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KEY=MODELING - JOHNS KELLEY

Theory of Quantum and Classical Connections in Modeling Atomic, Molecular and Electrodynamical Systems Academic Press **Quantum and Classical Connections in Modeling Atomic, Molecular and Electrodynamic Systems is intended for scientists and graduate students interested in the foundations of quantum mechanics and applied scientists interested in accurate atomic and molecular models. This is a reference to those working in the new field of relativistic optics, in topics related to relativistic interactions between very intense laser beams and particles, and is based on 30 years of research. The novelty of this work consists of accurate connections between the properties of quantum equations and corresponding classical equations used to calculate the energetic values and the symmetry properties of atomic, molecular and electrodynamical systems, as well as offering applications using methods for calculating the symmetry properties and the energetic values of systems and the calculation of properties of high harmonics in interactions between very intense electromagnetic fields and electrons. Features detailed explanations of the theories of atomic and molecular systems, as well as wave properties of stationary atomic and molecular systems Provides periodic solutions of classical equations, semi-classical methods, and theories of systems composed of very intense electromagnetic fields and particles Offers models and methods based on 30 years of research Applications of Quantum and Classical Connections in Modeling Atomic, Molecular and Electrodynamic Systems** Elsevier **Applications of Quantum and Classical Connections in Modeling Atomic, Molecular and Electrodynamical Systems is a reference on the new field of relativistic optics, examining topics related to relativistic interactions between very intense laser beams and particles. Based on 30 years of research, this unique book connects the properties of quantum equations to corresponding classical equations used to calculate the energetic values and the symmetry properties of atomic, molecular and electrodynamical systems. In addition, it examines applications for these methods, and for the calculation of properties of high harmonics in interactions between very intense electromagnetic fields and electrons. This resource is the only one of its kind, a valuable tool for scientists and graduate students interested in the foundations of quantum mechanics, as well as applied scientists interested in accurate atomic and molecular models. Features detailed explanations of the theories of atomic and molecular systems, as well as wave properties of stationary atomic and molecular systems Provides periodic solutions of classical equations, semi-classical methods, and theories of systems composed of very intense electromagnetic fields and particles Offers models and methods based on 30 years of research The Effects of Relativity in Atoms, Molecules, and the Solid State** Springer Science & Business Media **Recent years have seen a growing interest in the effects of relativity in atoms, molecules and solids. On the one hand, this can be seen as result of the growing awareness of the importance of relativity in describing the properties of heavy atoms and systems containing them. This has been fueled by the inadequacy of physical models which either neglect relativity or which treat it as a small perturbation. On the other hand, it is dependent upon the technological developments which have resulted in computers powerful enough to make calculations on heavy atoms and on systems containing heavy atoms meaningful. Vector processing and, more recently, parallel processing techniques are playing an increasingly vital role in rendering the algorithms which arise in relativistic studies tractable. This has been exemplified in atomic structure theory, where the dominant role of the central nuclear charge simplifies the problem enough to permit some prediction to be made with high precision, especially for the highly ionized atoms of importance in plasma physics and in laser confinement studies. Today's sophisticated physical models of the atom derived from quantum electrodynamics would be intractable without recourse to modern computational machinery. Relativistic atomic structure calculations have a history dating from the early attempts of Swirles in the mid 1930's but continue to provide one of the primary test beds of modern theoretical physics. Modern Nonlinear Optics** John Wiley & Sons **The new edition will provide the sole comprehensive resource available for non-linear optics, including detailed descriptions of the advances over the last decade from world-renowned experts. Nonlinear Electrodynamics in Biological Systems** Springer Science & Business Media **The past half century has seen an extraordinary growth in the fields of cellular and molecular biology. From simple morphologi cal concepts of cells as the essential units of living matter there has been an ever-sharper focus on functional organization of living systems, with emphasis on molecular dynamics. Thus, life forms have come to be defined increasingly in terms of metabolism, growth, reproduction and responses to environmental perturbations. Since these properties occur in varying degrees in systems below the level of cellular organization, there has been a blurring of older models that restricted the concepts of life to cellular systems. At the same time, a search has begun for elemental as pects of molecular and atomic behavior that might better define properties common to all life forms. This search has led to an examination of nonlinear behavior in biological macromolecules, whether in response to electrical or chemical stimulation, for example, or as a means of signaling along a molecular chain, or as a means of energy transfer. Experimental knowledge in this area has grown rapidly in the past decade, and in some respects has outstripped theoretical models adequate to ex plain these new observations. Nevertheless, it can be claimed that there is now an impressive body of experiments implicating non linear, nonequilibrium processes as fundamental steps in sequential operations of biological systems. Classical and Quantum Effects in Electrodynamics** Nova Publishers **Nuclear Science Abstracts Foundations of Molecular Quantum Electrodynamics** Cambridge University Press **This book presents a comprehensive account of molecular quantum electrodynamics from the perspectives of physics and theoretical chemistry. The first part of the book establishes the essential concepts underlying classical electrodynamics, using the tools of Lagrangian and Hamiltonian mechanics. The second part focuses on the fundamentals of quantum mechanics, particularly how they relate to, and influence, chemical and molecular processes. The special case of the Coulomb Hamiltonian (including the celebrated Born-Oppenheimer approximation) is given a modern treatment. The final part of the book is devoted to non-relativistic quantum electrodynamics and describes in detail its impact upon our understanding of atoms and molecules, and their interaction with light. Particular attention is paid to the Power-Zienau-Woolley (PZW) representations, and both perturbative and non-perturbative approaches to QED calculation are discussed. This book is ideal for graduate students and researchers in chemical and molecular physics, quantum chemistry, and theoretical chemistry. Introduction to Quantum Control and Dynamics** CRC Press **The introduction of control theory in quantum mechanics has created a rich, new interdisciplinary scientific field, which is producing novel insight into important theoretical questions at the heart of quantum physics. Exploring this emerging subject, Introduction to Quantum Control and Dynamics presents the mathematical concepts and fundamental physics behind the analysis and control of quantum dynamics, emphasizing the application of Lie algebra and Lie group theory. After introducing the basics of quantum mechanics, the book derives a class of models for quantum control systems from fundamental physics. It examines the controllability and observability of quantum systems and the related problem of quantum state determination and measurement. The author also uses Lie group decompositions as tools to analyze dynamics and to design control algorithms. In addition, he describes various other control methods and discusses topics in quantum information theory that include entanglement and entanglement dynamics. The final chapter covers the implementation of quantum control and dynamics in several fields. Armed with the basics of quantum control and dynamics, readers will invariably use this interdisciplinary knowledge in their mathematical, physics, and engineering work. Advances in the Theory of Atomic and Molecular Systems Conceptual and Computational Advances in Quantum Chemistry** Springer Science & Business Media **Advances in the Theory of Atomic and Molecular Systems, is a collection of contributions presenting recent theoretical and computational developments that provide new insights into the structure, properties, and behavior of a variety of atomic and molecular systems. This volume (subtitled: Conceptual and Computational Advances in Quantum Chemistry) focuses on electronic structure theory and its foundations. This volume is an invaluable resource for faculty, graduate students, and researchers interested in theoretical and computational chemistry and physics, physical chemistry and chemical physics, molecular spectroscopy, and related areas of science and engineering. The Electrodynamics of Water and Ice** Springer Nature **This book is a research monograph summarizing recent advances related to the molecular structure of water and ice, and it is based on the latest spectroscopic data available. A special focus is given to radio- and microwave frequency regions. Within the five interconnected chapters, the author reviews the electromagnetic waves interaction with water, ice, and moist substances, discussing the microscopic mechanisms behind the dielectric responses. Well-established classic views concerning the structure of water and ice are considered along with new approaches related to atomic and molecular dynamics. Particular attention is given to nanofluidics, atmospheric science, and electrochemistry. The mathematical apparatus, based on diverse approaches employed in condensed matter physics, is widely used and allows the reader to quantitatively describe the electrodynamic response of water and ice in both bulk and confined states. This book is intended for a wide audience covering physicists, electrochemists, geophysicists, engineers, biophysicists, and general scientists who work on the electromagnetic radiation interaction with water and moist substances. Principles and Practices of Molecular Properties Theory, Modeling, and Simulations** John Wiley & Sons **A comprehensive yet accessible exploration of quantum chemical methods for the determination of molecular properties of spectroscopic relevance Molecular properties can be probed both through experiment and simulation. This book bridges these two worlds, connecting the experimentalist's macroscopic view of responses of the electromagnetic field to the theoretician’s microscopic description of the molecular responses. Comprehensive in scope, it also offers conceptual illustrations of molecular response theory by means of time-dependent simulations of simple systems. This important resource in physical chemistry offers: A journey in electrodynamics from the molecular microscopic perspective to the conventional macroscopic viewpoint The construction of Hamiltonians that are appropriate for the quantum mechanical description of molecular properties Time- and frequency-domain perspectives of light–matter interactions and molecular responses of both electrons and nuclei An introduction to approximate state response theory that serves as an everyday tool for computational chemists A unified presentation of prominent molecular properties Principles and Practices of Molecular Properties: Theory, Modeling and Simulations is written by noted experts in the field. It is a guide for graduate students, postdoctoral researchers and professionals in academia and industry alike, providing a set of keys to the research literature. Molecular Quantum Electrodynamics** Courier Corporation **Self-contained, systematic introduction examines application of quantum electrodynamics to interpretation of optical experiments on atoms and molecules and explains the quantum theory of electromagnetic radiation and its interaction with matter. Relativistic Quantum Theory of Atoms and Molecules Theory and Computation** Springer Science & Business Media **This book is intended for physicists and chemists who need to understand the theory of atomic and molecular structure and processes, and who wish to apply the theory to practical problems. As far as practicable, the book provides a self-contained account of the theory of relativistic atomic and molecular structure, based on the accepted formalism of bound-state Quantum Electrodynamics. The author was elected a Fellow of the Royal Society of London in 1992. New Trends in Quantum Systems in Chemistry and Physics Volume 1 Basic Problems and Model Systems Paris, France, 1999** Springer

Science & Business Media **These two volumes collect thirty-eight selected papers from the scientific contributions presented at the Fourth European Workshop on Quantum Systems in Chemistry and Physics (QSCP-IV), held in Marly-le-Roi (France) in April 22-27, 1999, A total ofone hundred and fifteen scientists attended the workshop, 99 from Europe and 16 from the rest ofthe world. They discussed the state of the art, new trends, and future evolution of the methods and applications. The workshop was held in the old town of Marly-le-Roi, which lies to the West of Paris between the historic centres of Saint-Germain-en-Laye and Versailles. Participants were housed at the National Youth Institute, where over sixty lectures were given by l- ding members ofthe scientific community; in addition, over sixty posters were presented in two very animated sessions. We are grateful to the oral speakers and to the poster p- senters for making the workshop such an stimulating experience. The social programme was also memorable - and notjust for the closing banquet, which was held at the French Senate House. We are sure that participants will long remember their visit to the 'Musée des Antiquités Nationales': created by Napoleon III at the birthplace ofLouis XIV, this museum boasts one ofthe world finest collections ofarcheological artifacts. The Marly-le-Roi workshop followed the format established at the three previous meetings, organized by Prof. Complex Quantum Systems Analysis of Large Coulomb Systems** World Scientific **This volume is based on lectures given during the program "Complex Quantum Systems" held at the National University of Singapore's Institute for Mathematical Sciences from 17 February to 27 March 2010. It guides the reader through two introductory expositions on large Coulomb systems to five of the most important developments in the field: derivation of mean field equations, derivation of effective Hamiltonians, alternative high precision methods in quantum chemistry, modern many-body methods originating from quantum information, and — the most complex — semirelativistic quantum electrodynamics. These introductions are written by leaders in their fields; amongst them are Volker Bach, Rafael Benguria, Thomas Chen, and Jan Philip Solovej. Together, they fill a gap between current textbooks and the vast modern literature on complex quantum systems. Contents:Stability of Matter (Rafael D Benguria and Benjamín A Loewe)Mathematical Density and Density Matrix Functional Theory (DFT and DMFT) (Volker Bach)On the Dynamics of a Fermi Gas in a Random Medium with Dynamical Hartree–Fock Interactions (Thomas Chen)On the Minimization of Hamiltonians over Pure Gaussian States (Jan Dereziński, Marcin Napiórkowski and Jan Philip Solovej)Variational Approach to Electronic Structure Calculations on Second-Order Reduced Density Matrices and the N-Representability Problem (Maho Nakata, Mituhiro Fukuda, and Katsuki Fujisawa)Fermionic Quantum Many-Body Systems: A Quantum Information Approach (Christina V Kraus)Hydrogen-Like Atoms in Relativistic QED (Martin Könenberg, Oliver Matte, and Edgardo Stockmeyer) Readership: Mathematicians and mathematical physicists, advanced graduate students and researchers in rigorous many body theory. Keywords:Analysis;Large Coulomb Systems;Stability;Correlation Inequalities;Effective Equations;Quantum Information;Matrix Product States;Quantum Electrodynamics Chemical Modelling Applications and Theory** Royal Society of Chemistry **Chemical Modelling; Applications and Theory comprises critical literature reviews of all aspects of molecular modelling. Molecular modelling in this context refers to modelling the structure properties and reactions of atoms molecules and materials. Each chapter provides a selective review of recent literature, incorporating sufficient historical perspective for the non-specialist to gain an understanding. With chemical modelling covering such a wide range of subjects this Specialist Periodical Report serves as the first port of call to any chemist, biochemist, materials scientist or molecular physicist needing to acquaint themselves with major developments in the area. Volume 4 provides a review of the literature published from June 2003 to May 2005. Springer Handbook of Atomic, Molecular, and Optical Physics** Springer Science & Business Media **Comprises a comprehensive reference source that unifies the entire fields of atomic molecular and optical (AMO) physics, assembling the principal ideas, techniques and results of the field. 92 chapters written by about 120 authors present the principal ideas, techniques and results of the field, together with a guide to the primary research literature (carefully edited to ensure a uniform coverage and style, with extensive cross-references). Along with a summary of key ideas, techniques, and results, many chapters offer diagrams of apparatus, graphs, and tables of data. From atomic spectroscopy to applications in comets, one finds contributions from over 100 authors, all leaders in their respective disciplines. Substantially updated and expanded since the original 1996 edition, it now contains several entirely new chapters covering current areas of great research interest that barely existed in 1996, such as Bose-Einstein condensation, quantum information, and cosmological variations of the fundamental constants. A fully-searchable CD- ROM version of the contents accompanies the handbook. Electrodynamics Of Interfaces And Composite Systems - Proceedings Of The International Workshop** #N/A **Nuclear Science Abstracts Large Coulomb Systems Lecture Notes on Mathematical Aspects of QED** Springer Science & Business Media **A mathematically consistent formulation of relativistic quantum electrodynamics (QED) has still to be found. Nevertheless, there are several simplified effective models that successfully describe many body quantum systems and the interaction of radiation with matter. Large Coulomb Systems explores a selection of mathematical topics inspired by QED. It comprises selected, expanded and edited lectures given by international experts at a topical summer school. Fourth Summer School in Analysis and Mathematical Physics Topics in Spectral Theory and Quantum Mechanics, May 2005, Universidad Nacional Autónoma de México, Cuernavaca, Mexico** American Mathematical Soc. **This book consists of three expository articles written by outstanding researchers in Mathematical Physics: Rafael Benguria, Peter Hislop, and Elliott Lieb. The articles are based on their lectures at the Fourth Summer School in Analysis and Mathematical Physics, held at the Institute of Mathematics, Universidad Nacional Autonoma de Mexico, Cuernavaca in May 2005. The main goal of the articles is to link the basic knowledge of a graduate student in Mathematics with three current research topics in Mathematical Physics: Isoperimetric inequalities for eigenvalues of the Laplace Operator, Random Schrodinger Operators, and Stability of Matter, respectively. These well written articles will guide and introduce the reader to current research topics and will also provide information on recent progress in some areas of Mathematical Physics. Hierarchic Electrodynamics and Free Electron Lasers Concepts, Calculations, and Practical Applications** CRC Press **Hierarchic Electrodynamics and Free Electron Lasers: Concepts, Calculations, and Practical Applications presents intriguing new fundamental concepts in the phenomenon of hierarchical electrodynamics as a new direction in physics. Concentrating on the key theory of hierarchic oscillations and waves, this book focuses on the numerous applications of nonlinear theory in different types of high-current Free Electron Lasers (FEL), including their primary function in the calculation methods used to analyze various multi-resonant, multi-frequency nonlinear FEL models. This is considered the first book to: Completely and systematically describe the foundation of hierarchical electrodynamics as a new direction of physics Fully represent the physics of high-current FEL—and associated models—from the hierarchic oscillation wave perspective Cover the multi-harmonic nonlinear theory of new types of electronic devices, such as plasma-beam and two-stream FEL Formulate and substantiate the concept of cluster femtosecond FEL Analyze practical prospects for a new generation of a global "Star Wars" strategic defense systems These subjects involve a wide range of disciplines. Using numerous real-world examples to illustrate information and concepts, the book offers a mathematical foundation to explore FEL applications as well as analyze hierarchic plasma-like electrodynamic systems and femto-second clusters of electromagnetic energy. Assembling fragmented concepts from existing literature, the author re-examines classic approaches in order to develop new insights and achieve scientific breakthroughs. Physics Atoms, Molecules and Photons An Introduction to Atomic-, Molecular- and Quantum Physics** Springer **This introduction to Atomic and Molecular Physics explains how our present model of atoms and molecules has been developed over the last two centuries both by many experimental discoveries and, from the theoretical side, by the introduction of quantum physics to the adequate description of micro-particles. It illustrates the wave model of particles by many examples and shows the limits of classical description. The interaction of electromagnetic radiation with atoms and molecules and its potential for spectroscopy is outlined in more detail and in particular lasers as modern spectroscopic tools are discussed more thoroughly. Many examples and problems with solutions are offered to encourage readers to actively engage in applying and adapting the fundamental physics presented in this textbook to specific situations. Completely revised third edition with new sections covering all actual developments, like photonics, ultrashort lasers, ultraprecise frequency combs, free electron lasers, cooling and trapping of atoms, quantum optics and quantum information. Self-Organization of Molecular Systems From Molecules and Clusters to Nanotubes and Proteins** Springer Science & Business Media **Proceedings of the NATO Advanced Research Workshop on Molecular Self-Organization: From Molecules to Water, to Nanoparticles, to DNA and Proteins Kyiv, Ukraine 8-12 June 2008 Handbook of Molecular Physics and Quantum Chemistry, 3 Volume Set** Wiley **Published in three volumes, this comprehensive reference work brings together in a single source for the first time, a detailed presentation of the most important theoretical concepts and methods for the study of molecules and molecular systems. The logical format of the Handbook allows the reader to progress from the foundations of the field to the most important and exciting areas of current research. Edited and written by an outstanding international team, and containing over 100 articles written by more than 50 contributors, it will be invaluable for both the expert researcher and the graduate student or postdoctoral worker active in any of the broad range of fields where these concepts and methods are important. Comprises three themed volumes: * Fundamentals * Molecular Electronic Structure * Molecules in the Physico-Chemical Environment: Spectroscopy, Dynamics and Bulk Properties * Presents detailed articles covering the key topics, presented in a didactic manner * Focuses both on theory and the relation of experiment to theory Volume 1, Fundamentals presents the foundations of molecular physics and quantum chemistry. It consists of 7 parts arranged as follows:- Part 1 Introduction Part 2 Elements of Quantum Mechanics Part 3 Orbital Models for Atomic, Molecular and Crystal Structure Part 4 Symmetry Groups and Molecular Structure Part 5 Second Quantization and Many-Body Methods Part 6 Approximate Separation of Electronic and Nuclear Motion Part 7 Quantum Electrodynamics of Atoms and Molecules The central problem of molecular physics and quantum chemistry is the description of atomic and molecular electronic structure. The development of appropriate models for the description of the effects of electron correlation and of relativity are key components of the analysis. Volume 2, Molecular Electronic Structure, addresses these topics, and consists of 7 parts arranged as follows: Part 1 Approximation methods Part 2 Orbital Models and Generalized Product Functions Part 3 Electron correlation Part 4 Relativistic molecular electronic structure Part 5 Electronic structure of large molecules Part 6 Computational quantum chemistry Part 7 Visualization and interpretation of molecular electronic structure In reality no molecular system exists in isolation. Molecules interact with other atoms and molecules, and with their environment. Volume 3, Molecules in the Physico-Chemical Environment - Spectroscopy, Dynamics and Bulk Properties, consists of 7 parts arranged as follows:- Part 1 Response theory and propagator methods Part 2 Interactions between molecules Part 3 Molecules in different environments Part 4 Molecular Electronic spectra Part 5 Atomic Spectroscopy and Molecular Vibration-Rotation Spectroscopy Part 6 Molecular dynamics and dynamical processes Part 7 Bulk properties Ultra-Relativistic Effects of Laser Beam and Electron Interactions Basic Equations, Exact Solutions, and Modelling** IOP Publishing Limited **The latest generation of high-power pulsed lasers has renewed interest in the ultra-relativistic effects produced by the interaction between laser beams and electrons. Synthesising previous research, this book presents a unitary treatment of the main effects that occur in the ultra-relativistic interactions between laser beams and electrons. It uses exact solutions of relativistic and classical quantum equations, including a new solution of the Dirac equation, to fully describe the field and model the main ultra-relativistic effects created within it. Aimed at scientists, graduate students and professionals working in high-power laser facilities and labs, as well as those studying relativistic optics, the book presents a comprehensive survey of the field, intended to facilitate high-level engagement. Key Features: Models the ultra-relativistic effects of laser beam and electron interactions Presents a comprehensive, unitary treatment of the main effects occurring in ultra-relativistic interactions between laser beams and electrons. Based on exact solutions of relativistic quantum and classical equations. Includes instructions for designing new experiments Contains Mathematica(R) for further understanding Quantum Systems in Chemistry and Physics Volume 1: Basic Problems and Model Systems Volume 2: Advanced Problems and Complex Systems Granada, Spain (1997)** Springer Science & Business Media **These two volumes collect forty-four selected papers from the scientific contributions presented at the Third European Workshop on Quantum Systems in Chemistry and Physics, held in Granada (Spain), April 19–22, 1998. Ninety-nine scientists from Bulgaria, Columbia, Cuba, Denmark, Finland, France, Germany, Hungary, Israel, Italy, Mexico, Netherlands, Norway, Poland, Russia, Slovakia, Spain, Sweden, United Ki- dom, Uruguay and Venezuela attended the workshop, discussing the state of the art, new trends, and future evolution of the methods and applications. The workshop took place at the 'Los Alixares' Hotel, where 45 lectures were given by prominent members of the scientific community; in addition, 49 posters were presented in two very animated sessions. The success of this workshop is due, without doubt, to the excellent tradition initiated at the previous workshops, organised by Prof. R. McWeeny in San Miniato, Pisa (Italy), 1996, and by Prof. S. Wilson in Oxford (United Kingdom), 1997. These workshops create occasions for meetings and disc- sions on the current state of the art, emerging methods and applications and new trends in this area of science. The three meetings were sponsored and partially supported by the European Union (EU) in the frame of the Cooperation in Science and Technology (COST) chemistry**

actions. Advances in Chemical Physics, Volume 119, Parts 1 - 3 Modern Nonlinear Optics Wiley-Interscience **A comprehensive and up-to-date resource for the study of nonlinear optics Modern Nonlinear Optics serves as an updated, second edition of volume 85 of the series Advances in Chemical Physics. Utilizing the research of world-renowned experts, Modern Nonlinear Optics presents a dialogue between two prevailing schools of thought: one concerned with quantum optics and Abelian electrodynamics, the other with the emerging subject of non-Abelian electrodynamics and unified field theory. The prevailing paradigm–the Maxwell Heaviside theory–is developed in fields such as quantum optics, antenna theory, and holography, but it is also challenged using general relativity, O(3) electrodynamics, superluminal effects, and several other theories. This wide spectrum of opinion is presented so that a consensus can emerge. In addition, Modern Nonlinear Optics surveys developments over the last ten years, including advances in light squeezing, single photon optics, phase conjunction optics, and laser technology. It reviews thousands of papers emerging from both schools of thought and provides the most up-to-date and complete coverage available. Handbook of Molecular Physics and Quantum Chemistry, 3 Volume Set** Wiley **Published in three volumes, this comprehensive reference work brings together in a single source for the first time, a detailed presentation of the most important theoretical concepts and methods for the study of molecules and molecular systems. The logical format of the Handbook allows the reader to progress from the foundations of the field to the most important and exciting areas of current research. Edited and written by an outstanding international team, and containing over 100 articles written by more than 50 contributors, it will be invaluable for both the expert researcher and the graduate student or postdoctoral worker active in any of the broad range of fields where these concepts and methods are important. Comprises three themed volumes: * Fundamentals * Molecular Electronic Structure * Molecules in the Physico-Chemical Environment: Spectroscopy, Dynamics and Bulk Properties * Presents detailed articles covering the key topics, presented in a didactic manner * Focuses both on theory and the relation of experiment to theory Volume 1, Fundamentals presents the foundations of molecular physics and quantum chemistry. 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What survived from these attempts were Maxwell's four equations of electrodynamics together with the Lorentz force law, formulae that made no attempt to describe an underlying reality but stood only as a mathematical description of the observed phenomena. When the quantum of action was introduced by Planck in 1900 the difficulties that had faced Maxwell's generation were still unresolved. Since then theories of increasing mathematical complexity have been constructed to attempt to bring the totality of phenomena into order with little success. This work examines the problems that had been abandoned long before quantum mechanics was formulated in 1925 and argues that these issues need to be revisited before real progress in the quantum theory of the electromagnetic field can be made. Contents:IntroductionThe Faraday–Maxwell FieldsThe ElectronBlackbody RadiationAtomic StructureLight and ActionMass Vortex RingsThe Magnetic Vortex FieldThe Electric Vortex Field Readership: Advanced undergraduate and graduate students interested in quantum physics. Fields and Electrodynamics A Computer-Compatible Introduction** John Wiley & Sons Incorporated **The only text on this subject to detail numerical methods usually used in practice to calculate electromagnetic fields, and to integrate these methods with computer simulation. Thoroughly develops the basic mathematical methods which physicists use to describe fields (e.g., density, displacement, and electrical), demonstrating each with examples of applications to mechanical problems. Describe Maxwell's equations governing electric and magnetic fields and shows how these lead to physical phenomena such as electromagnetic waves, charged particle motion, electromagnetic induction, and other processes. Maxwell's equations are introduced in a discrete form--on a lattice--and are discussed in terms of the original definition of the polarization field rather than the more abstract ``dipole moment'' approach. Other topics covered include xerography, EMP, the magnetron oscillator, and boundary-value problems in the presence of superconductors, none of which are included in other texts at this level. Dynamics of Charged Particles and their Radiation Field** Cambridge University Press **This book provides a self-contained and systematic introduction to classical electron theory and its quantization, non-relativistic quantum electrodynamics. The first half of the book covers the classical theory. It discusses the well-defined Abraham model of extended charges in interaction with the electromagnetic field, and gives a study of the effective dynamics of charges under the condition that, on the scale given by the size of the charge distribution, they are far apart and the applied potentials vary slowly. The second half covers the quantum theory, leading to a coherent presentation of non-relativistic quantum electrodynamics. Topics discussed include non-perturbative properties of the basic Hamiltonian, the structure of resonances, the relaxation to the ground state through emission of photons, the non-perturbative derivation of the g-factor of the electron and the stability of matter. New Trends in Quantum Electrodynamics** MDPI **This book collects research and review articles covering some recent trends in nonrelativistic quantum electrodynamics, specifically the interaction of atoms or molecules within the quantum electromagnetic radiation field and the related physical effects. Specific topics covered are: two- and three-body dispersion interactions between atoms and molecules, both in the nonretarded van der Waals and the retarded Casimir–Polder regime; vacuum field fluctuations of the electromagnetic field and their effect in atomic systems; dispersion interactions between uniformly accelerating atoms and relation with the Fulling–Davies–Unruh effect; dynamics of atomic systems under strong electromagnetic fields; symmetries in quantum electrodynamics; and open quantum systems. The 5-year Outlook on Science and Technology Nano- and Micro-Electromechanical Systems Fundamentals of Nano- and Microengineering, Second Edition** CRC Press **Society is approaching and advancing nano- and microtechnology from various angles of science and engineering. The need for further fundamental, applied, and experimental research is matched by the demand for quality references that capture the multidisciplinary and multifaceted nature of the science. Presenting cutting-edge information that is applicable to many fields, Nano- and Micro-Electromechanical Systems: Fundamentals of Nano and Microengineering, Second Edition builds the theoretical foundation for understanding, modeling, controlling, simulating, and designing nano- and microsystems. The book focuses on the fundamentals of nano- and microengineering and nano- and microtechnology. It emphasizes the multidisciplinary principles of NEMS and MEMS and practical applications of the basic theory in engineering practice and technology development. Significantly revised to reflect both fundamental and technological aspects, this second edition introduces the concepts, methods, techniques, and technologies needed to solve a wide variety of problems related to high-performance nano- and microsystems. The book is written in a textbook style and now includes homework problems, examples, and reference lists in every chapter, as well as a separate solutions manual. It is designed to satisfy the growing demands of undergraduate and graduate students, researchers, and professionals in the fields of nano- and microengineering, and to enable them to contribute to the nanotechnology revolution. Handbook of Molecular Physics and Quantum Chemistry, 3 Volume Set** John Wiley & Sons Incorporated **Published in three volumes, this comprehensive reference work brings together in a single source for the first time, a detailed presentation of the most important theoretical concepts and methods for the study of molecules and molecular systems. The logical format of the Handbook allows the reader to progress from the foundations of the field to the most important and exciting areas of current research. Edited and written by an outstanding international team, and containing over 100 articles written by more than 50 contributors, it will be invaluable for both the expert researcher and the graduate student or postdoctoral worker active in any of the broad range of fields where these concepts and methods are important. Comprises three themed volumes: * Fundamentals * Molecular Electronic Structure * Molecules in the Physico-Chemical Environment: Spectroscopy, Dynamics and Bulk Properties * Presents detailed articles covering the key topics, presented in a didactic manner * Focuses both on theory and the relation of experiment to theory Volume 1, Fundamentals presents the foundations of molecular physics and quantum chemistry. It consists of 7 parts arranged as follows:- Part 1 Introduction Part 2 Elements of Quantum Mechanics Part 3 Orbital Models for Atomic, Molecular and Crystal Structure Part 4 Symmetry Groups and Molecular Structure Part 5 Second Quantization and Many-Body Methods Part 6 Approximate Separation of Electronic and Nuclear Motion Part 7 Quantum Electrodynamics of Atoms and Molecules The central problem of molecular physics and quantum chemistry is the description of atomic and molecular electronic structure. The development of appropriate models for the description of the effects of electron correlation and of relativity are key components of the analysis. Volume 2, Molecular Electronic Structure, addresses these topics, and consists of 7 parts arranged as follows: Part 1 Approximation methods Part 2 Orbital Models and Generalized Product Functions Part 3 Electron correlation Part 4 Relativistic molecular electronic structure Part 5 Electronic structure of large molecules Part 6 Computational quantum chemistry Part 7 Visualization and interpretation of molecular electronic structure In reality no molecular system exists in isolation. Molecules interact with other atoms and molecules, and with their environment. Volume 3, Molecules in the Physico-Chemical Environment - Spectroscopy, Dynamics and Bulk Properties, consists of 7 parts arranged as follows:- Part 1 Response theory and propagator methods Part 2 Interactions between molecules Part 3 Molecules in different environments Part 4 Molecular Electronic spectra Part 5 Atomic Spectroscopy and Molecular Vibration-Rotation Spectroscopy Part 6 Molecular dynamics and dynamical processes Part 7 Bulk properties Scientific and Technical Aerospace Reports Molecular Models for Fluids** Cambridge University Press **This book presents the development of modern molecular models for fluids from the interdisciplinary fundamentals of classical and statistical mechanics, of electrodynamics and of quantum mechanics. The concepts and working equations of the various fields are briefly derived and illustrated in the context of understanding the properties of molecular systems. Special emphasis is devoted to the quantum mechanical basis, since this is used throughout in the calculation of the molecular energy of a system. The book is application oriented. It stresses those elements that are essential for practical model development. The fundamentals are then used to derive models for various types of applications. Finally, equation of state models are presented based on quantum chemically based models for the intermolecular potential energy and perturbation theory. The book is suited for graduate courses in chemical and mechanical engineering, physics and chemistry, but may also, by proper selection, be found useful on the undergraduate level.**