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THE HISTORICAL DEVELOPMENT  
OF QUANTUM THEORY

VOLUME I  
Part I



Jagdish Mehra  
Helmut Rechenberg

THE HISTORICAL DEVELOPMENT  
OF  
QUANTUM THEORY

VOLUME I  
Part I

The Quantum Theory of  
Planck, Einstein, Bohr and Sommerfeld;  
Its Foundation and the Rise of Its Difficulties  
1900 - 1925

Springer-Verlag



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# Quantum Theory Volume 1 Elements

**editors: Yuhua Fu, Linfan Mao, and  
Mihaly Bencze**



## **Quantum Theory Volume 1 Elements:**

**Quantum Mechanics, Volume 1** Claude Cohen-Tannoudji, Bernard Diu, Franck Laloe, 2019-12-04 This new edition of the unrivalled textbook introduces the fundamental concepts of quantum mechanics such as waves particles and probability before explaining the postulates of quantum mechanics in detail In the proven didactic manner the textbook then covers the classical scope of introductory quantum mechanics namely simple two level systems the one dimensional harmonic oscillator the quantized angular momentum and particles in a central potential The entire book has been revised to take into account new developments in quantum mechanics curricula The textbook retains its typical style also in the new edition it explains the fundamental concepts in chapters which are elaborated in accompanying complements that provide more detailed discussions examples and applications The quantum mechanics classic in a new edition written by 1997 Nobel laureate Claude Cohen Tannoudji and his colleagues Bernard Diu and Franck Lalo As easily comprehensible as possible all steps of the physical background and its mathematical representation are spelled out explicitly Comprehensive in addition to the fundamentals themselves the book contains more than 350 worked examples plus exercises Claude Cohen Tannoudji was a researcher at the Kastler Brossel laboratory of the Ecole Normale Sup rieure in Paris where he also studied and received his PhD in 1962 In 1973 he became Professor of atomic and molecular physics at the Coll ge des France His main research interests were optical pumping quantum optics and atom photon interactions In 1997 Claude Cohen Tannoudji together with Steven Chu and William D Phillips was awarded the Nobel Prize in Physics for his research on laser cooling and trapping of neutral atoms Bernard Diu was Professor at the Denis Diderot University Paris VII He was engaged in research at the Laboratory of Theoretical Physics and High Energy where his focus was on strong interactions physics and statistical mechanics Franck Lalo was a researcher at the Kastler Brossel laboratory of the Ecole Normale Sup rieure in Paris His first assignment was with the University of Paris VI before he was appointed to the CNRS the French National Research Center His research was focused on optical pumping statistical mechanics of quantum gases musical acoustics and the foundations of quantum mechanics

**Quantum Physics, Volume 1** Vladimir Zelevinsky, 2010-12-28 This two volume set can be naturally divided into two semester courses and contains a full modern graduate course in quantum physics The idea is to teach graduate students how to practically use quantum physics and theory presenting the fundamental knowledge and gradually moving on to applications including atomic nuclear and solid state physics as well as modern subfields such as quantum chaos and quantum entanglement The book starts with basic quantum problems which do not require full quantum formalism but allow the student to gain the necessary experience and elements of quantum thinking Only then does the fundamental Schrodinger equation appear The author has included topics that are not usually covered in standard textbooks and has written the book in such a way that every topic contains varying layers of difficulty so that the instructor can decide where to stop Although supplementary sources are not required Further reading is given for each chapter including references to

scientific journals and publications and a glossary is also provided Problems and solutions are integrated throughout the text

**Nuclear Science Abstracts** ,1975      SCIENTIFIC ELEMENTS (International Book Series), Vol. I, Applications of Smarandache's Notions to Mathematics, Physics, and Other Sciences editors:Yuhua Fu, Linfan Mao, and Mihaly Bencze,2007  
The Scientific Elements is an international book series maybe with different subtitles This series is devoted to the applications of Smarandache s notions and to mathematical combinatorics These are two heartening mathematical theories for sciences and can be applied to many fields This book selects 12 papers for showing applications of Smarandache s notions such as those of Smarandache multi spaces Smarandache geometries Neutrosophy etc to classical mathematics theoretical and experimental physics logic cosmology Looking at these elementary applications we can experience their great potential for developing sciences 12 authors contributed to this volume Linfan Mao Yuhua Fu Shenglin Cao Jingsong Feng Changwei Hu Zhengda Luo Hao Ji Xinwei Huang Yiyang Guan Tianyu Guan Shuan Chen and Yan Zhang      *Quantum Theory* Peter Bongaarts,2014-12-01 This book was inspired by the general observation that the great theories of modern physics are based on simple and transparent underlying mathematical structures a fact not usually emphasized in standard physics textbooks which makes it easy for mathematicians to understand their basic features It is a textbook on quantum theory intended for advanced undergraduate or graduate students mathematics students interested in modern physics and physics students who are interested in the mathematical background of physics and are dissatisfied with the level of rigor in standard physics courses More generally it offers a valuable resource for all mathematicians interested in modern physics and all physicists looking for a higher degree of mathematical precision with regard to the basic concepts in their field      **Niels Bohr - Collected Works** Finn Aaserud,2011-09-22 Niels Bohr Collected Works Volume 13 Cumulative Subject Index documents aspects of Niels Bohr s varied life and work in the form of a cumulative subject index with emphasis on his scientific contributions in the field of physics The general organization of the material is thematic rather than strictly chronological allowing for the presentation of each paper or group of papers along with other relevant material such as drafts notes letters and other items The book is illustrated with rare photos and includes explanatory notes as well as a bibliography The bibliography is restricted to the versions of Bohr s publications reproduced in this volume and encompasses a wide range of topics in physics from the determination of the surface tension of water by the method of jet vibration to the electron theory of metals and of thermoelectric phenomena the theory of the decrease of velocity of moving electrified particles on passing through matter the constitution of atoms and molecules and the spectra of helium and hydrogen Bohr s other papers focus on the effect of electric and magnetic fields on spectral lines the quantum theory of radiation and the structure of the atom the polarization of radiation in the quantum theory and collisions between atomic systems and free electrical particles This monograph will be useful to students practitioners and researchers interested in Bohr s life and work in general and in quantum mechanics in particular      **Constructing Quantum Mechanics Volume Two** Michel Janssen,Anthony

Duncan,2023-08-17 This is the second of two volumes on the genesis of quantum mechanics in the first quarter of the 20th century It covers the period 1923 1927 After covering some of the difficulties the old quantum theory had run into by the early 1920s as well as the discovery of the exclusion principle and electron spin it traces the emergence of two forms of the new quantum mechanics matrix mechanics and wave mechanics in the years 1923 27 It then shows how the new theory took care of some of the failures of the old theory and put its successes on a more solid basis Finally it shows how in 1927 the two forms of the new theory were unified first through statistical transformation theory then through the Hilbert space formalism This volume provides a detailed analysis of the classic papers by Heisenberg Born Jordan Dirac De Broglie Einstein Schrödinger von Neumann and other authors Drawing on the correspondence of these and other physicists their later reminiscences and the extensive secondary literature on the quantum revolution this volume places these papers in the context of the discussions out of which modern quantum mechanics emerged It argues that the genesis of modern quantum mechanics can be seen as the construction of an arch on a scaffold provided by the old quantum theory discarded once the arch could support itself

**Introduction to the Theory of Atomic Spectra** I. I. Sobel'Man,2016-04-20 Introduction to the Theory of Atomic Spectra is a systematic presentation of the theory of atomic spectra based on the modern system of the theory of angular momentum Many questions which are of interest from the point of view of using spectroscopic methods for investigating various physical phenomena including continuous spectrum radiation excitation of atoms and spectral line broadening are discussed This volume consists of 11 chapters organized into three sections After a summary of elementary information on atomic spectra including the hydrogen spectrum and the spectra of multi electron atoms the reader is methodically introduced to angular momentum systematics of the levels of multi electron atoms and hyperfine structure of spectral lines Relativistic corrections are also given consideration with particular reference to the use of the Dirac equation to determine the stationary states of an electron in an arbitrary electromagnetic field In addition the book explores the Stark effect and the Zeeman effect the interaction between atoms and an electromagnetic field and broadening of spectral lines The final chapter is devoted to the problem of atomic excitation by collisions This book is intended for advanced course university students postgraduate students and scientists working on spectroscopy and spectral analysis and also in the field of theoretical physics

*A Method for Studying Model Hamiltonians* N. N. Bogolyubov,2013-10-22 A Method for Studying Model Hamiltonians A Minimax Principle for Problems in Statistical Physics centers on methods for solving certain problems in statistical physics which contain four fermion interaction Organized into four chapters this book begins with a presentation of the proof of the asymptotic relations for the many time correlation functions Chapter 2 details the construction of a proof of the generalized asymptotic relations for the many time correlation averages Chapter 3 explains the correlation functions for systems with four fermion negative interaction The last chapter shows the model systems with positive and negative interaction components

**Distributions and Their Applications in Physics** F. Constantinescu,2017-07-26 Distributions

and Their Applications in Physics is the introduction of the Theory of Distributions and their applications in physics The book contains a discussion of those topics under the Theory of Distributions that are already considered classic which include local distributions distributions with compact support tempered distributions the distribution theory in relativistic physics and many others The book also covers the Normed and Countably normed Spaces Test Function Spaces Distribution Spaces and the properties and operations involved in distributions The text is recommended for physicists that wish to be acquainted with distributions and their relevance and applications as part of mathematical and theoretical physics and for mathematicians who wish to be acquainted with the application of distributions theory for physics

**Theoretical Physics and Astrophysics** V.L. Ginzburg, 2013-10-22 The aim of this book is to present on the one hand various topics in theoretical physics in depth especially topics related to electrodynamics and on the other hand to show how these topics find applications in various aspects of astrophysics The first text on theoretical physics and astrophysical applications it covers many recent advances including those in X ray ray and radio astronomy with comprehensive coverage of the literature

The Pseudo-Spin Method in Magnetism and Ferroelectricity Ljubisav Novaković, 2013-10-22 The Pseudo Spin Method in Magnetism and Ferroelectricity deals with the pseudo spin method in magnetism and ferroelectricity with emphasis on three important ordered systems ferromagnets antiferromagnets and hydrogen bonded ferroelectrics Each system is analyzed in three important temperature regions low temperatures the critical region and high temperatures The presented mathematical method is predominantly analytical in the sense that all crucial physical quantities are expressed in terms of temperature or the reciprocal lattice vectors Comprised of four chapters this volume begins with an introduction to Basic concepts in lattice dynamics touching on topics such as symmetry groups light scattering and the spectrum of ionic crystals The discussion then turns to phase transitions and covers magnetism ferroelectricity and the Ising model with a transverse field Magnetic elementary excitations are then considered paying particular attention to the second quantization method the exchange interaction the Heisenberg ferromagnet in a boson representation and high temperature static susceptibility The final chapter is devoted to the Green functions and their perturbation expansion ferromagnetism at low temperatures antiferromagnetism and ferroelectric modes and high temperature dielectric susceptibilities This book will be of interest to physicists as well as students and researchers in physics

Progress in Physics, vol. 4/2010 Dmitri Rabounski, Florentin Smarandache, Larissa Borissova, Progress in Physics has been created for publications on advanced studies in theoretical and experimental physics including related themes from mathematics

**Gravitation and Relativity** M. G. Bowler, 2016-06-06 International Series in Natural Philosophy Volume 86 Gravitation and Relativity provides information pertinent to the fundamental aspects of the theories of gravitation This book applies the elementary tools of special relativity to the problem of generalizing Newton's theory of gravitation Organized into 10 chapters this volume begins with an overview of the principle of relativity which asserts that there is no meaningful way of defining absolute velocity This text then presents a

discussion of the E t v s Dicke experiments that established the identity of inertial and gravitational mass Other chapters consider the equations of electrodynamics derived by starting from the equations of electrostatics This book discusses as well gravitational redshift deflection of light and radar echo delay The final chapter attempts to establish the connection with general relativity and discusses how black holes may manifest themselves to the astronomer This book is a valuable resource for physicists and undergraduate students in physics      The Collected Works of P. A. M. Dirac: Volume 1 P. A. M.

Dirac,1995-10-26 A comprehensive collection of the scientific papers of one of this century s most outstanding physicists

**Interactions between Electromagnetic Fields and Matter** Karl-Heinz Steiner,2016-07-29 Interactions between Electromagnetic Fields and Matter deals with the principles and methods that can amplify electromagnetic fields from very low levels of signals This book discusses how electromagnetic fields can be produced amplified modulated or rectified from very low levels to enable these for application in communication systems This text also describes the properties of matter and some phenomenological considerations to the reactions of matter when an action of external fields results in a polarization of the particle system and changes the bonding forces existing in the matter This book considers the above phenomena in detail by explaining matter as a conglomeration of charged mass points in the electromagnetic field Quantum mechanics and Maxwell s theory can then account for the precise description of the interactions between the electromagnetic fields and matter This book then describes special processes such as 1 the static and quasistatic interactions and 2 dynamic processes particularly the resonance process This text also defines a general form for electric and magnetic reactions using the generalized field equation This book also cites the anharmonic oscillator and the single spin as different examples of electric and magnetic dipole interactions This text is suitable for electrical engineers radio technicians physicists whose work is in quantum mechanics and engineers interested in electro magnetism theory      Non-Linear Waves in Dispersive Media V. I. Karpman,2016-01-22 Non Linear Waves in Dispersive Media introduces the theory behind such topic as the gravitational waves on water surfaces Some limiting cases of the theory wherein proof of an asymptotic class is necessary and generated are also provided The first section of the book discusses the notion of linear approximation This discussion is followed by some samples of dispersive media Examples of stationary waves are also examined The book proceeds with a discussion of waves of envelopes The concept behind this subject is from the application of the methods of geometrical optics to non linear theory A section on non linear waves with slowly varying parameters is given at the end of the book along with a discussion of the evolution of electro acoustic waves in plasma with negative dielectric permittivity The gravitational waves on fluid surfaces are presented completely The text will provide valuable information for physicists mechanical engineers students and researchers in the field of optics acoustics and hydrodynamics      **Binary and Multiple Systems of Stars** Alan H. Batten,2013-10-22 Binary and Multiple Systems of Stars focuses on spectroscopic observational results and interpretations of binaries and a few of multiple systems Organized into 10 chapters this book begins with the basic concepts and terminologies

used in the study of binary and multiple systems of stars Then the incidence of both star systems is described Subsequent chapters explore the properties of individual binaries as well as the evolution and origin of such star system This book will be a valuable reference material for astronomers scientists in related fields as well as graduate students

**The Expanding Earth** Pascual Jordan, 2016-05-24 International Series of Monographs in Natural Philosophy Volume 37 The Expanding Earth Some Consequences of Dirac's Gravitation Hypothesis focuses on the applications of Dirac's gravitation hypothesis The book first discusses objections to Dirac's hypothesis and expansion cracks including geological chronology astrophysical objections rift valleys rills of the moon deep sea trenches and oceanic rifts The text then looks at the origin of the oceans as well as growth and shrink of continents expansion and formation of oceans growth of land areas and paleomagnetism The manuscript examines the physics of the earth moon system Topics include rheology and seismic exploration of the earth's interior quantitative data about the earth's expansion and Dirac's hypothesis and the many body problem The book also offers information on volcanoes lunar craters folded mountains and ice ages Topics include Bunge's explanation of volcanism folded mountains and submarine tablemounts and currents The text is a dependable source of data for readers interested in Dirac's gravitation hypothesis

**Fluctuations and Non-Linear Wave Interactions in Plasmas** A. G. Sitenko, 2016-09-20 Fluctuations and Non linear Wave Interactions in Plasmas talks about a theory of fluctuations in a homogenous plasma The title takes into consideration non linear wave interactions The text first presents the statistical description of plasma and then proceeds to covering non linear electrodynamic equations Next the selection deals with the electrodynamic properties of magnetized active plasma and waves in plasma The text also tackles non linear wave interactions along with fluctuations in plasmas The next chapter talks about the effect of non linear wave interaction on fluctuations in a plasma Chapter 8 details fluctuation dissipation theorem while Chapter 9 discusses kinetic equations The tenth chapter covers the scattering and radiation of waves and the last chapter tackles wave interaction in semi bounded plasma The book will be of great use to scientists and professionals who deal with plasmas



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## **Table of Contents Quantum Theory Volume 1 Elements**

1. Understanding the eBook Quantum Theory Volume 1 Elements
  - The Rise of Digital Reading Quantum Theory Volume 1 Elements
  - Advantages of eBooks Over Traditional Books
2. Identifying Quantum Theory Volume 1 Elements
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Quantum Theory Volume 1 Elements
  - User-Friendly Interface
4. Exploring eBook Recommendations from Quantum Theory Volume 1 Elements
  - Personalized Recommendations
  - Quantum Theory Volume 1 Elements User Reviews and Ratings
  - Quantum Theory Volume 1 Elements and Bestseller Lists
5. Accessing Quantum Theory Volume 1 Elements Free and Paid eBooks

- Quantum Theory Volume 1 Elements Public Domain eBooks
- Quantum Theory Volume 1 Elements eBook Subscription Services
- Quantum Theory Volume 1 Elements Budget-Friendly Options
- 6. Navigating Quantum Theory Volume 1 Elements eBook Formats
  - ePub, PDF, MOBI, and More
  - Quantum Theory Volume 1 Elements Compatibility with Devices
  - Quantum Theory Volume 1 Elements Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Quantum Theory Volume 1 Elements
  - Highlighting and Note-Taking Quantum Theory Volume 1 Elements
  - Interactive Elements Quantum Theory Volume 1 Elements
- 8. Staying Engaged with Quantum Theory Volume 1 Elements
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Quantum Theory Volume 1 Elements
- 9. Balancing eBooks and Physical Books Quantum Theory Volume 1 Elements
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Quantum Theory Volume 1 Elements
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Quantum Theory Volume 1 Elements
  - Setting Reading Goals Quantum Theory Volume 1 Elements
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Quantum Theory Volume 1 Elements
  - Fact-Checking eBook Content of Quantum Theory Volume 1 Elements
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

#### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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