High Energy Physics With Nuclei

#High Energy Physics #Nuclear Physics #Particle Collisions #Atomic Nuclei Research #Quantum Chromodynamics

Explore the cutting-edge field of High Energy Physics with Nuclei, where scientists smash atomic nuclei together at immense speeds to unravel the fundamental forces and particles governing our universe. This research delves into the properties of nuclear matter under extreme conditions, offering crucial insights into the strong force and the early universe.

High Energy Physics with Nuclei

This well-known introductory textbook gives a uniform presentation of nuclear and particle physics from an experimental point of view. The first part, Analysis, is devoted to disentangling the substructure of matter. This part shows that experiments designed to uncover the substructures of nuclei and nucleons have a similar conceptual basis, and lead to the present picture of all matter being constructed from a small number of elementary building blocks and a small number of fundamental interactions. The second part, Synthesis, shows how the elementary particles may be combined to build hadrons and nuclei. The fundamental interactions, which are responsible for the forces in all systems, become less and less evident in increasingly complex systems. Such systems are in fact dominated by many-body phenomena. A section on neutrino oscillations and one on nuclear matter at high temperatures bridge the field of "nuclear and particle physics" and "modem astrophysics and cosmology. The seventh revised and extended edition includes new material, in particular the experimental verification of the Higgs particle at the LHC, recent results in neutrino physics, the violation of CP-symmetry in the decay of neutral B-mesons, the experimental investigations of the nucleon's spin structure and outstanding results of the HERA experiments in deep-inelastic electron- and positron-proton scattering. The concise text is based on lectures held at the University of Heidelberg and includes numerous exercises with worked answers. It has been translated into several languages and has become a standard reference for advanced undergraduate and graduate courses.

Particles and Nuclei

High Energy Physics and Nuclear Structure covers the proceedings of the Ninth International Conference on High Energy Physics and Nuclear Structure, held in Versailles on July 6-10, 1981. The book focuses on the processes, reactions, and methodologies involved in high energy physics and nuclear structure. The selection first offers information on experiments on antinucleon-nucleon, baryonium, nucleon-nucleon, and dibaryons and the quark model pion and the goldstone pion. Discussions focus on antinucleon-nucleon and baryonium, nucleon-nucleon and dibaryon, and spontaneous breaking of chiral symmetry. The text also ponders on quarks and nuclei, multiquark resonant states, and electron scattering from complex nuclei. The publication elaborates on electromagnetic interactions on light nuclei, electromagnetic interactions with nuclei at high momentum transfer, and inelastic electron scattering at low energy. The book also touches on the dynamics of hadron nucleus interactions, hypernuclei and interactions of kaons with nuclei, and pion-nucleus scattering theory. The selection is a dependable reference for readers interested in high energy structure and nuclear physics.

High Energy Physics and Nuclear Structure

The second English edition has been updated from the fifth edition of the original German text. The principal addition is a chapter on nuclear ther modynamics. We consider in this chapter the behaviour of nuclear matter at high temperature, how it may be studied in the laboratory, via heavy ion experiments and how it was of great importance in the initial stages of the universe. Such a phase of matter may be described and interpreted using the tools of thermodynamics. In this way a connection between particle and nuclear physics and the currently exciting research areas of cosmology and astrophysics may be constructed. We would like to thank Martin Lavelle (Plymouth) for the translation of the new chapter and for revising the old text and Jurgen Sawinski (Heidelberg) for the excellent work he has done in reformatting the book. Heidelberg, May 1999 The Authors Preface to the First Edition The aim of PARTICLES AND NUCLEI is to give a unified description of nuclear and particle physics because the experiments which have uncovered the substructure of atomic nuclei and nucleons are conceptually similar. With the progress of experimental and theoretical methods, atoms, nuclei, nucleons, and finally quarks have been analysed during the course of this century. The intuitive assumption that our world is composed of a few constituents - an idea which seems attractive, but could not be taken for granted - appears to be confirmed.

Particles and Nuclei

In preparing the program for this Conference, the third in the series, it soon became evident that it was not possible to in clude in a conference of reasonable duration all the topics that might be subsumed under the broad title, "High Energy Physics and Nuclear Structure. " From their initiation, in 1963, it has been as much the aim of these Conferences to provide some bridges between the steadily separating domains of particle and nuclear physics, as to explore thoroughly the borderline territory between the two - the sort of no-man's-land that lies unclaimed, or claimed by both sides. The past few years have witnessed the rapid development of many new routes connecting the two major areas of 'elementary par ticles' and 'nuclear structure', and these now spread over a great expanse of physics, logically perhaps including the whole of both subjects. (As recently as 1954, an International Conference on 'Nuclear and Meson Physics' did, in fact, embrace both fields!) Since it is not now possible to traverse, in one Conference, this whole network of connections, still less to explore the entire ter ritory it covers, the choice of topics has to be in some degree arbitrary. It is hoped that ours has served the purpose of fairly exemplifying many areas where physicists, normally separated by their diverse interests, can find interesting and important topics which bring them together.

High-Energy Physics and Nuclear Structure

Stresses the reasoning chain of experimental observation, the development of physical principles and how to make math/quantitative models. Includes more modern material than its competitors. Chapters on the techniques of the fields provide a unique perspective and connect the methodologies of nuclear and particle physics. In addition, explanations of the connection between formalism of theory and more classical concepts bring the theory down to a more understandable level.

Introduction to Nuclear and Particle Physics

This textbook explains the experimental basics, effects and theory of nuclear physics. It supports learning and teaching with numerous worked examples, questions and problems with answers. Numerous tables and diagrams help to better understand the explanations. A better feeling to the subject of the book is given with sketches about the historical development of nuclear physics. The main topics of this book include the phenomena associated with passage of charged particles and radiation through matter which are related to nuclear resonance fluorescence and the Moessbauer effect., Gamov's theory of alpha decay, Fermi theory of beta decay, electron capture and gamma decay. The discussion of general properties of nuclei covers nuclear sizes and nuclear force, nuclear spin, magnetic dipole moment and electric quadrupole moment. Nuclear instability against various modes of decay and Yukawa theory are explained. Nuclear models such as Fermi Gas Model, Shell Model, Liquid Drop Model, Collective Model and Optical Model are outlined to explain various experimental facts related to nuclear structure. Heavy ion reactions, including nuclear fusion, are explained. Nuclear fission and fusion power production is treated elaborately.

Nuclear Physics

Written primarily for researchers and graduate students who are new in this emerging field, this book develops the necessary tools so that readers can follow the latest advances in this subject. Readers are first guided to examine the basic informations on nucleon-nucleon collisions and the use of the nucleus as an arena to study the interaction of one nucleon with another. A good survey of the relation between nucleon-nucleon and nucleus-nucleus collisions provides the proper comparison to study phenomena involving the more exotic quark-gluon plasma. Properties of the quark-gluon plasma and signatures for its detection are discussed to aid future searches and exploration for this exotic matter. Recent experimental findings are summarised.

Nuclei and Particles

This second edition of An Introduction to the Physics of Nuclei and Particles is intended as a textbook for a one semester third or fourth year undergraduate course and requires a basic background in quantum mechanics. The text covers the basic properties of nuclei and the models of nuclear structure. It also covers nuclear stability, nuclear decay processes and nuclear reactions. The basic properties of subatomic particles are presented, and the standard model of hadronic structure is covered. The book covers recent developments in both nuclear and particle physics. In the field of nuclear physics, these developments include alpha-clustering models and double beta decay. Recent advances in the development of nuclear fission and fusion reactors are also discussed. In the area of particle physics, the recent discovery of the Higgs boson and advancements in our knowledge of neutrino masses and oscillations are presented.

Introduction to High-energy Heavy-ion Collisions

Physics of Nuclei and Particles, Volume II explores the prevalent descriptive methods used in nuclear and particle physics, with emphasis on the phenomenological and model-based aspects. The interactions of nuclear particles are discussed, along with nuclear forces and potentials and scattering and reaction models employed in nuclear physics. The nuclear structure and models of the nucleus are also considered. Comprised of four chapters, this volume begins with a review of the characteristics of nucleons and other particles that play a role in nuclear interaction processes in order to gain further insight into the underlying physical problems. Neutron physics, antinucleons, deuteron physics, and two-body nuclear forces are highlighted, together with three- and four- nucleon systems and heavy-ion physics. The next three chapters deal with nuclear forces and potentials, as deduced from nuclear dynamics (scattering and polarization); scattering and reaction models used in nuclear physics; and nuclear models such as the shell model, models of deformed nuclei, and many-body self-consistent models. The book concludes with an analysis of the Brueckner-Bethe-Goldstone theory of nuclear matter. This book will be of interest to physicists.

An Introduction to the Physics of Nuclei and Particles

Nuclear physics is an exciting, broadly faceted field. It spans a wide range of topics, reaching from nuclear structure physics to high-energy physics, astrophysics and medical physics (heavy ion tumor therapy). New developments are presented in this volume and the status of research is reviewed. A major focus is put on nuclear structure physics, dealing with superheavy elements and with various forms of exotic nuclei: strange nuclei, very neutron rich nuclei, nuclei of antimatter. Also quantum

electrodynamics of strong fields is addressed, which is linked to the occurrence of giant nuclear systems in, e.g., U+U collisions. At high energies nuclear physics joins with elementary particle physics. Various chapters address the theory of elementary matter at high densities and temperature, in particular the quark gluon plasma which is predicted by quantum chromodynamics (QCD) to occur in high-energy heavy ion collisions. In the field of nuclear astrophysics, the properties of neutron stars and quark stars are discussed. A topic which transcends nuclear physics is discussed in two chapters: The proposed pseudo-complex extension of Einstein's General Relativity leads to the prediction that there are no black holes and that big bang cosmology has to be revised. Finally, the interdisciplinary nature of this volume is further accentuated by chapters on protein folding and on magnetoreception in birds and many other animals.

Physics of Nuclei and Particles

From Nucleons to Nucleus deals with single-particle and collective features of spherical nuclei. Each nuclear model is introduced and derived in detail. The formalism is then applied to light and medium-heavy nuclei in worked-out examples, and finally the acquired skills are strengthened by a wide selection of exercises, many relating the models to experimental data. Nuclear properties are discussed using particles, holes and quasi-particles. From Nucleons to Nucleus is based on lectures on nuclear physics given by the author, and serves well as a textbook for advanced students. Researchers too will appreciate it as a well-balanced reference to theoretical nuclear physics.

Exciting Interdisciplinary Physics

The reactor-based laboratory at the Institut Laue-Langevin is recognized as the world's most productive and reliable source of slow neutrons for the study of low energy particle and nuclear physics. The book highlights the impact of about 600 very diverse publications about work performed in these fields during the past more than 30 years of reactor operation at this institute. On one hand neutrons are used as a tool to generate nuclei in excited states for studying their structure and decay, in particular fission. Uniquely sensitive experiments can tell us a great deal about the symmetry characteristics of nuclei and their fission properties. On the other hand, studies with slow neutrons as the object of investigation are complementary to studies at huge particle accelerators. Experiments carried out at the ILL contribute to elucidate basic questions about the building blocks of the Universe by analyzing very precisely subtle neutron properties.

The Neutron

Behavior of the?-Meson Form Factor and a Limit on Its Radius.- The Vector Dominance Model and an Experimental Check of This Model on the Basis of Vector-Meson Decay to an Electron-Positron Pair.- Three-Dimensional Formulation of the Relativistic Two-Body Problem.- Conservation of Lepton Charge in Beta Decay.- Hydrogen Targets in the Physics of High-Energy Particles.- Large-Area Scintillation Counters. 1. Proportional Scintillation Counters.

From Nucleons to Nucleus

This book is intended for use in a first course on the physics of the atomic nucleus and is based on lectures given in the 'core' course to students of physics at the University of Bristol. The authors' aim is to provide a clear and comprehensive account of the basic concepts. The text opens by setting nuclear physics in the context of elementary particle physics. The authors then show how the application of simple models can provide an understanding of the properties of nuclei, both in their ground states and excited states, and also of the nature of nuclear reactions. The book includes chapters on nuclear fission and its application in nuclear power reactors, and on the role of nuclear physics in energy production and nucleosynthesis in stars. The authors assume a knowledge of basic quantum mechanics and special relativity, but there are appendices on some other more specialized but relevant topics. Each chapter ends with a set of problems applying and extending the material covered in the text. This book will fill the need for a concise introduction to one of the most fundamental subjects taught to undergraduates in physics.

The Neutron

Enhances the material outlined in the first volume of "Concepts of Particle Physics\

Particles and Nuclei

The 1978 Advanced Study Institute in Nuclear Theory devoted to common problems in Low and Intermediate Energy Nuclear Physics was held at the Banff Centre in Alberta, Canada from August 21 through September 1, 1978. The present volume contains the text of 25 lectures and seminars given at the Institute and illustrates the directions that nuclear physicists are taking in the evolution toward a unified picture of low, medium and high energy phenomena. Recent attempts at unifying the weak and electromagnetic inter action in particle physics have led naturally to question their role in nuclei. The success of the quark model at interpreting the new resonances in high energy physics makes it imperative to consider their role in dealing with nuclear physics problems at the microscopic level. Is our present knowledge of the nuclear potential consistent' with recent experimental evidence at low and medium energy and can it correlate meaningfully nuclear and pion physics phenomena? These are some of the fundamental questions debated in this book attempting to offer a consistent picture of the nuclear system as it emerges using the electromagnetic, weak and strong interaction probe. The lectures and seminars forming the present volume have been divided into four sections dealing with a) the weak interaction, b) quarks and nuclear structure, c) physics of electrons, protons and kaons, and finally d) pion physics.

An Introduction to Nuclear Physics

This thoroughly revised book, now in its Fourth Edition, continues to provide a comprehensive introduction to this increasingly important area of nuclear and particle physics. It combines coverage of basic concepts, principles and applications, along with the latest developments. Beginning with the historical developments of the subject, properties and constituents of the nucleus, quantitative facts about nucleus, etc., the book moves on to give insights into nuclear models, phenomenon of radioactivity and its applications in various fields, nuclear reactions including reactions in the Sun and stars, photoelectric and Compton effects, pair creation, different particle accelerators and radiation detectors. UNIQUE FEATURES • Contains actual experimental data • Large number of solved problems to help students comprehend the concepts with ease • Provides unsolved problems with answers and review questions to test the students' comprehension of the subject NEW TO THE FOURTH EDITION • Some sections have been revised and enlarged to enhance their comprehension, such as the neutron activation analysis, scintillation and HPGe detectors • Includes a list of accelerators • Provides several new solved and unsolved problems TARGET AUDIENCE • B.Sc./M.Sc. (Physics)

Concepts of Particle Physics

Dramatic progress has been made in all branches of physics since the National Research Council's 1986 decadal survey of the field. The Physics in a New Era series explores these advances and looks ahead to future goals. The series includes assessments of the major subfields and reports on several smaller subfields, and preparation has begun on an overview volume on the unity of physics, its relationships to other fields, and its contributions to national needs. Nuclear Physics is the latest volume of the series. The book describes current activity in understanding nuclear structure and symmetries, the behavior of matter at extreme densities, the role of nuclear physics in astrophysics and cosmology, and the instrumentation and facilities used by the field. It makes recommendations on the resources needed for experimental and theoretical advances in the coming decade.

High-Energy Physics and Nuclear Structure

This book focuses on the ideas to embed nuclear physics in the larger context of hadronic physics by stressing and deepening its widening overlap with particle, astroparticle and condensed matter physics and to emphasize the unity of the two facets not only of nuclear, but of the whole physics; the theoretical and the experimental ones. Counteracting the ominous trend of enlarging the gap between the two, the danger being of depriving experimental physics of ideas promoting experiments and of transforming theoretical physics into metaphysics. The reader will find modern conceptions on nuclear structure, how atomic nuclei are probed through the scattering of high energy electrons and how they interact when accelerated at ultra-relativistic energies. The item connects to the quest for the quark-gluon plasma, perhaps the central theme of the contemporary hadronic physics, whose unraveling requires a vast and profound knowledge of both nuclear and particle physics, in particular QCD.

Common Problems in Low- and Medium-Energy Nuclear Physics

Atomic and Molecular Physics : Atomic Physics (1001--1122) - Molecular Physics (1123--1142) - Nuclear Physics : Basic Nuclear Properties (2001--2023) - Nuclear Binding Energy, Fission and Fusion (2024--2047) - The Deuteron and Nuclear forces (2048--2058) - Nuclear Models (2059--2075) - Nuclear Decays (2076--2107) - Nuclear Reactions (2108--2120) - Particle Physics : Interactions and Symmetries (3001--3037) - Weak and Electroweak Interactions, Grand Unification Theories (3038--3071) - Structure of Hadros and the Quark Model (3072--3090) - Experimental Methods and Miscellaneous Topics : Kinematics of High-Energy Particles (4001--4061) - Interactions between Radiation and Matter (4062--4085) - Detection Techniques and Experimental Methods (4086--4105) - Error Estimation and Statistics (4106--4118) - Particle Beams and Accelerators (4119--4131).

INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS, FOURTH EDITION

In the present volume, Phillip J. Siemens, who has been a seminal contributor to our understanding of the nucleus as a many-body system, and his able collabourator, Aksel S. Jensen, introduce graduate students and colleagues in other fields to the basic concepts of nuclear physics in a way which connects clearly the methods of nuclear physics with those of condensed matter, atomic, and particle physics. Their book thus provides a lucid introduction to the key facts and concepts of nuclei, including many of the most recent developments, while emphasizing the similarities and the differences between the behaviour of nuclei, atoms, elementary particles, and condensed matter, It should thus prove useful, not only as a text for an introductory graduate course in nuclear physics, but as a reference book for all scientists interested in a unified picture of our understanding of physical phenomena associated with many-body systems.

Nuclear Physics

Our journey in search of the origin of matter — and, by extension, the origin of the Universe itself — has taken us deeper and deeper inside atoms. First to come into view was the atomic nucleus, and still further downscale the individual protons and neutrons that constitute the nucleus. At least for three decades, nucleons (protons and neutrons) were considered to be our final destination. Then, peering into them, we detected shadows of yet another layer of matter that lurks inside. Unable so far to crack open a nucleon and bring out one of these shadowy objects for observation and measurement, we can only guess what they are. We have named them quarks. We believe that two types of quarks — one named “up” and the other “down” — make up the proton and the neutron. Quarks are held together by a force dubbed the chromo force, represented by particles named gluons, which are just as unseen as quarks. So it is the quarks and gluons that lie at the bottom of all known matter!In this important book, the major developments in atomic, nuclear, particle and quark physics over the past one hundred years are presented in a style that is both accessible to the layperson and of value to the expert. It provides a brief history of particles, charting the discovery of electrons and photons, antimatter, atomic nuclei, strong and weak forces, and quarks and gluons. In particular, it traces the concept of “conserved charges”, a phenomenon that is consistently manifested in each of these milestone developments in modern physics.

From Nuclei and Their Constituents to Stars

The fourth edition includes new developments, in particular a new section on the double beta decay including a discussion of the possibility of a neutrinoless decay and its implications for the standard model.

Problems and Solutions on Atomic, Nuclear and Particle Physics

This user-friendly book on group theory introduces topics in as simple a manner as possible and then gradually develops those topics into more advanced ones, eventually building up to the current state-of-the-art. By using simple examples from physics and mathematics, the advanced topics become logical extensions of ideas already introduced. In addition to being used as a textbook, this book would also be useful as a reference guide for graduates and researchers in particle, nuclear and hadron physics.

Elements Of Nuclei

This book is intended to give a clear and concise introductory account of the basic ideas underlying nuclear and elementary particle physics. The attempt throughout is to convey a sound physical un-

derstanding of the structures and processes encountered. It assumes some knowledge of elementary quantum mechanics, particularly the treatment of angular momentum, and the rudiments of special relativity. In addition to 'standard' calculations based on this knowledge, frequent use is made of 'order-of-magnitude' and 'dimensional' arguments. In this way it has been possible to give some discussion of quite advanced topics and recent developments. Although reference is made from time to time to the apparatus of nuclear and particle physics no technical detail is given. My basic hope is that students using this book will acquire a sound understand ing of what nuclear and particle physics is about and will wish to learn more. I am indebted to Dr David Bailin and various (nameless) referees for penetrating and helpful comments on parts of the text.

Quarks And Gluons: A Century Of Particle Charges

Nuclear physics is presently experiencing a thrust towards fundamental phy sics questions. Low-energy experiments help in testing beyond today's stan dard models of particle physics. The search for finite neutrino masses and neutrino oscillations, for proton decay, rare and forbidden muon and pion de cays, for an electric dipole moment of the neutron denote some of the efforts to test today's theories of grand unification (GUTs, SUSYs, Superstrings, ...) complementary to the search for new particles and symmetries in high-energy experiments. The close connections between the laws of microphysics, astrophysics and cosmology open further perspectives. This concerns, to mention some of them, properties of exotic nuclei and nuclear matter, and star evolution; the neutrino and the dark matter in the universe; relations between grand unification and evolution of the early universe. The International Symposium on Weak and Electromagnetic Interactions in Nuclei (W.E.LN. 1986)' held in Heidelberg 1-5 July 1986, in conjunction with the 600th anniversary of the University of Heidelberg, brought together experts in the fields of nuclear and particle physics, astrophysics and cosmol ogy.

Particles and Nuclei

Nuclei and nuclear reactions offer a unique setting for investigating three (and in some cases even all four) of the fundamental forces in nature. Nuclei have been shown – mainly by performing scattering experiments with electrons, muons and neutrinos – to be extended objects with complex internal structures: constituent quarks; gluons, whose exchange binds the quarks together; sea-quarks, the ubiquitous virtual quark-antiquark pairs and last but not least, clouds of virtual mesons, surrounding an inner nuclear region, their exchange being the source of the nucleon-nucleon interaction. The interplay between the (mostly attractive) hadronic nucleon-nucleon interaction and the repulsive Coulomb force is responsible for the existence of nuclei; their degree of stability, expressed in the details and limits of the chart of nuclides; their rich structure and the variety of their interactions. Despite the impressive successes of the classical nuclear models and of ab-initio approaches, there is clearly no end in sight for either theoretical or experimental developments as shown e.g. by the recent need to introduce more sophisticated three-body interactions to account for an improved picture of nuclear structure and reactions. Yet, it turns out that the internal structure of the nucleons has comparatively little influence on the behavior of the nucleons in nuclei and nuclear physics – especially nuclear structure and reactions – is thus a field of science in its own right, without much recourse to subnuclear degrees of freedom. This book collects essential material that was presented in the form of lectures notes in nuclear physics courses for graduate students at the University of Cologne. It follows the course's approach, conveying the subject matter by combining experimental facts and experimental methods and tools with basic theoretical knowledge. Emphasis is placed on the importance of spin and orbital angular momentum (leading e.g. to applications in energy research, such as fusion with polarized nuclei) and on the operational definition of observables in nuclear physics. The end-of-chapter problems serve above all to elucidate and detail physical ideas that could not be presented in full detail in the main text. Readers are assumed to have a working knowledge of quantum mechanics and a basic grasp of both non-relativistic and relativistic kinematics; the latter in particular is a prerequisite for interpreting nuclear reactions and the connections to particle and high-energy physics.

Group Theory in Particle, Nuclear, and Hadron Physics

Recently a symbiotic relationship between particle and nuclear physics has developed, with techniques and ideas from one field fertilizing developments in the other. This work outlines concepts from modern particle physics important to the current understanding of nuclear physics and reviews experiments involving nuclei which have influenced the present particle physics view of the weak interaction. In his discussion, the author summarizes both past and present activity in the field and identifies areas for

future work. Familiarity with quantum mechanics is assumed in the presentation of ideas in this book intended for readers at the graduate level and beyond. A major goal of Weak Interactions in Nuclei is to encourage further activity at the intersection of particle and nuclear physics, two path-breaking areas of study in modern physics. Originally published in 1989. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Nuclear and Particle Physics

A comprehensive, unified treatment of present-day nuclear physics-the fresh edition of a classic text/reference. "A fine and thoroughly up-to-date textbook on nuclear physics . . . most welcome." -Physics Today (on the First Edition). What sets Introductory Nuclear Physics apart from other books on the subject is its presentation of nuclear physics as an integral part of modern physics. Placing the discipline within a broad historical and scientific context, it makes important connections to other fields such as elementary particle physics and astrophysics. Now fully revised and updated, this Second Edition explores the changing directions in nuclear physics, emphasizing new developments and current research-from superdeformation to quark-gluon plasma. Author Samuel S.M. Wong preserves those areas that established the First Edition as a standard text in university physics departments, focusing on what is exciting about the discipline and providing a concise, thorough, and accessible treatment of the fundamental aspects of nuclear properties. In this new edition, Professor Wong: * Includes a chapter on heavy-ion reactions-from high-spin states to quark-gluon plasma * Adds a new chapter on nuclear astrophysics * Relates observed nuclear properties to the underlying nuclear interaction and the symmetry principles governing subatomic particles * Regroups material and appendices to make the text easier to use * Lists Internet links to essential databases and research projects * Features end-of-chapter exercises using real-world data. Introductory Nuclear Physics, Second Edition is an ideal text for courses in nuclear physics at the senior undergraduate or first-year graduate level. It is also an important resource for scientists and engineers working with nuclei, for astrophysicists and particle physicists, and for anyone wishing to learn more about trends in the field.

Weak and Electromagnetic Interactions in Nuclei

"A first-principles discussion of the fundamental neutron interactions . . . the writing is clear, and the explanations stress essential physical principles . . . an excellent survey."—Physics Today "A must for libraries of all universities and laboratories that are engaged in nuclear physics, particle physics, nuclear energy, astrophysics or condensed matter research . . . an outstanding multidisciplinary introduction to the physics and applications of cold neutrons."—Physics World "So many tables, facts and figures . . . the coverage is remarkable."—American Scientist This encyclopedic reference work covers nearly every conceivable aspect of neutron physics. Assembled by an expert in the field, it ranges from the neutron's role as a major element in tests of the standard model of astro-particle physics to its use in nuclear energy generation and the study of condensed matter systems. The multidisciplinary approach includes detailed treatment of strong, weak, and electromagnetic properties of the neutron as well as parallel developments in cosmology and astrophysics. Each subject is placed within its scientific context and receives considerable attention to historical detail.

Nuclear Reactions

This introduction to nuclear physics and particle physics provides an accessible and clear treatment of the fundamentals. Starting with the structure of nuclei and explaining instability of nuclei, this textbook enables the reader to understand all basics in nuclear physics. The text is written from the experimental physics point of view, giving numerous real-life examples and applications of nuclear forces in modern technology. This highly motivating presentation deepens the reader's knowledge in a very accessible way. The second part of the text gives a concise introduction to elementary particle physics, again together with applications and instrumentation. Nuclear fusion, fission, radionuclides in medicine and particle accelerators are amongst the many examples explained in detail. Numerous problems with solutions are perfect for self-study.

Weak Interactions in Nuclei

This textbook is a unique and ambitious primer of nuclear physics, which introduces recent theoretical and experimental progresses starting from basics in fundamental quantum mechanics. The highlight is to offer an overview of nuclear structure phenomena relevant to recent key findings such as unstable halo nuclei, superheavy elements, neutron stars, nucleosynthesis, the standard model, lattice quantum chromodynamics (LQCD), and chiral effective theory. An additional attraction is that general properties of nuclei are comprehensively explained from both the theoretical and experimental viewpoints. The book begins with the conceptual and mathematical basics of quantum mechanics, and goes into the main point of nuclear physics – nuclear structure, radioactive ion beam physics, and nuclear reactions. The last chapters devote interdisciplinary topics in association with astrophysics and particle physics. A number of illustrations and exercises with complete solutions are given. Each chapter is comprehensively written starting from fundamentals to gradually reach modern aspects of nuclear physics with the objective to provide an effective description of the cutting edge in the field.

Introductory Nuclear Physics

Nuclear Physics in a Nutshell provides a clear, concise, and up-to-date overview of the atomic nucleus and the theories that seek to explain it. Bringing together a systematic explanation of hadrons, nuclei, and stars for the first time in one volume, Carlos A. Bertulani provides the core material needed by graduate and advanced undergraduate students of physics to acquire a solid understanding of nuclear and particle science. Nuclear Physics in a Nutshell is the definitive new resource for anyone considering a career in this dynamic field. The book opens by setting nuclear physics in the context of elementary particle physics and then shows how simple models can provide an understanding of the properties of nuclei, both in their ground states and excited states, and also of the nature of nuclear reactions. It then describes: nuclear constituents and their characteristics; nuclear interactions; nuclear structure, including the liquid-drop model approach, and the nuclear shell model; and recent developments such as the nuclear mean-field and the nuclear physics of very light nuclei, nuclear reactions with unstable nuclear beams, and the role of nuclear physics in energy production and nucleosynthesis in stars. Throughout, discussions of theory are reinforced with examples that provide applications, thus aiding students in their reading and analysis of current literature. Each chapter closes with problems, and appendixes address supporting technical topics.

Neutrons, Nuclei and Matter

A textbook for 2nd, 3rd, and 4th year undergraduates and postgraduates studying physics and theoretical physics, and a reference for nuclear and particle physicists in government and industry. It combines coverage of both nuclear and particle physics to present a detailed exposition of the behavior of the fundamental particles of nature. It examines the interaction between these particles and the symmetries that appear to govern them, as well as the intrinsic properties of the particles themselves. Annotation copyright by Book News, Inc., Portland, OR

Nuclear and Particle Physics

Fully updated for the second edition, this book introduces the growing and dynamic field of particle astrophysics. It provides an overview of high-energy nuclei, photons and neutrinos, including their origins, their propagation in the cosmos, their detection on Earth and their relation to each other. Coverage is expanded to include new content on high energy physics, the propagation of protons and nuclei in cosmic background radiation, neutrino astronomy, high-energy and ultra-high-energy cosmic rays, sources and acceleration mechanisms, and atmospheric muons and neutrinos. Readers are able to master the fundamentals of particle astrophysics within the context of the most recent developments in the field. This book will benefit graduate students and established researchers alike, equipping them with the knowledge and tools needed to design and interpret their own experiments and, ultimately, to address a number of questions concerning the nature and origins of cosmic particles that have arisen in recent research.

Modern Nuclear Physics

Presents latest developments in the fields of high, intermediate and low energy physics as well as in molecular and solid materials. With a detailed introduction, the subject matter is reviewed to its latest status, such as: High energy physics _ empirical approach systematizing the information on masses & spins etc, fundamental theories of antimatter, quarks & neutrino mass Intermediate energy _ hot and dense nuclear matter Low energy physics _ nuclear mass formula, "halo" structure of light, cold nuclear

phenomena (i.e., cold fission) Solid materials _ carbon clusters, semiconductors and phenomenon of atomic diffusion in solids Illustrating both present and future possibilities of new electrochromic materials and devices along with advances in Physics of molecular fluids and molecular materials in cosmic objects.

Nuclear Physics in a Nutshell

Nuclear and Particle Physics