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Advanced Quantum Mechanics

Advanced Quantum Mechanics

Advanced Quantum Mechanics

Lectures On Quantum Field Theory (Second Edition)

Problem Book in Quantum Field Theory

Open Quantum Systems

Quantum Mechanics

Problems and Solutions on Optics

Computational Physics

The Aharonov-Bohm Effect

Problems and Solutions in Quantum Mechanics

Symmetries and Group Theory in Particle Physics

Emergent Quantum Mechanics

Quantum Theory: Concepts and Methods

Fundamentals of Quantum Mechanics

Statistical Mechanics

Classical Mechanics and Quantum Mechanics: An Historic-Axiomatic Approach

Atomic Structure Theory

Information—Consciousness—Reality

Quantum Mechanics

Problems And Solutions On Quantum Mechanics

Single-site Green Function of the Dirac Equation for Full-potential Electron Scattering

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OMB No. 9702381462864 edited by

CASSIUS LEONIDAS

[Advanced Quantum Mechanics](#) Springer Science & Business Media

In the new edition supplements have been added at various places, including the formulation of some of the problems. In all these additions I have attempted not to change the compact character of the book. The present (second) English edition is, besides the problems and smaller corrections, identical to the current German fourth edition. The proofs were read by B. Kaufmann, M. Hummel and A. Vilfan. I would like to thank all colleagues and students who made suggestions to improve the book as well as the publisher. Special thanks go to S. Clar for preparing the new 'JEX file. Munich, March 1995 F. Schwabl Preface to the First Edition This is a textbook on quantum mechanics. In an introductory chapter, the basic postulates are established, beginning with the historical development, by the analysis of an interference experiment. From then on the organization is purely deductive. In addition to the basic ideas and numerous applications, new aspects of quantum mechanics and their experimental tests are presented. In the text, emphasis is placed on a concise, yet self-contained, presentation. The comprehensibility is guaranteed by giving all mathematical steps and by carrying out the intermediate calculations completely and thoroughly.

ADVANCED QUANTUM MECHANICS

Springer

A unique approach to quantum field theory, with emphasis on the principles of renormalization Quantum field theory is frequently approached from the perspective of particle physics. This book adopts a more general point of view and includes applications of condensed matter physics. Written by a highly respected writer and researcher, it first develops traditional concepts, including Feynman graphs, before moving on to key topics such as functional integrals, statistical mechanics, and Wilson's renormalization group. The connection between the latter and conventional perturbative renormalization is explained. Quantum Field Theory is an exceptional textbook for graduate students familiar with advanced quantum mechanics as well as physicists with an interest in theoretical physics. It features: * Coverage of quantum electrodynamics with practical calculations and a discussion of perturbative renormalization * A discussion of the Feynman path integrals and a host of current subjects, including the physical approach to renormalization, spontaneous symmetry breaking and superfluidity, and topological excitations * Nineteen self-contained chapters with

exercises, supplemented with graphs and charts

Advanced Quantum Mechanics Cambridge University Press

This book covers advanced topics in quantum mechanics, including nonrelativistic multi-particle systems, relativistic wave equations, and relativistic fields. Numerous examples for application help readers gain a thorough understanding of the subject. The presentation of relativistic wave equations and their symmetries, and the fundamentals of quantum field theory lay the foundations for advanced studies in solid-state physics, nuclear, and elementary particle physics. The authors' earlier book, Quantum Mechanics, was praised for its unsurpassed clarity.

LECTURES ON QUANTUM FIELD THEORY (SECOND EDITION)

World Scientific

Emergent quantum mechanics explores the possibility of an ontology for quantum mechanics. The resurgence of interest in "deeper-level" theories for quantum phenomena challenges the standard, textbook interpretation. The book presents expert views that critically evaluate the significance—for 21st century physics—of ontological quantum mechanics, an approach that David Bohm helped pioneer. The possibility of a deterministic quantum theory was first introduced with the original de Broglie-Bohm theory, which has also been developed as Bohmian mechanics. The wide range of perspectives that were contributed to this book on the occasion of David Bohm's centennial celebration provide ample evidence for the physical consistency of ontological quantum mechanics. The book addresses deeper-level questions such as the following: Is reality intrinsically random or fundamentally interconnected? Is the universe local or nonlocal? Might a radically new conception of reality include a form of quantum causality or quantum ontology? What is the role of the experimenter agent? As the book demonstrates, the advancement of 'quantum ontology'—as a scientific concept—marks a clear break with classical reality. The search for quantum reality entails unconventional causal structures and non-classical ontology, which can be fully consistent with the known record of quantum observations in the laboratory.

PROBLEM BOOK IN QUANTUM FIELD THEORY

World Scientific Publishing Company

The Problem Book in Quantum Field Theory contains about 200 problems with solutions or hints that help students to improve their understanding and develop skills necessary for pursuing the subject. It deals with the Klein-Gordon and Dirac equations, classical field theory, canonical quantization

of scalar, Dirac and electromagnetic fields, the processes in the lowest order of perturbation theory, renormalization and regularization. The solutions are presented in a systematic and complete manner. The material covered and the level of exposition make the book appropriate for graduate and undergraduate students in physics, as well as for teachers and researchers.

Open Quantum Systems Forschungszentrum Jülich

In this volume the fundamental theory of open quantum systems is revised in the light of modern developments in the field. A unified approach to the quantum evolution of open systems is presented by merging concepts and methods traditionally employed by different communities, such as quantum optics, condensed matter, chemical physics and mathematical physics. The mathematical structure and the general properties of the dynamical maps underlying open system dynamics are explained in detail. The microscopic derivation of dynamical equations, including both Markovian and non-Markovian evolutions, is also discussed. Because of the step-by-step explanations, this work is a useful reference to novices in this field. However, experienced researchers can also benefit from the presentation of recent results.

QUANTUM MECHANICS

John Wiley & Sons

This book comprises the lectures of a two-semester course on quantum field theory, presented in a quite informal and personal manner. The course starts with relativistic one-particle systems, and develops the basics of quantum field theory with an analysis on the representations of the Poincaré group. Canonical quantization is carried out for scalar, fermion, Abelian and non-Abelian gauge theories. Covariant quantization of gauge theories is also carried out with a detailed description of the BRST symmetry. The Higgs phenomenon and the standard model of electroweak interactions are also developed systematically. Regularization and (BPHZ) renormalization of field theories as well as gauge theories are discussed in detail, leading to a derivation of the renormalization group equation. In addition, two chapters — one on the Dirac quantization of constrained systems and another on discrete symmetries — are included for completeness, although these are not covered in the two-semester course. This second edition includes two new chapters, one on Nielsen identities and the other on basics of global supersymmetry. It also includes two appendices, one on fermions in arbitrary dimensions and the other on gauge invariant potentials and the Fock-Schwinger gauge.

Problems and Solutions on Optics Elsevier

Quantum Mechanics Springer Science & Business Media

Computational Physics Bentham Science Publishers

This unique textbook presents a novel, axiomatic pedagogical path from classical to quantum physics. Readers are introduced to the description of classical mechanics, which rests on Euler's and Helmholtz's rather than Newton's or Hamilton's representations. Special attention is given to the common attributes rather than to the differences between classical and quantum mechanics. Readers will also learn about Schrödinger's forgotten demands on quantization, his equation, Einstein's idea of 'quantization as selection problem'. The Schrödinger equation is derived without any assumptions about the nature of quantum systems, such as interference and superposition, or the existence of a quantum of action, h . The use of the classical expressions for the potential and kinetic energies within quantum physics is justified. Key features: · Presents extensive reference to original texts. · Includes many details that do not enter contemporary representations of classical mechanics, although these details are essential for understanding quantum physics. · Contains a simple level of mathematics which is seldom higher than that of the common (Riemannian) integral. · Brings information about important scientists · Carefully introduces basic equations, notations and quantities in simple steps This book addresses the needs of physics students, teachers and historians with its simple easy to understand presentation and comprehensive approach to both classical and quantum mechanics..

The Aharonov-Bohm Effect Quantum Mechanics

Subjects include formalism and its interpretation, analysis of simple systems, symmetries and invariance, methods of approximation, elements of relativistic quantum mechanics, much more. "Strongly recommended." -- "American Journal of Physics."

Cambridge University Press

The focus of the present work is nonrelativistic and relativistic quantum mechanics with standard applications to the hydrogen atom. The author has aimed at presenting quantum mechanics in a comprehensive yet accessible for mathematicians and other non-physicists. The genesis of quantum mechanics, its applications to basic quantum phenomena, and detailed explanations of the corresponding mathematical methods are presented. The exposition is formalized (whenever possible) on the basis of the coupled Schrödinger, Dirac and Maxwell equations. Aimed at upper graduate and graduate students in mathematical and physical science studies.

Problems and Solutions in Quantum Mechanics Springer Science & Business Media

This book provides an introduction into the fundamentals of non-relativistic quantum mechanics. In Part 1, the essential principles are developed. Applications and extensions of the formalism can be found in Part 2. The book includes not only material that is presented in traditional textbooks on quantum mechanics, but also discusses in detail current issues such as interaction-free quantum measurements, neutrino oscillations, various topics in the field of quantum information as well as fundamental problems and epistemological questions, such as the measurement problem, entanglement, Bell's inequality, decoherence, and the realism debate. A chapter on current interpretations of quantum mechanics concludes the book. To develop quickly and clearly the main principles of quantum mechanics and its mathematical formulation, there is a systematic change between wave mechanics and algebraic representation in the first chapters. The required mathematical tools are introduced step by step. Moreover, the appendix collects compactly the most important mathematical tools that supplementary literature can be largely dispensed. In addition, the appendix contains advanced topics, such as Quantum-Zeno effect, time-delay experiments, Lenz vector and the Shor algorithm. About 250 exercises, most of them with solutions, help to deepen the understanding of the topics.

SYMMETRIES AND GROUP THEORY IN PARTICLE PHYSICS

Springer Science & Business Media

This book is a comprehensive text in the field of quantum mechanics, covering fundamental concepts including the state of a quantum mechanical system, operators, superposition principle and measurement postulate. The notion of an operator and the algebra of operators are introduced with the help of elementary concepts of mathematical analysis. Mathematical tools developed will help readers in understanding the difficulties encountered in classical physics while trying to explain the experimental results involving atomic spectra and other phenomena. The differential equations that arise while solving eigenvalue problems are solved rigorously, to make the text self-sufficient. The solutions are then physically interpreted and explained. The text offers solved examples, analogous and homework problems to help students in solving practical problems of physics requiring quantum mechanical treatment.

EMERGENT QUANTUM MECHANICS

Springer Science & Business Media

Quantum physics and special relativity theory were two of the greatest breakthroughs in physics during the twentieth century and contributed to paradigm shifts in physics. This book combines these two discoveries to provide a complete description of the fundamentals of relativistic quantum physics, guiding the reader effortlessly from relativistic quantum mechanics to basic quantum field theory. The book gives a thorough and detailed treatment of the subject, beginning with the classification of particles, the Klein-Gordon equation and the Dirac equation. It then moves on to the canonical quantization procedure of the Klein-Gordon, Dirac and electromagnetic fields. Classical Yang-Mills theory, the LSZ formalism, perturbation theory, elementary processes in QED are introduced, and regularization, renormalization and radiative corrections are explored. With exercises scattered through the text and problems at the end of most chapters, the book is ideal for advanced undergraduate and graduate students in theoretical physics.

QUANTUM THEORY: CONCEPTS AND METHODS

Cambridge University Press

A comprehensive and unified introduction to describing and understanding complex interacting systems.

Fundamentals of Quantum Mechanics Springer

This textbook presents basic and advanced computational physics in a very didactic style. It contains very-well-presented and simple mathematical descriptions of many of the most important algorithms used in computational physics. The first part of the book discusses the basic numerical methods. The second part concentrates on simulation of classical and quantum systems. Several classes of integration methods are discussed including not only the standard Euler and Runge-Kutta method but also multi-step methods and the class of Verlet methods, which is introduced by studying the motion in Liouville space. A general chapter on the numerical treatment of differential equations provides methods of finite differences, finite volumes, finite elements and boundary elements together with spectral methods and weighted residual based methods. The book gives simple but non-trivial examples from a broad range of physical topics trying to give the reader insight into not only the numerical treatment but also simulated problems. Different methods are compared with regard to their stability and efficiency. The exercises in the book are realised as computer experiments.

STATISTICAL MECHANICS

Springer Science & Business Media

This collection of solved problems corresponds to the standard topics covered in established undergraduate and graduate courses in Quantum Mechanics. Problems are also included on topics of interest which are often absent in the existing literature. Solutions are presented in considerable detail, to enable students to follow each step. The emphasis is on stressing the principles and methods used, allowing students to master new ways of thinking and problem-solving techniques. The problems themselves are longer than those usually encountered in textbooks and consist of a number of questions based around a central theme, highlighting properties and concepts of interest. For undergraduate and graduate students, as well as those involved in teaching Quantum Mechanics, the book can be used as a supplementary text or as an independent self-study tool.

Classical Mechanics and Quantum Mechanics: An Historic-Axiomatic Approach Springer Science & Business Media

The two-volume textbook *Quantum Mechanics for Pedestrians* provides an introduction to the basics of nonrelativistic quantum mechanics. Originally written as a course for students of science education, the book addresses all those science students and others who are looking for a reasonably simple, fresh and modern introduction to the field. The basic principles of quantum mechanics are presented in the first volume. This second volume discusses applications and extensions to more complex problems. In addition to topics traditionally dealt with in quantum mechanics texts, such as symmetries or many-body problems, here also issues of current interest such as entanglement, Bell's inequalities, decoherence and various aspects of quantum information are treated in detail. Furthermore, questions of the basis of quantum mechanics and epistemological issues are discussed explicitly; these are relevant e.g. to the realism debate. A chapter on the interpretations of quantum mechanics completes this volume. The necessary mathematical tools are introduced step by step; in the appendix, the most relevant mathematics is compiled in compact form. More advanced topics such as the Lenz vector, Hardy's experiment and Shor's algorithm are treated in more detail in the appendix. As an essential aid to learning and teaching, 130 exercises are included, most of them with their solutions.

Atomic Structure Theory World Scientific Publishing Company

An accessible, comprehensive reference to modern quantum mechanics and field theory. In surveying available books on advanced quantum mechanics and field theory, Franz Gross determined that while established books were outdated, newer titles tended to focus on recent developments and disregard the basics. *Relativistic Quantum Mechanics and Field Theory* fills this striking gap in the field. With a strong emphasis on applications to

practical problems as well as calculations, Dr. Gross provides complete, up-to-date coverage of both elementary and advanced topics essential for a well-rounded understanding of the field. Developing the material at a level accessible even to newcomers to quantum mechanics, the book begins with topics that every physicist should know—quantization of the electromagnetic field, relativistic one body wave equations, and the theoretical explanation of atomic decay. Subsequent chapters prepare readers for advanced work, covering such major topics as gauge theories, path integral techniques, spontaneous symmetry breaking, and an introduction to QCD, chiral symmetry, and the Standard Model. A special chapter is devoted to relativistic bound state wave equations—an important topic that is often overlooked in other books. Clear and concise throughout, Relativistic Quantum

Mechanics and Field Theory boasts examples from atomic and nuclear physics as well as particle physics, and includes appendices with background material. It is an essential reference for anyone working in quantum mechanics today.

Information—Consciousness—Reality Springer Science & Business Media

The material for these volumes has been selected from the past twenty years' examination questions for graduate students at University of California at Berkeley, Columbia University, the University of Chicago, MIT, State University of New York at Buffalo, Princeton University and University of Wisconsin.

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