gives a step-by-step description of the techniques needed to treat one dimension, and discusses the resulting physics.

Advances in Methods and Applications of Quantum Systems in Chemistry, Physics, and Biology - Alexander V. Glushkov 2021-06-29

This book reviews the most significant advances in concepts, methods, and applications of quantum systems in a broad variety of problems in modern chemistry, physics, and biology. In particular, it discusses atomic, molecular, and solid structure, dynamics and spectroscopy, relativistic and correlation effects in quantum chemistry, topics of computational chemistry, physics and biology, as well as applications of theoretical chemistry and physics in advanced molecular and nano-materials and biochemical systems. The book contains peer-reviewed contributions written by leading experts in the fields and based on the presentations given at the Twenty-Fourth International Workshop on Quantum Systems in Chemistry, Physics, and Biology held in Odessa, Ukraine, in August 2019. This book is aimed at advanced graduate students, academics, and researchers, both in university and corporation laboratories, interested in state-of-the-art and novel trends in quantum chemistry, physics, biology, and their applications.

**The Many-Body Problem in Quantum Mechanics** - Norman Henry March 1995-01-01

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.

*Physics and Mathematics of Quantum Many-Body Systems* - Hal Tasaki 2020-05-07

This book is a self-contained advanced textbook on the mathematical-physical aspects of quantum many-body systems, which begins with a pedagogical presentation of the necessary background information before moving on to subjects of active research, including topological phases of matter. The book explores in detail selected topics in quantum spin systems and lattice electron systems, namely, long-range order and spontaneous symmetry breaking in the antiferromagnetic Heisenberg model in two or higher dimensions (Part I), Haldane phenomena in antiferromagnetic quantum spin chains and related topics in topological phases of quantum matter (Part II), and the origin of magnetism in various versions of the Hubbard model (Part III). Each of these topics represents certain nontrivial phenomena or features that are invariably encountered in a variety of quantum many-body systems, including quantum field theory, condensed matter systems, cold atoms, and artificial quantum systems designed for future quantum computers. The book's main focus is on universal properties of quantum many-body systems. The book includes roughly 50 problems with detailed solutions. The reader only requires elementary linear algebra and calculus to comprehend the material and work through the problems. Given its scope and format, the

book is suitable both for self-study and as a textbook for graduate or advanced undergraduate classes.

Quantum Theory of the Electron Liquid - Gabriele Giuliani 2005-03-31

Publisher Description

*Green's Functions in Quantum Physics* - Eleftherios N. Economou 2013-03-14

In this edition the second and main part of the book has been considerably expanded as to cover important applications of the formalism. In Chap.5 a section was added outlining the extensive role of the tight binding (or equivalently the linear combination of atomic-like orbitals) approach to many branches of solid-state physics. Some additional information (including a table of numerical values) regarding square and cubic lattice Green's functions were incorporated. In Chap.6 the difficult subjects of superconductivity and the Kondo effect are examined by employing an appealingly simple connection to the question of the existence of a bound state in a very shallow potential well. The existence of such a bound state depends entirely on the form of the unperturbed density of states near the end of the spectrum: if the density of states blows up there is always at least one bound state. If the density of states approaches zero continuously, a critical depth (and/or width) of the well must be reached in order to have a bound state. The borderline case of a finite discontinuity (which is very important to superconductivity and the Kondo effect) always produces a bound state with an exponentially small binding energy.

Mathematical Methods of Many-Body Quantum Field Theory - Detlef Lehmann 2004-08-30

Mathematical Methods of Many-Body Quantum Field Theory offers a comprehensive, mathematically rigorous treatment of many-body physics. It develops the mathematical tools for describing quantum many-body systems and applies them to the many-electron system. These tools include the formalism of second quantization, field theoretical perturbation theory

*Quantum Field Theory of Many-Body Systems* - Xiao-Gang Wen 2004-06-04

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.

**Methods of Quantum Field Theory in Statistical Physics** - Alekseĭ Alekseevich Abrikosov 1963

**Quantum Theory of the Solid State** - Joseph Callaway 1974

Quantum Theory of the Solid State, Part B describes the concepts and methods of the central problems of the quantum theory of solids. This book discusses the developed machinery applied to impurities, disordered systems, effects of external fields, transport phenomena, and superconductivity. The representation theory, low field diamagnetic susceptibility, electron-phonon interaction, and Landau theory of fermi liquids are also deliberated. This text concludes with an introduction to many-body theory and some applications. This publication is a suitable textbook for students who have completed ...

**Mathematical Methods of Many-Body Quantum Field Theory** - Detlef Lehmann 2019-08-30

Mathematical Methods of Many-Body Quantum Field Theory offers a comprehensive, mathematically rigorous treatment of many-body physics. It develops the mathematical tools for describing quantum many-body systems and applies them to the many-electron system. These tools include the formalism of second quantization, field theoretical perturbation theory, functional integral methods, bosonic and fermionic, and

estimation and summation techniques for Feynman diagrams. Among the physical effects discussed in this context are BCS superconductivity, s-wave and higher l-wave, and the fractional quantum Hall effect. While the presentation is mathematically rigorous, the author does not focus solely on precise definitions and proofs, but also shows how to actually perform the computations. Presenting many recent advances and clarifying difficult concepts, this book provides the background, results, and detail needed to further explore the issue of when the standard approximation schemes in this field actually work and when they break down. At the same time, its clear explanations and methodical, step-by-step calculations shed welcome light on the established physics literature.

*Quantum Physics of Light and Matter* - Luca Salasnich 2014-05-13

The book gives an introduction to the field quantization (second quantization) of light and matter with applications to atomic physics. The first chapter briefly reviews the origins of special relativity and quantum mechanics and the basic notions of quantum information theory and quantum statistical mechanics. The second chapter is devoted to the second quantization of the electromagnetic field, while the third chapter shows the consequences of the light field quantization in the description of electromagnetic transitions. In the fourth chapter it is analyzed the spin of the electron, and in particular its derivation from the Dirac equation, while the fifth chapter investigates the effects of external electric and magnetic fields on the atomic spectra (Stark and Zeeman effects). The sixth chapter describes the properties of systems composed by many interacting identical particles by introducing the Hartree-Fock variational method, the density functional theory and the Born-Oppenheimer approximation. Finally, in the seventh chapter it is explained the second quantization of the non-relativistic matter field, i.e. the Schrodinger field, which gives a powerful tool for the investigation of many-body problems and also atomic quantum optics. At the end of each chapter there are several solved problems which can help the students to put into practice the things they learned.

**Quantum Theory of Many-Body Systems** - Alexandre Zagoskin 2016-09-10

This text presents a self-contained treatment of the physics of many-body systems from the point of view of condensed matter. The approach, quite traditionally, uses the mathematical formalism of quasiparticles and Green's functions. In particular, it covers all the important diagram techniques for normal and superconducting systems, including the zero-temperature perturbation theory and the Matsubara, Keldysh and Nambu-Gor'kov formalism, as well as an introduction to Feynman path integrals. This new edition contains an introduction to the methods of theory of one-dimensional systems (bosonization and conformal field theory) and their applications to many-body problems. Intended for graduate students in physics and related fields, the aim is not to be exhaustive, but to present enough detail to enable the student 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 their volume and which therefore provides an ideal testing ground for many-body theories.

**Quantum Theory of Many-Particle Systems** - Alexander L. Fetter 2012-03-08

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.

**A Guide to Feynman Diagrams in the Many-Body Problem** - Richard D. Mattuck 2012-08-21

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.

**Tensor Network Contractions** - Shi-Ju Ran 2020-01-01

Tensor network is a fundamental mathematical tool with a huge range of applications in physics, such as condensed matter physics, statistic physics, high energy physics, and quantum information sciences. This open access book aims to explain the tensor network contraction approaches in a systematic way, from the basic definitions to the important applications. This book is also useful to those who apply tensor networks in areas beyond physics, such as machine learning and the big-data analysis. Tensor network originates from the numerical renormalization group approach proposed by K.G. Wilson in 1975. Through a rapid

development in the last two decades, tensor network has become a powerful numerical tool that can efficiently simulate a wide range of scientific problems, with particular success in quantum many-body physics. Varieties of tensor network algorithms have been proposed for different problems. However, the connections among different algorithms are not well discussed or reviewed. To fill this gap, this book explains the fundamental concepts and basic ideas that connect and/or unify different strategies of the tensor network contraction algorithms. In addition, some of the recent progresses in dealing with tensor decomposition techniques and quantum simulations are also represented in this book to help the readers to better understand tensor network. This open access book is intended for graduated students, but can also be used as a professional book for researchers in the related fields. To understand most of the contents in the book, only basic knowledge of quantum mechanics and linear algebra is required. In order to fully understand some advanced parts, the reader will need to be familiar with notion of condensed matter physics and quantum information, that however are not necessary to understand the main parts of the book. This book is a good source for non-specialists on quantum physics to understand tensor network algorithms and the related mathematics.

**Introduction To Modern Methods Of Quantum Many-body Theory And Their Applications** - Adelchi Fabrocini 2002-08-19

This invaluable book contains pedagogical articles on the dominant nonstochastic methods of microscopic many-body theories — the methods of density functional theory, coupled cluster theory, and correlated basis functions — in their widest sense. Other 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 that are 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. It should, therefore, provide useful reference material for a broad range of theoretical physicists in condensed-matter and nuclear theory.

*Renormalization Group and Effective Field Theory Approaches to Many-Body Systems* - Achim Schwenk 2012-06-25

There have been many recent and important developments based on effective field theory and the renormalization group in atomic, condensed matter, nuclear and high-energy physics. These powerful and versatile methods provide novel approaches to study complex and strongly interacting many-body systems in a controlled manner. The six extensive lectures gathered in this volume combine selected introductory and interdisciplinary presentations focused on recent applications of effective field theory and the renormalization group to many-body problems in such diverse fields as BEC, DFT, extreme matter, Fermi-liquid theory and gauge theories. Primarily aimed at graduate students and junior researchers, they offer an opportunity to explore fundamental physics across subfield boundaries at an early stage in their careers.

**Quantum Scaling in Many-Body Systems** - Mucio Continentino 2017-04-17

Focusing on experimental results, this updated edition approaches the problem of quantum phase transitions from a new and unifying perspective.

*Introduction to the Statistical Physics of Integrable Many-body Systems* - Ladislav Šamaj 2013-05-16

Including topics not traditionally covered in literature, such as (1+1)-dimensional QFT and classical 2D Coulomb gases, this book considers a wide range of models and demonstrates a number of situations to which they can be applied. Beginning with a treatise of nonrelativistic 1D continuum Fermi and Bose quantum gases of identical spinless particles, the book describes the quantum inverse scattering method and the analysis of the related Yang-Baxter equation and integrable quantum Heisenberg models. It also discusses systems within condensed matter physics, the complete solution of the sine-Gordon model and modern trends in the thermodynamic Bethe ansatz. Each chapter concludes with problems and solutions to help consolidate the reader's understanding of the theory and its applications. Basic knowledge of quantum mechanics and equilibrium statistical physics is assumed, making this book suitable for graduate students and researchers in statistical physics, quantum mechanics and mathematical and theoretical physics.

**Advanced Quantum Condensed Matter Physics** - Michael El-Batanouny 2020-03-26

Based on an established course, this comprehensive textbook on advanced quantum condensed matter

physics covers one-body, many-body and topological perspectives. Discussing modern topics and containing end-of-chapter exercises throughout, it is ideal for graduate students studying advanced condensed matter physics.

**Many-Body Problems and Quantum Field Theory** - Philippe Andre Martin 2013-04-17

Emphasis is placed on analogies between the various systems rather than on advanced or specialized aspects, with the purpose of illustrating common ideas within different domains of physics. Starting from a basic knowledge of quantum mechanics and classical electromagnetism, the exposition is self-contained and explicitly details all steps of the derivations. The new edition features a substantially new treatment of nucleon pairing.

**Condensed Matter Field Theory** - Alexander Altland 2010-03-11

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* - Xiao-Gang Wen 2004-06-03

This book is a pedagogical and systematic introduction to new concepts and quantum field theoretical methods in condensed matter physics, which may have an impact on our understanding of the origin of light, electrons and other elementary particles in the universe. Emphasis is on clear physical principles, while at the same time bringing students to the fore of today's research.

*Quantum Field Theory of Non-equilibrium States* - Jørgen Rammer 2011-03-03

Quantum field theory is the application of quantum mechanics to systems with infinitely many degrees of freedom. This 2007 textbook presents quantum field theoretical applications to systems out of equilibrium. It introduces the real-time approach to non-equilibrium statistical mechanics and the quantum field theory of non-equilibrium states in general. It offers two ways of learning how to study non-equilibrium states of many-body systems: the mathematical canonical way and an easy intuitive way using Feynman diagrams. The latter provides an easy introduction to the powerful functional methods of field theory, and the use of Feynman diagrams to study classical stochastic dynamics is considered in detail. The developed real-time technique is applied to study numerous phenomena in many-body systems. Complete with numerous exercises to aid self-study, this textbook is suitable for graduate students in statistical mechanics and condensed matter physics.

Discrete Quantum Mechanics - H. Thomas Williams 2015-12-01

After a quarter century of discoveries that rattled the foundations of classical mechanics and electrodynamics, the year 1926 saw the publication of two works intended to provide a theoretical structure to support new quantum explanations of the subatomic world. Heisenberg's matrix mechanics and

Schrodinger's wave mechanics provided compatible but mathematically disparate ways of unifying the discoveries of Planck, Einstein, Bohr and many others. Efforts began immediately to prove the equivalence of these two structures, culminated successfully by John von Neumann's 1932 volume "Mathematical Foundations of Quantum Mechanics." This forms the springboard for the current effort. We begin with a presentation of a minimal set of von Neumann postulates while introducing language and notation to facilitate subsequent discussion of quantum calculations based in finite dimensional Hilbert spaces. Chapters which follow address two-state quantum systems (with spin one-half as the primary example), entanglement of multiple two-state systems, quantum angular momentum theory and quantum approaches to statistical mechanics. A concluding chapter gives an overview of issues associated with quantum mechanics in continuous infinite-dimensional Hilbert spaces.

**Many-Body Theory of Condensed Matter Systems** - Michael G. Cottam 2020-07-30

For non-specialist students and researchers, this is a broad and concise introduction to the many-body theory of condensed-matter systems.

*Elements of Advanced Quantum Theory* - J. M. Ziman 1969

This textbook gives a connected mathematical derivation of the important mathematical results, concentrating on the central ideas without including elaborate detail or unnecessary rigour, and explaining in the simplest terms the symbols and concepts which confront the researcher in solid state, nuclear or high-energy physics.

*Ultracold Atoms in Optical Lattices* - Maciej Lewenstein 2012-03-08

This book explores the physics of atoms frozen to ultralow temperatures and trapped in periodic light structures. It introduces the reader to the spectacular progress achieved on the field of ultracold gases and describes present and future challenges in condensed matter physics, high energy physics, and quantum computation.

**Quantum Theory of Many-Body Systems** - Alexandre Zagoskin 2012-12-06

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. '

Introduction to Tensor Network Methods - Simone Montangero 2018-11-28

This volume of lecture notes briefly introduces the basic concepts needed in any computational physics course: software and hardware, programming skills, linear algebra, and differential calculus. It then presents more advanced numerical methods to tackle the quantum many-body problem: it reviews the numerical renormalization group and then focuses on tensor network methods, from basic concepts to gauge invariant ones. Finally, in the last part, the author presents some applications of tensor network methods to equilibrium and out-of-equilibrium correlated quantum matter. The book can be used for a graduate computational physics course. After successfully completing such a course, a student should be able to write a tensor network program and can begin to explore the physics of many-body quantum systems. The book can also serve as a reference for researchers working or starting out in the field.