

Ashcroft Solid State Physics Solutions Manual

The object of this textbook is to present the central principles of the quantum theory of solids to theoretical physicists generally and to those experimental solid state physicists who have had a one year course in quantum mechanics.

While the standard solid state topics are covered, the basic ones often have more detailed derivations than is customary (with an emphasis on crystalline solids). Several recent topics are introduced, as are some subjects normally included only in condensed matter physics. Lattice vibrations, electrons, interactions, and spin effects (mostly in magnetism) are discussed the most comprehensively. Many problems are included whose level is from "fill in the steps" to long and challenging, and the text is equipped with references and several comments about experiments with figures and tables. Intended for a two semester advanced undergraduate or graduate course in Solid State Physics, this treatment offers modern coverage of the theory and related experiments, including the group theoretical approach to band structures, Moessbauer recoil free fraction, semi-classical electron theory, magnetoconductivity, electron self-energy and Landau theory of Fermi liquid, and both quantum and fractional quantum Hall effects. Integrated throughout are developments from the newest semiconductor devices, e.g. space charge layers, quantum wells and superlattices. The first half includes all material usually covered in the introductory course, but in greater depth than most introductory textbooks. The second half includes most of the important developments in solid-state researches of the past half century, addressing e.g. optical and electronic properties such as collective bulk and surface modes and spectral

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function of a quasiparticle, which is a basic concept for understanding LEED intensities, X ray fine structure spectroscopy and photoemission. So both the fundamental principles and most recent advances in solid state physics are explained in a class-tested tutorial style, with end-of-chapter exercises for review and reinforcement of key concepts and calculations.

Updated to reflect recent work in the field, this book emphasizes crystalline solids, going from the crystal lattice to the ideas of reciprocal space and Brillouin zones, and develops these ideas for lattice vibrations, for the theory of metals, and for semiconductors. The theme of lattice periodicity and its varied consequences runs through eighty percent of the book. Other sections deal with major aspects of solid state physics controlled by other phenomena: superconductivity, dielectric and magnetic properties, and magnetic resonance.

This undergraduate textbook merges traditional solid state physics with contemporary condensed matter physics, providing an up-to-date introduction to the major concepts that form the foundations of condensed materials. The main foundational principles are emphasized, providing students with the knowledge beginners in the field should understand. The book is structured in four parts and allows students to appreciate how the concepts in this broad area build upon each other to produce a cohesive whole as they work through the chapters. Illustrations work closely with the text to convey concepts and ideas visually, enhancing student understanding of difficult material, and end-of-chapter exercises varying in difficulty allow students to put into practice the theory they have covered in each chapter and reinforce new concepts.

An accessible overview of the concepts and tools essential to the physics of materials, with applications, exercises, and

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color figures.

Providing a broad review of many techniques and their application to condensed matter systems, this book begins with a review of thermodynamics and statistical mechanics, before moving onto real and imaginary time path integrals and the link between Euclidean quantum mechanics and statistical mechanics. A detailed study of the Ising, gauge-Ising and XY models is included. The renormalization group is developed and applied to critical phenomena, Fermi liquid theory and the renormalization of field theories. Next, the book explores bosonization and its applications to one-dimensional fermionic systems and the correlation functions of homogeneous and random-bond Ising models. It concludes with Bohm–Pines and Chern–Simons theories applied to the quantum Hall effect. Introducing the reader to a variety of techniques, it opens up vast areas of condensed matter theory for both graduate students and researchers in theoretical, statistical and condensed matter physics.

Quantum gravity has developed into a fast-growing subject in physics and it is expected that probing the high-energy and high-curvature regimes of gravitating systems will shed some light on how to eventually achieve an ultraviolet complete quantum theory of gravity. Such a theory would provide the much needed information about fundamental problems of classical gravity, such as the initial big-bang singularity, the cosmological constant problem, Planck scale physics and the early-time inflationary evolution of our Universe. While in the first part of this book concepts of quantum gravity are introduced and approached from different angles, the second

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part discusses these theories in connection with cosmological models and observations, thereby exploring which types of signatures of modern and mathematically rigorous frameworks can be detected by experiments. The third and final part briefly reviews the observational status of dark matter and dark energy, and introduces alternative cosmological models. Edited and authored by leading researchers in the field and cast into the form of a multi-author textbook at postgraduate level, this volume will be of benefit to all postgraduate students and newcomers from neighboring disciplines wishing to find a comprehensive guide for their future research.

The First Edition Of This Book Was Brought Out By Wiley Eastern Ltd. In 1994. The Sixth Edition Now At Your Hand Differs From The First Edition In Many Respects. Many-Sided Changes Both Qualitatively And Quantitatively Are The Quotable Features Of This Edition. The Purpose Of This Edition Is Not Only To Initiate The Beginners Into This Fascinating Subject, But Also To Prepare Them In This Area For The Postgraduate Examinations Conducted By Universities Spread All Over The Country. Reading This Text Book In Depth Rather Than A Casual, Go-Through May Improve The Workaholic Culture Of The Students Desiring Higher Education At IITs And Highly Graded Universities Through Gate. The Same Yardstick Is Adoptable By The Postgraduate Students In Physics And Engineering Streams

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Aiming To Score High Grades In The Written Tests Conducted By Upsc For Class I Posts In Various Central Government Departments And Boards. Problems in Solid State Physics with SolutionsWorld Scientific Publishing Company Incorporated Demonstrates how anyone in math, science, and engineering canmaster DFT calculations Density functional theory (DFT) is one of the most frequentlyused computational tools for studying and predicting the propertiesof isolated molecules, bulk solids, and material interfaces,including surfaces. Although the theoretical underpinnings of DFTare quite complicated, this book demonstrates that the basicconcepts underlying the calculations are simple enough to beunderstood by anyone with a background in chemistry, physics,engineering, or mathematics. The authors show how the widespreadavailability of powerful DFT codes makes it possible for studentsand researchers to apply this important computational technique toa broad range of fundamental and applied problems. Density Functional Theory: A Practical Introductionoffers a concise, easy-to-follow introduction to the key conceptsand practical applications of DFT, focusing on plane-wave DFT. Theauthors have many years of experience introducing DFT to studentsfrom a variety of backgrounds. The book therefore offers severalfeatures that have proven to be helpful in enabling students tomaster the subject, including:

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Problem sets in each chapter that give readers the opportunity to test their knowledge by performing their own calculations. Worked examples that demonstrate how DFT calculations are used to solve real-world problems. Further readings listed in each chapter enabling readers to investigate specific topics in greater depth. This text is written at a level suitable for individuals from a variety of scientific, mathematical, and engineering backgrounds. No previous experience working with DFT calculations is needed.

Describing the fundamental physical properties of materials used in electronics, the thorough coverage of this book will facilitate an understanding of the technological processes used in the fabrication of electronic and photonic devices. The book opens with an introduction to the basic applied physics of simple electronic states and energy levels. Silicon and copper, the building blocks for many electronic devices, are used as examples. Next, more advanced theories are developed to better account for the electronic and optical behavior of ordered materials, such as diamond, and disordered materials, such as amorphous silicon. Finally, the principal quasi-particles (phonons, polarons, excitons, plasmons, and polaritons) that are fundamental to explaining phenomena such as component aging (phonons) and optical performance in terms of yield (excitons) or communication speed

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(polarons) are discussed.

This book provides a practical approach to consolidate one's acquired knowledge or to learn new concepts in solid state physics through solving problems. It contains 300 problems on various subjects of solid state physics. The problems in this book can be used as homework assignments in an introductory or advanced course on solid state physics for undergraduate or graduate students. It can also serve as a desirable reference book to solve typical problems and grasp mathematical techniques in solid state physics. In practice, it is regarded fascinating and rewarding to learn a new idea or technique through solving a real challenging problem than through reading only. In this aspect, this book is not a plain collection of problems but it presents a large number of problem-solving ideas and procedures, some of which are valuable to practitioners in condensed matter physics.

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

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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. Introduction to Solid-State Theory is a textbook for graduate students of physics and materials science. It also provides the theoretical background needed by physicists doing research in pure solid-state physics and its applications to electrical engineering. The fundamentals of solid-state theory are based on a description by delocalized and localized states and - within the concept of delocalized states - by elementary excitations. The development of solid-state theory within the last ten years has shown that by a systematic introduction of these concepts, large parts of the theory can be described in a unified way. This form of description gives a "pictorial" formulation of many elementary processes in solids, which facilitates their understanding. Based on an established course and covering the

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fundamentals, central areas and contemporary topics of this diverse field, Fundamentals of Condensed Matter Physics is a much-needed textbook for graduate students. The book begins with an introduction to the modern conceptual models of a solid from the points of view of interacting atoms and elementary excitations. It then provides students with a thorough grounding in electronic structure and many-body interactions as a starting point to understand many properties of condensed matter systems - electronic, structural, vibrational, thermal, optical, transport, magnetic and superconducting - and methods to calculate them. Taking readers through the concepts and techniques, the text gives both theoretically and experimentally inclined students the knowledge needed for research and teaching careers in this field. It features 246 illustrations, 9 tables and 100 homework problems, as well as numerous worked examples, for students to test their understanding. Solutions to the problems for instructors are available at www.cambridge.org/cohenlouie. An introduction to the application of Feynman diagram techniques for researchers and advanced undergraduate students in condensed matter theory and many-body physics.

Crystal structures and properties (1001-1027) -
Electron theory, energy bands and semiconductors (1028-1051) -
Electromagnetic properties, optical

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properties and superconductivity (1052-1076) -
Other topics (1077-1081) - Special relativity
(2001-2007) - General relativity 2008-2023) -
Relativistic cosmology (2024-2028) - History of
physics and general questions (3001-3025) -
Measurements, estimations and errors (3026-3048) -
Mathematical techniques (3049-3056).

Solid State Physics is a textbook for students of physics, material science, chemistry, and engineering. It is the state-of-the-art presentation of the theoretical foundations and application of the quantum structure of matter and materials. This second edition provides timely coverage of the most important scientific breakthroughs of the last decade (especially in low-dimensional systems and quantum transport). It helps build readers' understanding of the newest advances in condensed matter physics with rigorous yet clear mathematics. Examples are an integral part of the text, carefully designed to apply the fundamental principles illustrated in the text to currently active topics of research. Basic concepts and recent advances in the field are explained in tutorial style and organized in an intuitive manner. The book is a basic reference work for students, researchers, and lecturers in any area of solid-state physics. Features additional material on nanostructures, giving students and lecturers the most significant features of low-dimensional systems, with focus on carbon allotropes Offers

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detailed explanation of dissipative and nondissipative transport, and explains the essential aspects in a field, which is commonly overlooked in textbooks. Additional material in the classical and quantum Hall effect offers further aspects on magnetotransport, with particular emphasis on the current profiles. Gives a broad overview of the band structure of solids, as well as presenting the foundations of the electronic band structure. Also features reported with new and revised material, which leads to the latest research.

This is a first undergraduate textbook in Solid State Physics or Condensed Matter Physics. While most textbooks on the subject are extremely dry, this book is written to be much more exciting, inspiring, and entertaining.

This comprehensive text covers the basic physics of the solid state starting at an elementary level suitable for undergraduates but then advancing, in stages, to a graduate and advanced graduate level. In addition to treating the fundamental elastic, electrical, thermal, magnetic, structural, electronic, transport, optical, mechanical and compositional properties, we also discuss topics like superfluidity and superconductivity along with special topics such as strongly correlated systems, high-temperature superconductors, the quantum Hall effects, and graphene. Particular emphasis is given to so-called first principles calculations utilizing modern density

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functional theory which for many systems now allow accurate calculations of the electronic, magnetic, and thermal properties.

This book provides a practical approach to consolidate one's acquired knowledge or to learn new concepts in solid state physics through solving problems. It contains 300 problems on various subjects of solid state physics. The problems in this book can be used as homework assignments in an introductory or advanced course on solid state physics for undergraduate or graduate students. It can also serve as a desirable reference book to solve typical problems and grasp mathematical techniques in solid state physics. In practice, it is more fascinating and rewarding to learn a new idea or technique through solving challenging problems rather than through reading only. In this aspect, this book is not a plain collection of problems but it presents a large number of problem-solving ideas and procedures, some of which are valuable to practitioners in condensed matter physics.

A must-have textbook for any undergraduate studying solid state physics. This successful brief course in solid state physics is now in its second edition. The clear and concise introduction not only describes all the basic phenomena and concepts, but also such advanced issues as magnetism and superconductivity. Each section starts with a gentle introduction, covering basic principles, progressing

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to a more advanced level in order to present a comprehensive overview of the subject. The book is providing qualitative discussions that help undergraduates understand concepts even if they can't follow all the mathematical detail. The revised edition has been carefully updated to present an up-to-date account of the essential topics and recent developments in this exciting field of physics. The coverage now includes ground-breaking materials with high relevance for applications in communication and energy, like graphene and topological insulators, as well as transparent conductors. The text assumes only basic mathematical knowledge on the part of the reader and includes more than 100 discussion questions and some 70 problems, with solutions free to lecturers from the Wiley-VCH website. The author's webpage provides Online Notes on x-ray scattering, elastic constants, the quantum Hall effect, tight binding model, atomic magnetism, and topological insulators. This new edition includes the following updates and new features: * Expanded coverage of mechanical properties of solids, including an improved discussion of the yield stress * Crystal structure, mechanical properties, and band structure of graphene * The coverage of electronic properties of metals is expanded by a section on the quantum hall effect including exercises. New topics include the tight-binding model and an expanded discussion

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on Bloch waves. * With respect to semiconductors, the discussion of solar cells has been extended and improved. * Revised coverage of magnetism, with additional material on atomic magnetism * More extensive treatment of finite solids and nanostructures, now including topological insulators * Recommendations for further reading have been updated and increased. * New exercises on Hall mobility, light penetrating metals, band structure

This book provides an introduction to band theory and the electronic properties of materials at a level suitable for final-year undergraduates or first-year graduate students. It sets out to provide the vocabulary and quantum-mechanical training necessary to understand the electronic, optical and structural properties of the materials met in science and technology and describes some of the experimental techniques which are used to study band structure today. In order to leave space for recent developments, the Drude model and the introduction of quantum statistics are treated synoptically. However, Bloch's theorem and two tractable limits, a very weak periodic potential and the tight-binding model, are developed rigorously and in three dimensions. Having introduced the ideas of bands, effective masses and holes, semiconductor and metals are treated in some detail, along with the newer ideas of artificial structures such as super-lattices and quantum wells,

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layered organic substances and oxides. Some recent 'hot topics' in research are covered, e.g. the fractional Quantum Hall Effect and nano-devices, which can be understood using the techniques developed in the book. In illustrating examples of e.g. the de Haas-van Alphen effect, the book focuses on recent experimental data, showing that the field is a vibrant and exciting one. References to many recent review articles are provided, so that the student can conduct research into a chosen topic at a deeper level. Several appendices treating topics such as phonons and crystal structure make the book self-contained introduction to the fundamentals of band theory and electronic properties in condensed matter physics today.

Solid State Physics, a comprehensive study for the undergraduate and postgraduate students of pure and applied sciences, and engineering disciplines is divided into eighteen chapters. The First seven chapters deal with structure related aspects such as lattice and crystal structures, bonding, packing and diffusion of atoms followed by imperfections and lattice vibrations. Chapter eight deals mainly with experimental methods of determining structures of given materials. While the next nine chapters cover various physical properties of crystalline solids, the last chapter deals with the anisotropic properties of materials. This chapter has been added for benefit of readers to understand the crystal properties

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(anisotropic) in terms of some simple mathematical formulations such as tensor and matrix. New to the Second Edition: Chapter on: *Anisotropic Properties of Materials

The ideal companion in condensed matter physics - now in new and revised edition. Solving homework problems is the single most effective way for students to familiarize themselves with the language and details of solid state physics. Testing problem-solving ability is the best means at the professor's disposal for measuring student progress at critical points in the learning process. This book enables any instructor to supplement end-of-chapter textbook assignments with a large number of challenging and engaging practice problems and discover a host of new ideas for creating exam questions. Designed to be used in tandem with any of the excellent textbooks on this subject, Solid State Physics: Problems and Solutions provides a self-study approach through which advanced undergraduate and first-year graduate students can develop and test their skills while acclimating themselves to the demands of the discipline. Each problem has been chosen for its ability to illustrate key concepts, properties, and systems, knowledge of which is crucial in developing a complete understanding of the subject, including: * Crystals, diffraction, and reciprocal lattices. * Phonon dispersion and electronic band structure. * Density of states. *

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Transport, magnetic, and optical properties. *
Interacting electron systems. * Magnetism. *
Nanoscale Physics.

The correlation between the microscopic composition of solids and their macroscopic (electrical, optical, thermal) properties is the goal of solid state physics. This book is the deeply revised version of the French book *Initiation physique du solide: exercices commentés avec rappels de cours*, written more than 20 years ago. It has five sections. Now updated—the leading single-volume introduction to solid state and soft condensed matter physics. This Second Edition of the unified treatment of condensed matter physics keeps the best of the first, providing a basic foundation in the subject while addressing many recent discoveries.

Comprehensive and authoritative, it consolidates the critical advances of the past fifty years, bringing together an exciting collection of new and classic topics, dozens of new figures, and new experimental data. This updated edition offers a thorough treatment of such basic topics as band theory, transport theory, and semiconductor physics, as well as more modern areas such as quasicrystals, dynamics of phase separation, granular materials, quantum dots, Berry phases, the quantum Hall effect, and Luttinger liquids. In addition to careful study of electron dynamics, electronics, and superconductivity, there is much material drawn from

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soft matter physics, including liquid crystals, polymers, and fluid dynamics. Provides frequent comparison of theory and experiment, both when they agree and when problems are still unsolved. Incorporates many new images from experiments. Provides end-of-chapter problems including computational exercises. Includes more than fifty data tables and a detailed forty-page index. Offers a solutions manual for instructors. Featuring 370 figures and more than 1,000 recent and historically significant references, this volume serves as a valuable resource for graduate and undergraduate students in physics, physics professionals, engineers, applied mathematicians, materials scientists, and researchers in other fields who want to learn about the quantum and atomic underpinnings of materials science from a modern point of view.

Now in paperback, this book provides an overview of the physics of condensed matter systems. Assuming a familiarity with the basics of quantum mechanics and statistical mechanics, the book establishes a general framework for describing condensed phases of matter, based on symmetries and conservation laws. It explores the role of spatial dimensionality and microscopic interactions in determining the nature of phase transitions, as well as discussing the structure and properties of materials with different symmetries. Particular attention is given to critical phenomena and renormalization group methods. The properties of liquids,

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liquid crystals, quasicrystals, crystalline solids, magnetically ordered systems and amorphous solids are investigated in terms of their symmetry, generalised rigidity, hydrodynamics and topological defect structure. In addition to serving as a course text, this book is an essential reference for students and researchers in physics, applied physics, chemistry, materials science and engineering, who are interested in modern condensed matter physics.

This textbook, now in its third edition, provides a formative introduction to the structure of matter that will serve as a sound basis for students proceeding to more complex courses, thus bridging the gap between elementary physics and topics pertaining to research activities. The focus is deliberately limited to key concepts of atoms, molecules and solids, examining the basic structural aspects without paying detailed attention to the related properties. For many topics the aim has been to start from the beginning and to guide the reader to the threshold of advanced research. This edition includes four new chapters dealing with relevant phases of solid matter (magnetic, electric and superconductive) and the related phase transitions. The book is based on a mixture of theory and solved problems that are integrated into the formal presentation of the arguments. Readers will find it invaluable in enabling them to acquire basic knowledge in the wide and wonderful field of condensed matter and to understand how phenomenological properties originate from the microscopic, quantum features of nature.

This book fills a gap between many of the basic solid

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state physics and materials sciencebooks that are currently available. It is written for a mixed audience of electricalengineering and applied physics students who have some knowledge of elementaryundergraduate quantum mechanics and statistical mechanics. This book, based on asuccessful course taught at MIT, is divided pedagogically into three parts: (I) ElectronicStructure, (II) Transport Properties, and (III) Optical Properties. Each topic is explainedin the context of bulk materials and then extended to low-dimensional materials whereapplicable. Problem sets review the content of each chapter to help students to understandthe material described in each of the chapters more deeply and to prepare them to masterthe next chapters.

Solid state physics continues to be the most rapidly growing subdiscipline in physics. As a result, entering graduate students wishing to pursue research in this field face the daunting task of not only mastering the old topics but also gaining competence in the problems of current interest, such as the fractional quantum Hall effect, strongly correlated electron systems, and quantum phase transitions. This book is written to serve the needs of such students. I have attempted in this book to present some of the standard topics in a way that makes it possible to move smoothly to current material. Hence, all the interesting topics are not presented at the end of the book. For example, immediately after the first 50 pages, Anderson's analysis of local magnetic moments is presented as an application of Hartree-Fock theory; this affords a discussion of the relationship with

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the Kondo model and how scaling ideas can be used to uncloak low-energy physics. As the key problems of current interest in solid state involve some aspects of electron-electron interactions or disorder or both, I have focused on the archetypal problems in which such physics is central. However, only those problems in which there is a consensus view are discussed extensively. In addition, I have placed the emphasis on physics rather than on techniques. Consequently, I focus on a clear presentation of the phenomenology along with a pedagogical derivation of the relevant equations. A key goal of the detailed derivations is to make it possible for the students who have read this book to immediately comprehend research papers on related topics. A key omission in this book is magnetism beyond the Stoner criterion and local magnetic moments. This omission has arisen primarily because the topic is adequately treated in the book by Assa Auerbach.

This text provides a modern introduction to the main principles of thermal physics, thermodynamics and statistical mechanics. The key concepts are presented and new ideas are illustrated with worked examples as well as description of the historical background to their discovery.

These lecture notes constitute a course on a number of central concepts of solid state physics ? classification of solids, band theory, the developments in one-electron band theory in the presence of perturbation, effective Hamiltonian theory, elementary excitations and the various types of collective elementary excitation (excitons, spin waves and phonons), the Fermi liquid,

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ferromagnetic spin waves, antiferromagnetic spin waves and the theory of broken symmetry. The book can be used in conjunction with a survey course in solid state physics, or as the basis of a first graduate-level course. It can be read by anyone who has had basic grounding in quantum mechanics.

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