Advances In Nuclear Physics Vol 22

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Advances In Nuclear Physics Vol 22 *2024-03-09*

CONRAD DIAZ

Advances in Nuclear Physics Springer Science & Business Media
The three articles of the present volume clearly exhibit a wide scope of articles, which is the aim of this series. The article by Kahana and Baltz lies in the main flow of the large stream of work currently in progress with heavy-ion accelerators. A related article by Terry Fortune on "Multinuclear Transfer Reactions with Heavy Ions" is scheduled to appear in the next volume. The article by Whitehead, Watt, Cole, and Morrison pertains to the nuclear-shell model for which a number of articles have appeared in our series. Our very first volume had an article on how SU(3) techniques can, with great elegance, enable one to cope with the sizable number of states within a configuration. But the actual nuclear force is not exactly that yielded by the elegant techniques, and so interest continued in dealing with the large number of states by brute force. Then the Glasgow school of Whitehead et al. discovered that mathematical techniques existed for coping more simply with the lowest eigenvalues of large matrices. The present ar ticle aims generally to make accessible to nuclear physicists the methods developed at Glasgow. The final article by Baer, Crowe, and Truol on radiative pion capture describes a new field of importance because of the advent of the meson factories. More and more pions and muons will become standard tools in nuclear physics.
Advances in Nuclear Science and Technology Springer
Review articles on three topics of considerable current interest make up the present volume. The first, on A-hypernuclei, was solicited by the editors in order to provide nuclear physicists with a general description of the most recent developments in a field which this audience has largely neglected or, perhaps, viewed as a novelty in which a bizarre nuclear system gave some information about the lambda-nuclear intersection. That view was never valid. The very recent developments reviewed here-particularly those pertaining to hypernuclear excitations and the strangeness exchange reactions-emphasize that this field provides important information about the models and central ideas of nuclear physics. The off-shell behavior of the nucleon-nucleon interaction is a topic which was at first received with some embarrassment, abuse, and neglect, but it has recently gained proper attention in many nuclear problems. Interest was first focused on it in nuclear many-body theory, but it threatened nuclear physicists'comfortable feeling about nonrelativistic potential theory, and many no doubt hoped that it would remain merely an esoteric diversion within the many-body cult. In the editors' opinion, this subject is now emi nently respectable and a review of it indeed timely. The third topic, nuclear charge distributions, is one which almost every nuclear physicist believed had been well in hand for some years.
Advances in Nuclear Physics Springer
With the appearance of Volume 3 of our series the review articles them selves can speak for the nature of the series. Our initial aim of charting the field of nuclear physics with some regularity and completeness is, hopefully, beginning to be established. We are greatly indebted to the willing coopera tion of many authors which has kept the series on schedule. By means of the "stream" technique on which our series is based - in which articles emerge from a flow of future articles at the convenience of the authors-the articles appear in this volume without any special coordination of topics. The topics range from the interaction of pions with nuclei to direct reactions in deformed nuclei. There is a great number of additional topics which the series hopes to include. Some of these are indicated by our list of future articles. Some have so far not appeared on our list because the topics have been reviewed re cently in other channels. Much of our series has originated from the sug gestions of our colleagues. We continue to welcome such aid and we continue to need, particularly, more suggestions about experimentalists who might write articles on experimental topics.
Advances in Nuclear Physics Springer Science & Business Media
"Analytic Insights into Intermediate-Energy Hadron-Nucleus Scattering," by R. D. Amado, presents a review of optical diffraction leading into discussions of elastic scattering, single- and multistep inelastic scattering, spin observables, and directions indicated for further research. "Recent Developments in Quasi-Free Nucleon-Nucleon Scattering," by P. Kitching, W. J. McDonald, Th. A. J. Maris, and C. A. Z. Vascon cellos, opens with a comprehensive review of the theory, going on to detail frontier research advances in spin dependence in (p, 2p) scattering, isospin dependence, and other quasi-free reactions. The final chapter, "Energetic Particle Emission in Nuclear Reactions" by D. H. Boal, explores new findings regarding direct interactions in the nucleus, thermalization and multiple scattering in nucleon emission, light fragment formation, and production of intermediate-mass fragments. A valuable and instructive trio of papers, Volume 15 of Advances in Nuclear Physics will be of interest to nonspecialists as well as specialists in the fields of nuclear physics, high-energy physics, and theoretical physics.
Advances in Nuclear Physics Springer Science & Business Media
Recent advances in three areas of nuclear physics are addressed in this volume. The theory of the ground state of matter is fundamental to many areas of physics and, in particular, is crucial to a microscopic understanding of nuclear physics. All conclusions concerning the relevance of me sonic, nu clear isobar, and quark degrees of freedom to nuclear structure are nec essarily subject to limitations in one's ability to accurately solve the nuclear many-body problem with static two-body interactions. Thus, it is particularly significant that in recent years great advances have been made in the vari ational theory of the ground state of zero-temperature infinite matter. The first article presents a pedagogical treatment of these advances and surveys computational results for a variety of model and physical systems. The second article reviews recent progress in determining nuclear tran sition densities from inelastic electron scattering. In the past, detailed knowl edge of the charge distributions in nuclear ground states obtained from inverting elastic electron scattering data has proven extremely valuable.
Advances in Nuclear Physics Springer Science & Business Media
This volume presents five pedagogical articles spanning frontier developments in contemporary nuclear physics ranging from the physics of a single nucleon to nucleosynthesis in the Big Bang. Although the objectives of Advances in Nuclear Physics have been and will continue to be quite distinct from those of conventional conference proceedings, the articles in this volume are carefully edited and expanded manuscripts based on an outstanding series of lectures delivered at the VI J. A. Swieca Summer School in Brazil. Starting at the smallest scale, the first article by Dan Olof Riska addresses realistic chiral symmetric models of the nucleon. Since the analytic tools are not yet developed to solve nonperturbative QCD directly, significant effort has been devoted in recent years to the development of models which incorporate and are constrained by the approximate chiral symmetry manifested in QCD. This article provides a clear introduction to chiral symmetry and the Skyrme model, and discusses the Skyrme model’s relation to the chiral bag model, its extensions, and its application to nucleons and hyperons.
Advances in Nuclear Physics Springer Science & Business Media
The present volume reaffirms nuclear physics as an experimental science since the authors are primarily experimentalists and since the treatment of the topics might be said to be "experimental." (This is no reflection on the theoretical competence of any of the authors.) The subject of high-spin phenomena in heavy nuclei has grown much beyond the idea of "backbending" which gave such an impetus to its study five years ago. It is a rich, new field to which Lieder and Ryde have contributed greatly. The article "Valence and Doorway Mechanisms in Resonance Neutron Capture" is, in contradistinction, an article pertaining to one of the oldest branches of nuclear physics-and it brings back one of our previous authors. The Doppler-shift method, reviewed by Alexander and Forster, is one of the important new experimental techniques that emerged in the previous decade. This review is intended, deliberately, to describe thoroughly a classic technique whose elegance epitomizes much of the fascination which nuclear physics techniques have held for a generation of scientists. This volume concludes the work on the Advances in Nuclear Physics series of one of the editors (M. Baranger), whose judgment and style characterize that which is best in the first ten volumes. Many of our readers and most of our authors will be grateful for the high standards which marked his contributions and which often elicited extra labor from the many authors of the series.
Advances in Nuclear Physics Springer Science & Business Media
Nuclear many-body theory provides the foundation for understanding and exploiting the new generation of experimental probes of nuclear structure that are now becoming available. The twentieth volume of Advances in Nuclear Physics is thus devoted to two major theoretical chapters addressing two fundamental issues: understanding single-particle properties in nuclei and the consistent formulation of a relativistic theory appropriate for hadronic physics. The long-standing problem of understanding single-particle behavior in a strongly interacting nuclear system takes on new urgency and sig nificance in the face of detailed measurements of the nuclear spectral function in (e, e'p) experiments. In the first chapter, Mahaux and Sartor confront head-on the ambiguities in defining single-particle properties and the limitations in calculating them microscopically. This thoughtful chapter provides a thorough, pedagogical review of the relevant aspects of many body theory and of previous treatments in the nuclear physics literature. It also presents the author's own vision of how to properly formulate and understand single-particle behavior based on the self-energy, or mass operator. Their approach provides a powerful, unified description of the nuclear mean field that covers negative as well as positive energies and consistently fills in that information that cannot yet be calculated reliably microscopically by a theoretically motivated phenomenology. Particular emphasis is placed upon experiment, both in the exhaustive comparisons with experimental data and in the detailed discussion of the relations of each of the theoretical quantities defined in the chapter to physical observables.
Advances in Nuclear Physics Springer Science & Business Media
Advances in Nuclear Science and Technology, Volume 9 provides information pertinent to the fundamental aspects of nuclear science and technology. This book discusses the safe and beneficial development of land-based nuclear power plants. Organized into five chapters, this volume begins with an overview of the possible consequences of a large-scale release of radioactivity from a nuclear reactor in the event of a serious accident. This text then discusses the extension of conventional perturbation techniques to multidimensional systems and to high-order approximations of the Boltzmann equation. Other chapters consider details of probability treatment of the conventionally assumed loss-of-pressure accident to a modern gas-cooled reactor. This book discusses as well details of reliability analysis of a typical electromechanical protective system. The final chapter deals with the computer applications and the need for standardization as both computing and nuclear energy shifted from research and development to industry status. This book is a valuable resource for reactor physicists, engineers, scientists, and research workers.
Advances in Nuclear Physics Elsevier
For the first half of the 20th Century, low-energy nuclear physics was one of the dominant foci of all of science. Then accelerators prospered and energies rose, leading to an increase of interest in the GeV regime and beyond. The three articles comprising this end-of-century Advances in Nuclear Physics present a fitting and masterful summary of the energy regimes through which nuclear physics has developed and promises to develop in future. One article describes new information about fundamental symmetries found with kV neutrons. Another reviews our progress in understanding nucleon-nucleus scattering up to 1 GeV. The third analyzes dilepton production as a probe for quark-gluon plasmas generated in relativistic heavy-ion collisions.
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Advances in Nuclear Physics Academic Press
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Advances in Nuclear Physics Springer

In the present volume and in the preceding one we have stretched our normal pattern of reviews by including articles of more major proportions than any we have published before. As a consequence each of these two vol umes contains only three review articles. From the beginning of this series it has been our aim, as editors, to achieve variation in the scope, style, and length of individual articles sufficient to match the needs of the individual topic, rather than to restrain the authors within rigid limits. We feel that the two major articles of Vols. 5 and 6 are entirely justified and do not repre sent unnecessary exuberance on the part of the authors. The article by Michaudon on fission is the first comprehensive account of the developments in this subject, which have placed it in the center of the stage of nuclear physics during the past few years. The discovery of fission isomerism and its dramatic manifestations in the intermediate structure of the neutron cross sections for fissionable isotopes are among the most im portant and interesting events to occur in nuclear physics. These events came as a surprise, and reaffirmed that the strength of nuclear physics lies in the combination of ingenious experiments with simple ideas.

Advances in Nuclear Physics Springer

As much by chance as by design, the present volume comes closer to having a single theme than any of our earlier volumes. That theme is the properties of nuclear strength functions or, alternatively, the problem of line spreading. The line spreading or strength function concepts are essential for the nucleus because of its many degrees of freedom. The description of the nucleus is approached by using model wave functions-for example, the shell model or the collective model-in which one has truncated the number of degrees of freedom. The question then is how closely do the model wave functions correspond to the actual nuclear wave functions which enjoy all the degrees of freedom of the nuclear Hamiltonian? More precisely, one views the model wave functions as vectors in a Hilbert space and one views the actual wave functions as vectors spanning another, larger Hilbert space. Then the question is: how is a single-model wave function (or vector) spread among the vectors corresponding to the actual wave functions? As an example we consider a model state which is a shell-model wave function with a single nucleon added to a closed shell. Such a model state is called a single-particle wave function. At the energy of the single-particle waVe function one of the actual nuclear wave functions may resemble the single-particle wave function closely.

Advances in Nuclear Science and Technology Springer Science & Business Media

In both the present volume of Advances in Nuclear Physics and in the next volume, which will follow in a few months' time, we have stretched our normal pattern of reviews by including articles of more major proportions than any we have published before. As a result we have only three review articles in Volume 5. From the beginning of this series it has been our aim, as editors, to achieve variation in the scope, style, and length of individual articles sufficient to match the needs of the individual topic, rather than to restrain authors within rigid limits. It has not been our experience that this flexibility has led to unnecessary exuberance on the part of the authors. We feel that the major articles now entering the series are entirely justified. The article by Professor Delves on "Variational Techniques in the Nuclear Three-Body Problem" is an authoritative, definitive article on a subject which forms a cornerstone of nuclear physics. If we start with two body interactions, then the three-nucleon system is, perhaps, the only many nucleon system whose exact description may lie within the scope of human ingenuity. In recent years some new techniques of scattering theory, origi nating mostly in particle physics, have led to a great deal of new interest in the nuclear three-body problem. In this series we have had two articles (by Mitra and by Duck) on the new approaches.

Progress in Nuclear Physics Springer Science & Business Media

The present volume in our annual review series reviews a wide range of developments, giving a broad interpretation to the "technology" of our title. Starting at the beginning, Science, we have the review of basic nuclear physics data of Walker and Weaver for reactor kinetics, particularly, there fore, delayed neutron data. In the search for better and better accuracy, it is being realized that this involves the closest scrutiny of fundamental data, given to us here from the Birmingham school. Associated with this review of data is the review from Italy by Professor Pacilio and his co workers of the theory of reactor kinetics in the stochastic form, and a valuable compilation of the theory underlying a wide range of practical techniques. Tending more to technology come the papers by Jervis, reviewing the application of digital computers to the control of large nuclear power stations as developed in both the united Kingdom and Canada, Pickman's review of the design of fuels for heavy water reactors, and the account by Ishi kawa and Inabe of the new Japanese Research Reactor Program, itself initially directed largely to fuel element studies. The balance of the volume is made up of more philoso phical contributions to the practicalities of nuclear power.

Advances in Nuclear Physics Springer

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