

# Quantum Mechanics Fundamentals Graduate Texts In Contemporary Physics

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Physics*

2020-04-19

## MELENDEZ ESSENCE

**Quantum Mechanics** OUP Oxford

The counter-intuitive aspects of quantum physics have been long illustrated by thought experiments, from Einstein's photon box to Schrödinger's cat. These experiments have now become real, with single particles - electrons, atoms, or photons - directly unveiling the strange features of the quantum. State superpositions, entanglement and complementarity define a novel quantum logic which can be harnessed for information processing, raising great hopes for applications. This book describes a class of such thought experiments made real. Juggling with atoms and photons confined in cavities, ions or cold atoms in traps, is here an incentive to shed a new light on the basic concepts of quantum physics. Measurement processes and decoherence at the quantum-classical boundary are highlighted. This volume, which combines theory and experiments, will be of interest to students in quantum physics, teachers seeking illustrations for their lectures and new problem sets, researchers in quantum optics and quantum information.

*Electroweak and Strong Interactions* Springer Science & Business Media

An innovative and mathematically sound treatment of the foundations of analytical mechanics and the relation of classical mechanics to relativity and quantum theory. It presents classical mechanics in a way designed to assist the student's transition to quantum theory.

*Elements of Quantum Mechanics* World Scientific

This graduate-level text surveys the fundamentals of quantum optics, including the quantum theory of partial coherence and the nature of the relations between classical and quantum theories of coherence. 1968 edition.

**QUANTUM MECHANICS.** Springer Science & Business Media  
Fundamentals of Quantum Mechanics, Third Edition is a clear and detailed introduction to quantum mechanics and its applications in chemistry and physics. All required math is clearly explained, including intermediate steps in derivations, and concise review of the math is included in the text at appropriate points. Most of the elementary quantum mechanical models—including particles in boxes, rigid rotor, harmonic oscillator, barrier penetration, hydrogen atom—are clearly and completely presented.

Applications of these models to selected "real world topics are also included. This new edition includes many new topics such as band theory and heat capacity of solids, spectroscopy of molecules and complexes (including applications to ligand field theory), and small molecules of astrophysical interest. Accessible style and colorful illustrations make the content appropriate for professional researchers and students alike. Presents results of quantum mechanical calculations that can be performed with readily available software. Provides exceptionally clear discussions of spin-orbit coupling and group theory, and comprehensive coverage of barrier penetration (quantum mechanical tunneling) that touches upon hot topics, such as superconductivity and scanning tunneling microscopy. Problems given at the end of each chapter help students to master concepts.

*Quantum Theory of Materials* Springer Nature

Graduate students who want to become familiar with advanced computational strategies in classical and quantum dynamics will find here both the fundamentals of a standard course and a detailed treatment of the time-dependent oscillator, Chern-Simons mechanics, the Maslov anomaly and the Berry phase, to name a few. Well-chosen and detailed examples illustrate the perturbation theory, canonical transformations, the action principle and demonstrate the usage of path integrals. This new edition has been revised and enlarged with chapters on quantum electrodynamics, high energy physics, Green's functions and strong interaction. "This book is a brilliant exposition of dynamical systems covering the essential aspects and written in an elegant manner. The book is written in modern language of mathematics and will ideally cater to the requirements of graduate and first year Ph.D. students...a wonderful introduction to any student who wants to do research in any branch of theoretical Physics." (Indian Journal of Physics)

*Modern Semiconductor Physics and Device Applications* Oxford University Press

Photonics is the discipline of electrons and photons working in tandem to create new physics, new devices and new applications. This textbook employs a pedagogical approach that facilitates access to the fundamentals of quantum photonics. Beginning with a review of the quantum properties of photons and electrons, the

book then introduces the concept of their non-locality at the quantum level. It presents a determination of electronic band structure using the pseudopotential method, enabling the student to directly compute the band structures of most group IV, group III-V, and group II-VI semiconductors. The book devotes further in-depth discussion of second quantization of the electromagnetic field that describes spontaneous and stimulated emission of photons, quantum entanglement and introduces the topic of quantum cascade lasers, showing how electrons and photons interact in a quantum environment to create a practical photonic device. This extended second edition includes a detailed description of the link between quantum photon states and the macroscopic electric field. It describes the particle qualities of quantum electrons via their unique operator algebra and distinguishable behavior from photons, and employs these fundamentals to describe the quantum point contact, which is the quantum analogue of a transistor and the basic building block of all nanoscopic circuits, such as electron interferometers. Pearsall's Quantum Photonics is supported by numerous numerical calculations that can be repeated by the reader, and every chapter features a reference list of state-of-the-art research and a set of exercises. This textbook is an essential part of any graduate-level course dealing with the theory of nanophotonic devices or computational physics of solid-state quantum devices based on nanoscopic structures.

*Many-Body Quantum Theory in Condensed Matter Physics* John Wiley & Sons

Along with the authors' follow-up book on advanced topics, this text provides students with a broad, up-to-date introduction to quantum mechanics. The text offers a graduate-level account of the behavior of matter and energy at the molecular, atomic, nuclear, and sub-nuclear levels. It presents the latest mathematical treatments, theoretical methods, applications, and experimental observations. A collection of problems at the end of each chapter develops students' understanding of both basic concepts and the application of theory to various physically important systems.

**Fundamentals of Quantum Physics** Cambridge University Press

Fundamentals of relativistic quantum physics, from relativistic quantum mechanics to basic quantum field theory, for graduate students in theoretical physics.

*Modern Quantum Mechanics* Courier Corporation

Filling an important gap in the literature, this comprehensive text develops conformal field theory from first principles. The treatment is self-contained, pedagogical, and exhaustive, and includes a great deal of background material on quantum field theory, statistical mechanics, Lie algebras and affine Lie algebras. The many exercises, with a wide spectrum of difficulty and subjects, complement and in many cases extend the text. The text is thus not only an excellent tool for classroom teaching but also for individual study. Intended primarily for graduate students and researchers in theoretical high-energy physics, mathematical physics, condensed matter theory, statistical physics, the book will also be of interest in other areas of theoretical physics and mathematics. It will prepare the reader for original research in this very active field of theoretical and mathematical physics.

**Relativistic Quantum Physics** John Wiley & Sons

The mathematical formalism of quantum theory in terms of vectors and operators in infinite-dimensional complex vector spaces is very abstract. The definitions of many mathematical quantities used do not seem to have an intuitive meaning, which makes it difficult to appreciate the mathematical formalism and understand quantum mechanics. This book provides intuition and motivation to the mathematics of quantum theory, introducing the mathematics in its simplest and familiar form, for instance, with three-dimensional vectors and operators, which can be readily understood. Feeling confident about and comfortable with the mathematics used helps readers appreciate and understand the concepts and formalism of quantum mechanics. This book is divided into four parts. Part I is a brief review of the general properties of classical and quantum systems. A general discussion of probability theory is also included which aims to help in understanding the probability theories relevant to quantum mechanics. Part II is a detailed study of the mathematics for quantum mechanics. Part III presents quantum mechanics in a series of postulates. Six groups of postulates are presented to describe orthodox quantum systems. Each statement of a postulate is supplemented with a detailed discussion. To make them easier to understand, the postulates for discrete observables are presented before those for continuous observables. Part IV presents several illustrative applications, which include harmonic and isotropic oscillators, charged particle

in external magnetic fields and the Aharonov-Bohm effect. For easy reference, definitions, theorems, examples, comments, properties and results are labelled with section numbers. Various symbols and notations are adopted to distinguish different quantities explicitly and to avoid misrepresentation. Self-contained both mathematically and physically, the book is accessible to a wide readership, including astrophysicists, mathematicians and philosophers of science who are interested in the foundations of quantum mechanics.

**Introduction to Quantum Mechanics** Academic Press  
Changes and additions to the new edition of this classic textbook include a new chapter on symmetries, new problems and examples, improved explanations, more numerical problems to be worked on a computer, new applications to solid state physics, and consolidated treatment of time-dependent potentials.  
*Principles of Quantum Mechanics* Springer Science & Business Media

Quantum mechanics has evolved from a subject of study in pure physics to one with a wide range of applications in many diverse fields. The basic concepts of quantum mechanics are explained in this book in a concise and easy-to-read manner, leading toward applications in solid-state electronics and optics. Following a logical sequence, the book focuses on key ideas and is conceptually and mathematically self-contained. The fundamental principles of quantum mechanics are illustrated by showing their application to systems such as the hydrogen atom, multi-electron ions and atoms, the formation of simple organic molecules and crystalline solids of practical importance. It leads on from these basic concepts to discuss some of the most significant applications in semiconductor electronics and optics. Containing many homework problems, the book is suitable for senior-level undergraduate and graduate-level students in electrical engineering, material sciences, applied physics and chemistry.

**Quantum Computing Explained** CRC Press

After an introduction to relativistic quantum mechanics, which lays the foundation for the rest of the text, the author moves on to the phenomenology and physics of fundamental interactions via a detailed discussion of the empirical principles of unified theories of strong, electromagnetic, and weak interactions. There then follows a development of local gauge theories and the minimal standard model of the fundamental interactions together with their characteristic applications. The book concludes with further possibilities and the theory of interactions for elementary particles probing complex nuclei. Numerous exercises with solutions make this an ideal text for graduate courses on quantum mechanics and elementary particle physics.

**Introduction to Quantum Mechanics** Oxford University Press on Demand

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

*Theoretical and Quantum Mechanics* Cambridge University Press  
Elements of Quantum Mechanics provides a solid grounding in the fundamentals of quantum theory and is designed for a first semester graduate or advanced undergraduate course in quantum mechanics for chemistry, chemical engineering, materials science, and physics students. The text includes full development of quantum theory. It begins with the most basic concepts of quantum theory, assuming only that students have some familiarity with such ideas as the uncertainty principle and quantized energy levels. Fayer's accessible approach presents balanced coverage of various quantum theory formalisms, such as the Schrödinger representation, raising and lowering operator techniques, the matrix representation, and density matrix methods. He includes a more extensive consideration of time dependent problems than is usually found in an introductory graduate course. Throughout the book, sufficient mathematical detail and classical mechanics background are provided to enable students to follow the quantum mechanical developments and analysis of physical phenomena. Fayer provides many examples and problems with fully detailed analytical solutions. Creating a distinctive flavor throughout, Fayer has produced a challenging text with exercises designed to help students become fluent in the concepts and language of modern quantum theory, facilitating their future understanding of more specialized topics. The book concludes with a section containing problems for each chapter that amplify and expand the topics covered in the book. A complete and detailed solution manual is available.

**Quantum Mechanics in a Nutshell** Springer

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.

*No-Nonsense Quantum Mechanics* World Scientific

Inspired by Richard Feynman and J.J. Sakurai, *A Modern Approach to Quantum Mechanics* allows lecturers to expose their undergraduates to Feynman's approach to quantum mechanics while simultaneously giving them a textbook that is well-ordered, logical and pedagogically sound. This book covers all the topics that are typically presented in a standard upper-level course in quantum mechanics, but its teaching approach is new. Rather than organizing his book according to the historical development of the field and jumping into a mathematical discussion of wave mechanics, Townsend begins his book with the quantum mechanics of spin. Thus, the first five chapters of the book succeed in laying out the fundamentals of quantum mechanics with little or no wave mechanics, so the physics is not obscured by mathematics. Starting with spin systems it gives students straightforward examples of the structure of quantum mechanics. When wave mechanics is introduced later, students should perceive it correctly as only one aspect of quantum mechanics and not the core of the subject.

*Foundations of Quantum Theory* Cambridge University Press

A self-contained treatment of the fundamentals of quantum computing This clear, practical book takes quantum computing out of the realm of theoretical physics and teaches the fundamentals of the field to students and professionals who have

not had training in quantum computing or quantum information theory, including computer scientists, programmers, electrical engineers, mathematicians, physics students, and chemists. The author cuts through the conventions of typical jargon-laden physics books and instead presents the material through his unique "how-to" approach and friendly, conversational style. Readers will learn how to carry out calculations with explicit details and will gain a fundamental grasp of: \* Quantum mechanics \* Quantum computation \* Teleportation \* Quantum cryptography \* Entanglement \* Quantum algorithms \* Error correction A number of worked examples are included so readers can see how quantum computing is done with their own eyes, while answers to similar end-of-chapter problems are provided for readers to check their own work as they learn to master the information. Ideal for professionals and graduate-level students alike, *Quantum Computing Explained* delivers the fundamentals of quantum computing readers need to be able to understand current research papers and go on to study more advanced quantum texts.

**Quantum Mechanics** Cambridge University Press

A comprehensive and engaging textbook, providing a graduate-level, non-historical, modern introduction of quantum mechanical concepts.

**Applied Quantum Mechanics** Springer Science & Business Media

This book has emerged from an undergraduate course as well as a graduate one, which I have taught for a number of years.

Recently, many universities have experimented by bringing quantum theory forward in the curriculum and we follow their example. This book is intended to serve as an introduction to theoretical mechanics and quantum mechanics for chemists. I have included those parts of quantum mechanics which are of greatest fundamental interest and utility, and have developed those parts of classical mechanics which relate to and illuminate them. I try to give a comprehensive treatment wherever possible. The book would acquaint chemists with the quantum structure of the basic object of chemistry, the atom. My intention is to bridge the gap between classical physics, general and inorganic chemistry, and quantum mechanics. For these reasons: 1. I present in one course the basics of theoretical mechanics and quantum mechanics, to emphasise the continuity between them; 2. I have chosen the topics of theoretical mechanics based upon two criteria: a) usefulness for chemical problems: two-body problem; rotational motion of a charged particles (free and in an atom); interaction of a magnetic field with a magnetic dipole; details of small oscillations and oscillations of molecules; b) the need for transition from classical to quantum mechanics: basics of Lagrangian mechanics; basics of Hamiltonian mechanics; 3. I give detailed explanation of an application of the quantum method to simple systems: one-dimensional potential, harmonic oscillator, hydrogen atom, and hydrog- like atoms.