Theory Of Elementary Atomic And Molecular Processes In Gases International Series Of Monographs On Physics

This highly readable book uncovers the mysteries of the physics of elementary particles for a broad audience. From the familiar notions of atoms and molecules to the complex ideas of the grand unification of all the basic forces, this book allows the interested lay public to appreciate the fascinating building blocks of matter that make up our universe.Beginning with a description of the quantum nature of atoms and particles, readers are introduced to the elementary constituents of atomic nuclei: quarks. The book goes on to consider all of the important ideas in particle physics: quantum electrodynamics and quantum chromodynamics, the theory of strong interactions, the gauge theories of the weak and electromagnetic interactions, as well as the problem of mass generation. To conclude the book, the ideas of grand unification are described, and finally, some applications to astrophysics are discussed.Your guide to this exciting world is an author who, together with the originator of the idea of quarks, Murray Gell-Mann, has played an important role in the development of the theory of quantum chromodynamics and the concept of grand unification.

The Theory of Elementary Waves: A New Explanation of Fundamental Physics, by Dr. Lewis E. Little, upends the standard view of quantum mechanics. His new theory explains activity at the sub-atomic level with the same understanding of cause and effect that governs all other science: In other words, the Theory of Elementary Waves (TEW) "makes sense of the physical universe." The science of physics should allow us to understand the physical world, from galaxies to sub-atomic particles. Yet quantum mechanics has produced a sad irony, namely that millions of high school and college students consider physics to be virtually incomprehensible. Explanations under quantum mechanics include a variety of contradictions. Most prominent is that elementary particles simultaneously exhibit the properties and behavior of particles and waves, a notion which produced the claim that a single particle-or at least it's "potential"-can be in two places at once. The links in this chain of absurdity have led to bizarre extremes, such as the idea of backwards time, curved space and the comment from a well-known physicist that "the moon is demonstrably not there when nobody looks." The time is ripe for a credible challenge to the formalisms of quantum theory. The Theory of Elementary Waves presents: -A full critique of quantum theory, including Heisenberg's Uncertainty Principle, Bell's Theorem, the "double-slit" experiment and such topics as "dark matter." -An entire chapter on how TEW provides a physical explanation of Einstein's theory of relativity. -How TEW sheds new light on the physics of the atom and atomic decay. -Suggestions for future research, not just in physics but in chemistry and biology as well. In the book's foreword, best-selling author Robert Prechter credits Dr. Little with "a vision as revolutionary as that of Copernicus 350 years earlier," and writes "he not only revolutionizes the fundamentals of sub-atomic physics but also reclaims the fundamentals of scientific philosophy." If you want to experience being at the forefront of a scientific revolution in what was formerly an unnecessarily mysterious field, The Theory of Elementary Waves: A New Explanation of Fundamental Physics is for you.

Excerpt from The Atom and the Bohr Theory of Its Structure, an Elementary Presentation At the close of the nineteenth century and the beginning of the twentieth, our knowledge of the activities in the interior of matter experienced a development which surpassed the boldest hopes that could have been entertained by the chemists and physicists of the nineteenth century. The smallest particles of chemistry, the atoms of the elements, which hitherto had been approached merely by inductive thought, now became tangible realities, so to speak, which could be counted and whose tracks could be photographed. A series of remarkable experimental investigations, stimulated largely by the English physicist, J. J. Thomson, had disclosed the existence of negatively charged particles, the so-called electrons, the mass of the smallest atom of the known elements. A theory of electrons, based on Maxwell's classical electrodynamical theory and developed mainly through the labours of Lorentz in Holland and Larmor in England, had brought the problem of atomic structure into close connection with the theory of radiation. The experiments of Rutherford proved, beyond a doubt, that atoms were composed simply of light, negative electric particles, and small heavy, positive electric particles. About the Publisher Forgotten Books publishes hundreds of thousands of rare and classic books. Find more at www.forgottenbooks.com This book is a reproduction of an important historical work. Forgotten Books uses state-of-the-art technology to digitally reconstruct the work, preserving the original format whilst repairing imperfections present in the aged copy. In rare cases, an imperfection in the original, such as a blemish or missing page, may be replicated in our edition. We do, however, repair the vast majority of imperfections successfully; any imperfections that remain are intentionally left to preserve the state of such historical works.

This book grew out of a graduate course given in the Physics Department of the City College of New York for the first time during the 1976-1977 academic year and a series of lectures given at the Catholic University of Louvain, at Louvain-la-Neuve, Belgium during the Spring and Summer of 1977. I am indebted to Professor F. Brouillard and the DYMO group at that institution for the stimulation and hospitality provided during that period. In both cases, the lectures were at a level that assumed only a knowledge of elementary quantum mechanics of a typical first-year grad uate course. I have tried to continue that level of discussion in this book and to make it self-contained for any discussions that go beyond that level. In some sections of the book, the problems dealt with are too complicated to provide the entire description here. In that case, references to the original work are given.

Until recently, the field of atomic and molecular collisions was left to a handful of practitioners who essentially explored it as a branch of atomic physics and gathered their experimental re sults mainly from spectroscopy measurements in bulk. But in the past ten years or so, all of this has dramatically changed, and we are now witnessing the rapid growth of a large body of research that encompasses the simplest atoms as well as the largest mole cules, that looks at a wide variety of phenomena well outside purely spectroscopic observation, and that finds applications in an unexpectedly broad range of physico-chemical and physical pro cesses. The latter are in turn surprisingly close to very important sectors of applied research, such as the modeling of molecular lasers, the study of isotope separation techniques, and the energy losses in confined plasmas, to mention just a few of them. As a consequence of this healthy state of affairs, greatly diversified research pathways have developed; however, their specialized problems are increasingly at risk of being viewed in isolation, although they are part of a major and extended branch of physics or chemistry. This is particularly true when it comes to the theory of this work -- where well-established methods and models of one subfield are practically unknown to researchers in other subfields -- and, consequently, the danger of wasteful duplication arising is quite real.

Suitable for advanced undergraduates and graduate students, this compact treatment of basic theory of nuclear forces, structures, and reactions is based on familiar results of nonrelativistic quantum theory. 1956 edition.

Photons and Atoms Photons and Atoms: Introduction to Quantum Electrodynamics provides the necessary background to understand the various physical processes associated with photon-atom interactions. It starts with elementary quantum theory and classical electrodynamics and progresses to more advanced approaches. A critical comparison is made between these different, although equivalent, formulations of quantum electrodynamics. Using this format, the reader is offered a gradual, yet flexible introduction to quantum electrodynamics, avoiding formal discussions and excessive shortcuts. Complementing each chapter are numerous examples and exercises that can be used independently from the rest of the book to extend each chapter in many disciplines depending on the interests and needs of the reader.

This text on atomic structure is intermediate in level between purely introductory general texts on 'modern physics' and advanced specialized treatises. It is short enough to be read in the time normally devoted to atomic structure in physics degree courses. Throughout the book real-life examples from atomic spectroscopy are discussed alongside the exposition of the theory, both to give a feeling for orders of magnitude and to impart a real understanding of the application of elementary quantum mechanics.

When one approaches the study of the quantal relativistic theory of the electron, one may be surprised by the gap which lies between the frame of the experiments, i.e. the real geometry of the space and time, and the abstraction of the complex matrices and spinors formalism employed in the presentation of the theory. This book uses a theory of the electron, introduced by David Hestenes, in which the mathematical language is the same as the one of the geometry of the space and time. Such a language not only allows one to find again the well known results concerning the one-electron atoms theory but furthermore leads easily to the resolution of problems considered for a long time without solution.

Nobel Laureate's lucid treatment of kinetic theory of gases, elementary particles, nuclear atom, wave-corpuscles, atomic structure and spectral lines, much more. Over 40 appendices, bibliography.

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These notes summarize in part lectures held regularly at the University of Zurich and, in the Summer of 1974, at the Semi nario Latinoamericano de QUimica Cuantica in Mexico. I am grateful to those who have encouraged me to publish these lec tures or have contributed to them by their suggestions. In particular, I wish to thank Professor J. Keller of the Univer sidad Nacional Autonoma in Mexico, Professor H. Labhart and Professor H. Fischer of the University of Zurich, as well as my former students Dr. J. Kuhn, Dr. W. Hug and Dr. R. Geiger. The aim of these notes is to provtde a summary and concise introduction to elementary molecular orbital theory, with an emphasis on semiempirical methods. Within the last decade the development and refinement of ab initio computations has tended to overshadow the usefulness of semiempirical methods. However, both approaches have their justification. Ab initio methods are designed for accurate predictions, at the expense of greater computational labor. The aim of semiempirical methods mainly lies in a semiquantitative classification of electronic pro perties and in the search for regularities within given classes of larger molecules. The reader is supposed to have had some previous basic instruc tion in quantum mechanics, such as is now offered in many uni versities to chemists in their third or fourth year of study. The bibliography should encourage the reader to consult other texts, in particular also selected publications in scientific journals.

Hadronic atoms provide a unique laboratory for studying hadronic interactions essentially at threshold. This text is the first book-form exposition of hadronic atom theory with emphasis on recent developments, both theoretical and experimental. Since the underlying Hamiltonian is a non-self-adjoined operator, the theory goes beyond traditional quantum mechanics and this book covers topics that are often glossed over in standard texts on nuclear physics. The material contained here is intended for the advanced student and researcher in nuclear, atomic or elementary-particle physics. A good knowledge of quantum mechanics and familiarity with nuclear physics are presupposed. Contents: Theoretical Background: Hadronic Atoms OCo An Overview; Extended Quantum Mechanical Framework; Coulomb Wave Functions; Coulomb Propagator and Scattering Operators; Two-Potential Scattering Formalism; Bound States and Low-Energy Scattering; Atomic Spectrum; Gamow States and Completeness Problem; X-Ray Transition Rate; Computational Methods; Examples; Chiral Theory Primer; Comparison with Experiment: Two-Meson Atomic Bound States; Hadronic Hydrogen; Hadronic Deuterium; Hadronic Atoms with A OeN4. Readership: Graduate students and academics in nuclear, atomic, high-energy, computational, quantum and theoretical physics."

A basic understanding of the quantum theory is essential in many areas of chemistry, especially in connection with spectroscopy and with theories of atomic and molecular structure. This introduction to the theory, and its application to elementary atomic structure, puts the essential ideas in their historical context. With the crucial and difficult concepts of wave-particle duality, modern illustrations are used to show that they have current applications in chemistry. Recognising that many chemistry students do not have a strong background in physics, most chapters start with some essential physics, concerning waves, mechanics, and electrostatics. The maths is kept to a minimum, consistent with a proper understanding of what is necessary. Each chapter ends with some simple problems.

Into the short compass of this book Professor Graetz has succeeded in compressing an eminently readable survey of the directions in which the atomic theory, as accepted in the nineteenth century, has been extended by the remarkable and almost revolutionary physical investigations and discoveries of the two decades preceding the book’s original publication in 1923.

In working with graduate students in engineering physics at the University of Virginia on research problems in gas kinetics, radiation biology, ion materials interactions, and upper-atmosphere chemistry, it became quite apparent that there was no satisfactory text available to these students on atomic and molecular collisions. For graduate students in physics and quantum chemistry and researchers in atomic and molecular interactions there are a large number of excellent advanced texts. However, for students in applied science, who require some knowledge and understanding of col lision phenomena, such texts are of little use. These students often have some background in modern physics and/or chemistry but lack graduate level course work in quantum mechanics. Such students, however, tend to have a good intuitive grasp of classical mechanics and have been exposed to wave phenomena in some form (e. g. , electricity and magnetism, acoustics, etc.). Further, their requirements in using collision processes and employing models do not generally include the use of formal scattering theory, a large fraction of the content of many advanced texts. In fact, most researchers who work in the area of atomic and molecular collisions tend to pride themselves on their ability to describe results using simple theoretical models based on classical and semiclassical methods.

Colleague and confidant of Einstein and Bohr, pioneer of nuclear fission theory, and staunch champion of the theory of black holes - John Archibald Wheeler is one of the most original and profound thinkers of modern science. In 1939 he published, with Niels Bohr, the first paper to describe nuclear fission successfully in terms of quantum physics, a ground-breaking study that led to his involvement in the Los Alamos atom bomb project and his subsequent work on the hydrogen bomb. Wheeler has made significant contributions to atomic and nuclear physics, elementary-particle physics, relativity theory, cosmology, and astrophysics. Yet, in the final analysis, it is his simple delight and wonder in "the machinery of existence" that illuminates this collection. At Home in the Universe presents a feast of engaging essays formed of reminiscence, science, and conjecture. Wheeler provides intimate glimpses of Einstein, Bohr, and other giants in the field who were his friends and collaborators. He writes of debates and discussions with Bohr that formed the cornerstone of nuclear fission theory, long talks with Einstein in his upstairs study at Princeton, and the eloquence and nobility of Hermann Weyl. He sees in these and other great physicists - Marie Curie, Hideki Yukawa, and Hendrik Anthony Kramers - exemplars of the scientific spirit. Wheeler ranges over what he calls the "intensely human activity" of science, the nature of scientific endeavor, the role of curiosity and creativity, characteristics of good scientists, and scientific skepticism and optimism. He delves into new directions of physics, notably his intriguing proposition that reality can be thought of as binary units - or "bits" - similar to those from information theory. Uniting the collection is Wheeler's lifelong passion for the truth and his unconcealed joy in its pursuit. An unforgettable journey through the mind and memory of one of the century's great physicists, At Home in the Universe will delight, educate, and inspire.

Ideas, theories, experiments, and unanswered questions in particle physics, explained (with anecdotes) for the general reader. The elementary particles of matter hold the secrets of Nature together with the fundamental forces. In Ever Smaller, neutrino physicist Antonio Ereditato describes the amazing discoveries of the “particle revolution,” explaining ideas, theories, experiments, and unanswered questions in particle physics in a way that is accessible (and enjoyable) for the general reader. Ereditato shows us that physics is not the exclusive territory of scientists in white lab coats exclaiming “Eureka” but that its revelations can be appreciated by any reader curious about the mysteries of the universe. Ereditato's overview takes us through a century of particle physics, from the discovery of the components of the atom through an endless procession of subatomic particles—the pion, the muon, the quarks, the W, Z, gluon, Higgs boson, and the mysterious, ubiquitous neutrino (Ereditato's chosen specialty)—interweaving the history of these discoveries with basic explanations of the physics itself as well as the technology behind the discoveries. He considers the particle physicist's impulse to pursue the “ever smaller”—to divide matter into ever more minuscule parts, until reaching the elementary constituents of the universe; explains how Nature likes symmetries; describes the workings of particle accelerators and detectors; demonstrates how to distinguish between three identical quarks; and warns that the ugliest experimental data are more important than the most beautiful theory. With Ever Smaller, Ereditato invites readers to join him in appreciating the beauty of the microcosm.

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