

Introductory Nuclear Physics Krane Solutions Manual

Nuclear Sizes and Structure
Subatomic Physics
Introduction to Atomic and Nuclear Physics
Modern Physics
Thermal Physics
Modern Particle Physics
Nuclear and Particle Physics
Nuclear Physics
NUCLEAR PHYSICS: PRINCIPLES AND APPLICATIONS
Introductory Nuclear Physics
Handbook of Drug Metabolism, Third Edition
Nuclear and Particle Physics
Introductory Nuclear Physics
200 Puzzling Physics Problems
Fundamentals in Nuclear Physics
Foundations of Nuclear and Particle Physics
Exercises with Solutions in Radiation Physics
Modern Physics
Physics
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1000 Solved Problems in Modern Physics
Basic Ideas and Concepts in Nuclear Physics, An Introductory Approach
Intermediate Physics for Medicine and Biology
Introduction to High Energy Physics
Introductory Nuclear Physics
Modern Physics, Loose-Leaf
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Student Solutions Manual to Accompany Physics, 5th Edition
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Computer Solutions in Physics
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Radiation Detection and Measurement
Introductory Nuclear Physics
Introduction to Nuclear and Particle Physics
An Introduction to Nuclear Physics
Problems and Solutions on Atomic, Nuclear and Particle Physics
Solutions Manual to Accompany Introductory Nuclear Physics
Nuclear and Particle Physics
Problems and Solutions in Nuclear and Particle Physics

Nuclear Sizes and Structure

Subatomic Physics

This new edition of the methods and instrumentation used in the detection of ionizing radiation has been revised and updated to reflect recent advances. It covers modern engineering practice, provides useful design information and contains an up-to-date review of the literature.

Introduction to Atomic and Nuclear Physics

Exercise problems in each chapter.

Modern Physics

Accessible and flexible, MODERN PHYSICS, Third Edition has been specifically designed to provide simple, clear, and mathematically uncomplicated explanations of physical concepts and theories of modern physics. The authors clarify and show support for these theories through a broad range of current applications and examples-attempting to answer questions such as: What holds molecules together? How do electrons tunnel through barriers? How do electrons move through solids? How can currents persist indefinitely in superconductors? To pique student interest, brief sketches of the historical

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development of twentieth-century physics such as anecdotes and quotations from key figures as well as interesting photographs of noted scientists and original apparatus are integrated throughout. The Third Edition has been extensively revised to clarify difficult concepts and thoroughly updated to include rapidly developing technical applications in quantum physics. To complement the analytical solutions in the text and to help students visualize abstract concepts, the new edition also features free online access to QMTools, new platform-independent simulation software created by co-author, Curt Moyer, and developed with support from the National Science Foundation. Icons in the text indicate the problems designed for use with the software. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Thermal Physics

Nuclear physics is the study of the nuclei of atoms and their interactions. This textbook is a comprehensive, balanced, and up to date introduction to the subject. It describes both the experiments made to study nuclear reactions and nuclear structure, and the theories and models that have been developed to understand the properties of nuclei and their interactions. Introductory nuclear physics will serve both as a textbook for undergraduates and graduates, and as a useful reference work for professional nuclear physicists.

Modern Particle Physics

This text is an accessible, balanced introduction to nuclear and particle physics, providing an overview of the theoretical and experimental aspects of the subject.

Nuclear and Particle Physics

Nuclear 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

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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.

NUCLEAR PHYSICS: PRINCIPLES AND APPLICATIONS

Unique in its coverage of all aspects of modern particle physics, this textbook provides a clear connection between the theory and recent experimental results, including the discovery of the Higgs boson at CERN. It provides a comprehensive and self-contained description of the Standard Model of particle physics suitable for upper-level undergraduate students and graduate students studying experimental particle physics. Physical theory is introduced in a straightforward manner with full mathematical derivations throughout. Fully-worked examples enable students to link the

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mathematical theory to results from modern particle physics experiments. End-of-chapter exercises, graded by difficulty, provide students with a deeper understanding of the subject. Online resources available at www.cambridge.org/MPP feature password-protected fully-worked solutions to problems for instructors, numerical solutions and hints to the problems for students and PowerPoint slides and JPEGs of figures from the book.

Introductory Nuclear Physics

Handbook of Drug Metabolism, Third Edition

Modern Physics, Second Edition provides a clear, precise, and contemporary introduction to the theory, experiment, and applications of modern physics. This eagerly awaited second edition puts the modern back into modern physics courses. Pedagogical features throughout the text focus the reader on the core concepts and theories while offering optional, more advanced sections, examples, and cutting-edge applications to suit a variety of courses. Critically acclaimed for his lucid style, in the second edition, Randy Harris applies the same insights into recent developments in physics, engineering, and technology. Physics at the Turn of the 20th Century, Special Relativity, Waves and Particles I: Electromagnetic Radiation Behaving as Particles, Waves and Particles II: Matter Behaving as Waves, Bound States: Simple Cases, Unbound States:

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Obstacles, Tunneling and Particle-Wave Propagation, Quantum Mechanics in Three Dimensions and The Hydrogen Atom, Spin and Atomic Physics, Statistical Mechanics, Bonding: Molecules and Solids, Nuclear Physics, Fundamental Particles and Interactions. For all readers interested in modern physics.

Nuclear and Particle Physics

This book is targeted mainly to the undergraduate students of USA, UK and other European countries, and the M. Sc of Asian countries, but will be found useful for the graduate students, Graduate Record Examination (GRE), Teachers and Tutors. This is a by-product of lectures given at the Osmania University, University of Ottawa and University of Tebrez over several years, and is intended to assist the students in their assignments and examinations. The book covers a wide spectrum of disciplines in Modern Physics, and is mainly based on the actual examination papers of UK and the Indian Universities. The selected problems display a large variety and conform to syllabi which are currently being used in various countries. The book is divided into ten chapters. Each chapter begins with basic concepts containing a set of formulae and explanatory notes for quick reference, followed by a number of problems and their detailed solutions. The problems are judiciously selected and are arranged section-wise. The solutions are neither pedantic nor terse. The approach is straight forward and step-- step solutions are elaborately provided. More importantly the relevant formulas used for solving the problems can

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be located in the beginning of each chapter. There are approximately 150 line diagrams for illustration. Basic quantum mechanics, elementary calculus, vector calculus and Algebra are the pre-requisites.

Introductory Nuclear Physics

Market_Desc: This text is aimed at undergraduates in science and engineering who require knowledge of the fundamental principles of nuclear physics and its applications. Special Features: The book offers numerous practical examples and problems to enhance the material. It avoids complex and extensive mathematical treatments. It covers the basic theory but emphasizes the applications About The Book: This title provides the latest information on applications of Nuclear Physics. Written from an experimental point of view this text is broadly divided into two parts, firstly a general introduction to Nuclear Physics and secondly its applications. The book also includes chapters on practical examples and problems. It also contains hints to solving problems which are included in the appendix.

200 Puzzling Physics Problems

One of the field's most respected introductory texts, Modern Physics provides a deep exploration of fundamental theory and experimentation. Appropriate for second-year undergraduate science and engineering students, this esteemed text presents a comprehensive introduction to the concepts and methods that form the basis of modern physics,

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including examinations of relativity, quantum physics, statistical physics, nuclear physics, high energy physics, astrophysics, and cosmology. A balanced pedagogical approach examines major concepts first from a historical perspective, then through a modern lens using relevant experimental evidence and discussion of recent developments in the field. The emphasis on the interrelationship of principles and methods provides continuity, creating an accessible “storyline” for students to follow. Extensive pedagogical tools aid in comprehension, encouraging students to think critically and strengthen their ability to apply conceptual knowledge to practical applications. Numerous exercises and worked examples reinforce fundamental principles.

Fundamentals in Nuclear Physics

Student Solutions Manual to accompany Physics, 5th edition: Written for the full year or three term Calculus-based University Physics course for science and engineering majors, the publication of the first edition of Physics in 1960 launched the modern era of Physics textbooks. It was a new paradigm at the time and continues to be the dominant model for all texts. Physics is the most realistic option for schools looking to teach a more demanding course.

Foundations of Nuclear and Particle Physics

With the great progress in numerical methods and the speed of the modern personal computer, if you can

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formulate the correct physics equations, then you only need to program a few lines of code to get the answer. Where other books on computational physics dwell on the theory of problems, this book takes a detailed look at how to set up the equations and actually solve them on a PC. Focusing on popular software package Mathematica, the book offers undergraduate student a comprehensive treatment of the methodology used in programming solutions to equations in physics.

Exercises with Solutions in Radiation Physics

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 understanding 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 understanding of what nuclear and particle physics is about and will wish to learn more. I am indebted to Dr

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David Bailin and various (nameless) referees for penetrating and helpful comments on parts of the text.

Modern Physics

An accessible introduction to nuclear and particle physics with equal coverage of both topics, this text covers all the standard topics in particle and nuclear physics thoroughly and provides a few extras, including chapters on experimental methods; applications of nuclear physics including fission, fusion and biomedical applications; and unsolved problems for the future. It includes basic concepts and theory combined with current and future applications. An excellent resource for physics and astronomy undergraduates in higher-level courses, this text also serves well as a general reference for graduate studies.

Physics

This text is specifically designed to provide students of medicine and biology with a treatment of physics related to their fields of study. Assuming a basic understanding of physics, it develops ideas from first principles, using calculus and statistics when necessary but avoiding complex mathematics. Coverage includes translational and rotational equilibrium, with a description of the forces in the hip joint as a clinical example; exponential growth and decay, giving examples from pharmacology and physiology; nuclear physics and medical applications;

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X-ray production and their biological effects; diffusion and transport of solute in an infinite medium, and much more. Most chapters have been revised, and new material has been added on charged membranes, biomagnetism, image reconstruction, and magnetic resonance imaging. The text also contains computer programs on numerical integrations, Fourier series, and image reconstruction.

Nuclear Physics in a Nutshell

Nuclear and Particle Physics

"The textbook itself is the culmination of the authors' many years of teaching and research in atomic physics, nuclear and particle physics, and modern physics. It is also a crystallization of their intense passion and strong interest in the history of physics and the philosophy of science. Together with the solution manual which presents solutions to many end-of-chapter problems in the textbook, they are a valuable resource to the instructors and students working in the modern atomic field."--Publisher's website.

1000 Solved Problems in Modern Physics

This book presents 140 problems with solutions in introductory nuclear and particle physics. Rather than being only partially provided or simply outlined, as is typically the case in textbooks on nuclear and particle physics, all solutions are explained in detail.

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Furthermore, different possible approaches are compared. Some of the problems concern the estimation of quantities in realistic experimental situations. In general, solving the problems does not require a substantial mathematics background, and the focus is instead on developing the reader's sense of physics in order to work out the problem in question. Consequently, sections on experimental methods and detection methods constitute a major part of the book. Given its format and content, it offers a valuable resource, not only for undergraduate classes but also for self-assessment in preparation for graduate school entrance and other examinations.

Basic Ideas and Concepts in Nuclear Physics, An Introductory Approach

This highly-regarded text provides a comprehensive introduction to modern particle physics. Extensively rewritten and updated, this 4th edition includes developments in elementary particle physics, as well as its connections with cosmology and astrophysics. As in previous editions, the balance between experiment and theory is continually emphasised. The stress is on the phenomenological approach and basic theoretical concepts rather than rigorous mathematical detail. Short descriptions are given of some of the key experiments in the field, and how they have influenced our thinking. Although most of the material is presented in the context of the Standard Model of quarks and leptons, the shortcomings of this model and new physics beyond its compass (such as supersymmetry, neutrino mass

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and oscillations, GUTs and superstrings) are also discussed. The text includes many problems and a detailed and annotated further reading list.

Intermediate Physics for Medicine and Biology

The textbook begins with exercises related to radioactive sources and decay schemes. The problems covered include series decay and how to determine the frequency and energy of emitted particles in disintegrations. The next chapter deals with the interaction of ionizing radiation, including the treatment of photons and charged particles. The main focus is on applications based on the knowledge of interaction, to be used in subsequent work and courses. The textbook then examines detectors and measurements, including both counting statistics and properties of pulse detectors. The chapter that follows is dedicated to dosimetry, which is a major subject in medical radiation physics. It covers theoretical applications, such as different equilibrium situations and cavity theories, as well as experimental dosimetry, including ionization chambers and solid state and liquid dosimeters. A shorter chapter deals with radiobiology, where different cell survival models are considered. The last chapter concerns radiation protection and health physics. Both radioecology and radiation shielding calculations are covered. The textbook includes tables to simplify the solutions of the exercises, but the reader is mainly referred to important websites for importing necessary data.

Introduction to High Energy Physics

This clear and concise introduction to nuclear physics provides an excellent basis for a core undergraduate course in this area. 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. The book also includes chapters on nuclear fission, its application in nuclear power reactors, the role of nuclear physics in energy production and nucleosynthesis in stars. This second edition contains several additional topics: muon-catalysed fusion, the nuclear and neutrino physics of supernovae, neutrino mass and neutrino oscillations, and the biological effects of radiation. A knowledge of basic quantum mechanics and special relativity is assumed. Appendices deal with other more specialized topics. Each chapter ends with a set of problems for which outline solutions are provided.

Introductory Nuclear Physics

Fundamentals of Nuclear Reactor Physics offers a one-semester treatment of the essentials of how the fission nuclear reactor works, the various approaches to the design of reactors, and their safe and efficient operation . It provides a clear, general overview of atomic physics from the standpoint of reactor functionality and design, including the sequence of fission reactions and their energy release. It provides in-depth discussion of neutron reactions, including

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neutron kinetics and the neutron energy spectrum, as well as neutron spatial distribution. It includes ample worked-out examples and over 100 end-of-chapter problems. Engineering students will find this applications-oriented approach, with many worked-out examples, more accessible and more meaningful as they aspire to become future nuclear engineers. A clear, general overview of atomic physics from the standpoint of reactor functionality and design, including the sequence of fission reactions and their energy release In-depth discussion of neutron reactions, including neutron kinetics and the neutron energy spectrum, as well as neutron spatial distribution Ample worked-out examples and over 100 end-of-chapter problems Full Solutions Manual

Modern Physics, Loose-Leaf

This book, part of the seven-volume series Major American Universities PhD Qualifying Questions and Solutions contains detailed solutions to 483 questions/problems on atomic, molecular, nuclear and particle physics, as well as experimental methodology. The problems are of a standard appropriate to advanced undergraduate and graduate syllabi, and blend together two objectives — understanding of physical principles and practical application. The volume is an invaluable supplement to textbooks.

Fundamentals of Nuclear Reactor Physics

Student Solutions Manual to Accompany Physics, 5th Edition

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.

Introduction to Nuclear Physics

The second edition of a bestseller, this book presents the latest innovative research methods that help break new ground by applying patterns, reuse, and design science to research. The book relies on familiar patterns to provide the solid fundamentals of various research philosophies and techniques as touchstones that demonstrate how to innovate research methods. Filled with practical examples of applying patterns to IT research with an emphasis on reusing research activities to save time and money, this book describes design science research in relation to other information systems research paradigms such as positivist and interpretivist research.

Computer Solutions in Physics

This textbook brings together nuclear and particle physics, presenting a balanced overview of both fields as well as the interplay between the two. The theoretical as well as the experimental foundations are covered, providing students with a deep understanding of the subject. In-chapter exercises ranging from basic experimental to sophisticated theoretical questions provide an important tool for students to solidify their knowledge. Suitable for upper undergraduate courses in nuclear and particle physics as well as more advanced courses, the book includes road maps guiding instructors on tailoring the content to their course. Online resources including color figures, tables, and a solutions manual complete the teaching package. This textbook will be essential

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for students preparing for further study or a career in the field who require a solid grasp of both nuclear and particle physics.

Modern Atomic and Nuclear Physics

NUCLEAR AND PARTICLE PHYSICS discusses the Characteristics of Nucleus, Nuclear Forces, Nuclear Models, Nuclear Reactions, Fission and Fusion, Radioactive Decay, Detectors, Accelerators, Reactors, and Elementary Particles. Each topic is explained with the help of simple exercises using simple language.

Radiation Detection and Measurement

An explanation of the basic concepts of theoretical and experimental nuclear and particle physics.

Introductory Nuclear Physics

Introduction to Nuclear and Particle Physics

to Atomic and Nuclear Physics Aerial view of the National Accelerator Laboratory, Batavia, Illinois. (Photograph courtesy of NAL.) Introduction to Atomic and Nuclear Physics HENRY SEMAT Professor Emeritus The City College of the City University of New York JOHN R. ALBRIGHT The Florida State University FIFTH EDITION LONDON NEW YORK CHAPMAN AND HALL First edition 1939 Fifth edition, first published in the U.S.A. by Holt, Rinehart and Winston, Inc. Fifth edition

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An Introduction to Nuclear Physics

Covers all the phenomenological and experimental data on nuclear physics and demonstrates the latest experimental developments that can be obtained. Introduces modern theories of fundamental processes, in particular the electroweak standard model, without using the sophisticated underlying quantum field theoretical tools. Incorporates all major present applications of nuclear physics at a level that is both understandable by a majority of physicists and scientists of many other fields, and usefull as a first introduction for students who intend to pursue in the domain.

Problems and Solutions on Atomic, Nuclear and Particle Physics

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This is the second edition of an established textbook on nuclear physics for senior undergraduates and postgraduate students. Professor Heyde has taken the opportunity to make the book more useful for students and teachers by adding an extensive set of problems. To bring the book up to date, he has revised several chapters and added a new chapter on nuclei at the extremes of stability. The book has evolved from a course taught by the author and gives a balanced account of both theoretical and experimental nuclear physics. It is also ideal for researchers wanting an accessible introduction to the subject. Emphasis is given to depth of treatment rather than skimming over topics and there are many diagrams as well as box inserts illustrating particular topics.

Solutions Manual to Accompany Introductory Nuclear Physics

Nuclear and Particle Physics

This book will strengthen a student's grasp of the laws of physics by applying them to practical situations, and problems that yield more easily to intuitive insight than brute-force methods and complex mathematics. These intriguing problems, chosen almost exclusively from classical (non-quantum) physics, are posed in accessible non-technical language requiring the student to select the right framework in which to analyse the situation and decide which branches of physics are involved. The

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level of sophistication needed to tackle most of the two hundred problems is that of the exceptional school student, the good undergraduate, or competent graduate student. The book will be valuable to undergraduates preparing for 'general physics' papers. It is hoped that even some physics professors will find the more difficult questions challenging. By contrast, mathematical demands are minimal, and do not go beyond elementary calculus. This intriguing book of physics problems should prove instructive, challenging and fun.

Problems and Solutions in Nuclear and Particle Physics

' The original edition of Introduction to Nuclear and Particle Physics was used with great success for single-semester courses on nuclear and particle physics offered by American and Canadian universities at the undergraduate level. It was also translated into German, and used overseas. Being less formal but well-written, this book is a good vehicle for learning the more intuitive rather than formal aspects of the subject. It is therefore of value to scientists with a minimal background in quantum mechanics, but is sufficiently substantive to have been recommended for graduate students interested in the fields covered in the text. In the second edition, the material begins with an exceptionally clear development of Rutherford scattering and, in the four following chapters, discusses sundry phenomenological issues concerning nuclear properties and structure, and general applications of radioactivity and of the nuclear force.

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This is followed by two chapters dealing with interactions of particles in matter, and how these characteristics are used to detect and identify such particles. A chapter on accelerators rounds out the experimental aspects of the field. The final seven chapters deal with elementary-particle phenomena, both before and after the realization of the Standard Model. This is interspersed with discussion of symmetries in classical physics and in the quantum domain, bringing into full focus the issues concerning CP violation, isotopic spin, and other symmetries. The final three chapters are devoted to the Standard Model and to possibly new physics beyond it, emphasizing unification of forces, supersymmetry, and other exciting areas of current research. The book contains several appendices on related subjects, such as special relativity, the nature of symmetry groups, etc. There are also many examples and problems in the text that are of value in gauging the reader's understanding of the material.

Contents: Rutherford Scattering Nuclear Phenomenology Nuclear Models Nuclear Radiation Applications of Nuclear Physics Energy Deposition in Media Particle Detection Accelerators Properties and Interactions of Elementary Particles Symmetries Discrete Transformations Neutral Kaons, Oscillations, and CP Violation Formulation of the Standard Model Standard Model and Confrontation with Data Beyond the Standard Model Readership: Advanced undergraduates and researchers in nuclear and particle physics. Keywords: Rutherford Scattering; Nuclear Properties; Nuclear Structure; Elementary Particles; Sub-Structure of

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Particles; Particle Detectors; Interactions in Matter; The Standard Model; Symmetries of Nature; Theories of Nuclear and Particle

Structure; Radioactivity; Supersymmetry

Reviews: "The book by Das and Ferbel is particularly suited as a basis for a one-semester course on both subjects since it contains a very concise introduction to those topics and I like very much the outline and contents of this book." Kay Konigsmann Universität Freiburg, Germany "The book provides an introduction to the subject very well suited for the introductory course for physics majors. Presentation is very clear and nicely balances the issues of nuclear and particle physics, exposes both theoretical ideas and modern experimental methods. Presentation is also very economic and one can cover most of the book in a one-semester course. In the second edition, the authors updated the contents to reflect the very recent developments in the theory and experiment. They managed to do it without substantial increase of the size of the book. I used the first edition several times to teach the course 'Introduction to Subatomic Physics' and I am looking forward to use this new edition to teach the course next year." Professor Mark Strikman Pennsylvania State University, USA "This book can be recommended to those who find elementary particle physics of absorbing interest." Contemporary Physics '

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