Experimental Techniques In Nuclear And Particle Physics Unlocked

This is the first book covering the theory, practicalities, and the extensive applications of neutron powder diffraction in materials science, physics, chemistry, mineralogy, and engineering. The broad coverage should be accessible to graduate students and senior undergraduates in science and engineering, as well as lecturers and researchers.
This practical book provides recipes for the construction of devices used in low temperature experimentation. It emphasizes what works, rather than what might be the optimum method, and lists current sources for purchasing components and equipment.
High-resolution x-ray diffraction and scattering is a key tool for structure analysis not only in bulk materials but also at surfaces and buried interfaces from the sub-nanometer range to micrometers. This book offers an overview of diffraction and scattering methods currently available at modern synchrotron sources and illustrates bulk and interface investigations of solid and liquid matter with up-to-date research examples. It presents important characteristics of the sources, experimental set-up, and new detector developments. The book also considers future exploitation of x-ray free electron lasers for diffraction applications.
Cryostat Design, Material Properties and Superconductor Critical-Current Testing
Nuclear Methods in Science and Technology
Experimental Techniques
Experimental Techniques in Nuclear Physics
Nuclear Physics: Experimental And Theoretical
A How-to Approach

Physical Principles and Techniques of Protein Chemistry, Part C focuses on the effects of intermolecular interactions that are transmitted between ligands and proteins and from protein to protein. This book discusses the density and volume change measurements; direct volume change; osmotic pressure; and small-angle X-ray scattering. The theory of particulate scattering; pulsed nuclear magnetic resonance; absorption of water by diamagnetic molecules; and use of least squares in data analysis are also elaborated. This text likewise covers the iteration process; optical rotatory dispersion and the main chain conformation of proteins; and basic relations for optically active molecules. Other topics include the circular dichroism, secondary structure of proteins, visible rotatory dispersion, and peptide cotton effects. This publication is intended for protein chemists, but is also useful to biologists, medical practitioners, and students researching on protein chemistry.

This second open access volume of the handbook series deals with detectors, large experimental facilities and data handling, both for accelerator and non-accelerator based experiments. It also covers applications in medicine and life sciences. A joint CERN-Springer initiative, the "Particle Physics Reference Library" provides revised and updated contributions based on previously published material in the well-known Landolt-Boernstein series on particle physics, accelerators and detectors (volumes 21A,B1,B2,C), which took stock of the field approximately one decade ago. Central to this new initiative is publication under full open access.

"This book details developments in advanced technology to explore micro-level structural changes during food processing. It is based on the authors' comprehensive knowledge and application of microimaging methods in thermal processing"--

An Introduction
Experimental Techniques In Condensed Matter Physics At Low Temperatures
Modern Experimental Techniques
Technological Applications and Experimental Techniques of Nuclear Energy
Radiation Detection for Nuclear Physics
Report to the Congress [on The] Atomic Energy Commission, Dept. of the Interior [and] Federal Power Commission

Rare Isotope Beams (RIBs) are ion beams of exotic radioactive nuclei. The study of these nuclei is key to understanding the limits of nuclear existence, nucleo-synthesis in such violent stellar sites as supernovae and merging neutron stars, and the fundamental symmetries of nature. These nuclei also provide a unique probe to study condensed matter and many of them are potentially new radioisotopes for more effective medical diagnostics and therapy. Rare Isotope Beams: Concepts and Techniques gives an up-to-date overview of all these aspects of RIB science in a single volume containing the scientific motivation, production techniques, experimental techniques for studying exotic nuclei, methods used in condensed matter research, and medical applications. The emphasis throughout is on concepts to facilitate understanding of the essence of each topic in this diverse and cross-disciplinary field involving nuclear physics, astrophysics, and particle accelerators. A brief description of major RIB facilities is also presented. Exotic nuclei are difficult to produce in enough numbers and their production involves different nuclear reaction routes and a wide range of advanced technologies, which are presented in a comprehensive manner. Experimental techniques used to study exotic nuclei are provided with examples highlighting the intricate nature of such experiments. Another unique feature is the open-ended nature of the discussions, bringing out the future challenges and possibilities in this evolving field. The book offers an excellent overview of concepts and techniques involved in RIB science for new researchers entering the field as well as professionals.

Nuclear Fuel Elements: Design, Fabrication and Performance is concerned with the design, fabrication, and performance of nuclear fuel elements, with emphasis on fast reactor fuel elements. Topics range from fuel types and the irradiation behavior of fuels to cladding and duct materials, fuel element design and modeling, fuel element performance testing and qualification, and the performance of water reactor fuels. Fast reactor fuel elements, research and test reactor fuel elements, and unconventional fuel elements are also covered. This volume consists of 12 chapters and begins with an overview of nuclear reactors and fuel elements, as well as fuel element design and development based on the reactor operator's approach, materials scientist's approach, and interdisciplinary approach. The reader is then introduced to different types of nuclear fuels and their irradiation behavior, considerations for using cladding and duct materials in fuel element design and development, and fuel element design and modeling. The chapters that follow focus on the testing of fuel element performance, experimental techniques and equipment for testing fuel element designs, and the performance of fuels for water reactors. Fuel elements for gas-cooled reactors, fast reactors, and research and test reactors are also described. The book concludes with an assessment of unconventional fuel elements. This book will be useful to fuel element technologists as well as materials scientists and engineers.
Publisher description
Nuclear and Particle Physics
Concepts and Techniques
Report to the Congress: Progress and Problems in Developing Nuclear and Other Experimental Techniques for Recovering Natural Gas in the Rocky Mountain Area
Experimental Techniques in Nuclear and Particle Physics
Nuclear Fuel Elements
Giant Resonances

This volume presents a comprehensive introduction to the study of nuclear structure at finite temperature. By measuring the frequencies of the high-energy photons emitted or absorbed by an atomic nucleus it is possible to visualize the structure of that nucleus. In such experiments it is observed that the atomic nucleus displays resonant behavior, absorbing or emitting photons within a relatively narrow range of frequencies. To study emission processes one measures the y-decay of compound nuclei, and by this means it is possible to probe the structure of the nucleus at finite temperature. This book is divided into two main parts: the study of giant resonances based on the atomic nucleus ground state (zero temperature), and the study of the y-decay of giant resonances from compound (finite temperature) nuclei. As this work is an outgrowth of their lectures to fourth-year students at the University of Milan, the authors have placed special emphasis on the general concepts that form the foundation of the phenomenon of giant resonances. This basic subject matter is supplemented with material taken from work going on at the forefront of research on the structure of hot nuclei. Thus, this volume will serve as an essential reference for both young researchers and experienced practitioners.
Nuclear Acoustic Resonance serves as an introduction to the field of nuclear acoustic resonance and highlights its differences from nuclear magnetic resonance. Topics covered range from the nature of the coupling mechanisms, including dynamic electric quadrupole coupling and dynamic Alpher-Rubin coupling, to experimental techniques. The application of nuclear acoustic resonance to the study of conducting media is given consideration. This book consists of 10 chapters and begins with a description of nuclear acoustic resonance, nuclear magnetic resonance, and combination acoustic-electromagnetic spin resonance. A detailed treatment of nuclear electrostatic multipole interactions is presented, with emphasis on the irreducible tensor operators and their application to the calculation of nuclear acoustic resonance absorption and dispersion, as well as of line width and relaxation effects. An alternative approach that builds on the concepts of acoustic impedance and susceptibility for calculating absorption and dispersion in nuclear acoustic resonance is also presented. In an extension of the usual treatment of nuclear dipolar and nuclear quadrupolar interactions, the reader is introduced to appropriate expressions for nuclear acoustic coupling in solids via the dynamic hexadecapole moment. The final chapter explores the use of the Superconducting Quantum Interference Device (SQUID) in the detection of nuclear acoustic resonance. This book will be helpful to students and practitioners of physics and those interested in nuclear acoustic resonance.
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.
Methods of Experimental Physics
Nuclear Condensed Matter Physics
Theory, Experiments, and Applications, Second Edition
Advanced Micro-level Experimental Techniques for Food Drying and Processing Applications
The Core of Matter, The Fuel of Stars
Volume 2: Detectors for Particles and Radiation

This book presents a unique collection of clinical cases to help combat the difficulty of diagnosis and treatment of Syncope. Medical professionals using this book are provided with a reference to a large array of succinctly described and illustrated clinical scenarios. Each case is presented with the results of appropriate tests and critical comments about the evaluation, diagnosis and treatment according to guidelines. Syncope is considered a difficult diagnostic and treatment problem for all who work in the field. Regardless of your prior knowledge, you will find the case studies easy to digest, enlightening, and immediately pertinent to improving the care patients – giving you confidence in your diagnosis and your advice. The editors have developed a lively and easy-to-read book with a focused expert editorial commentary, offering the reader a broader and easily understood context for each case, as well as key citations from the literature. Syncope Cases is a valuable contribution to your collection; edited by seven prominent

authorities on the management of syncope from four countries, with more than 130 contributors, this book provides a unique additional step in the fostering of a better understanding of the many factors that can cause syncope, with the ultimate goal of facilitating the delivery of more precise and cost-effective care for syncope patients. It is a contribution that should be widely read, and one that offers the possibility of distinctly enhancing medical care of the syncope patient.

Experimental Techniques in Materials and Mechanics provides a detailed yet easy-to-follow treatment of various techniques useful for characterizing the structure and mechanical properties of materials. With an emphasis on techniques most commonly used in laboratories, the book enables students to understand practical aspects of the methods and derive the maximum possible information from the experimental results obtained. The text focuses on crystal structure determination, optical and scanning electron microscopy, phase diagrams and heat treatment, and different types of mechanical testing methods. Each chapter follows a similar format: Discusses the importance of each technique Presents the necessary theoretical and background details Clarifies concepts with numerous worked-out examples Provides a detailed description of the experiment to be conducted and how the data could be tabulated and interpreted Includes a large number of illustrations, figures, and micrographs Contains a wealth of exercises and references for further reading Bridging the gap between lecture and lab, this text gives students hands-on experience using mechanical engineering and materials science/engineering techniques for determining the structure and properties of materials. After completing the book, students will be able to confidently perform experiments in the lab and extract valuable data from the experimental results.

Based on the modern approach of information theory, this book presents novel experimental techniques, tools, and data processing methods for physics applications. It shows readers how to plan and conduct experiments, design and certify measuring equipment, and process and interpret the experimental data. Drawing on his extensive experience in experimental research, the author discusses the theory of systems for measuring and recording data, the equipment and methods used for studying fast processes, the basic methods of experimental physics, and the methods for interpretation and data processing. Bringing together approaches that have previously been scattered in the literature, the book covers high-speed photography, Fourier optics, spectroscopy, interferometry, holography, electromagnetic waves, X-rays, and corpuscular investigation.

Progress and Problems in Developing Nuclear and Other Experimental Techniques for Recovering Natural Gas in the Rocky Mountain Area

Syncope Cases

Experimental Techniques for Low-Temperature Measurements

Report to Congress [on The] Atomic Energy Commission

An Introduction to Experimental Nuclear Reactions

Nuclear Methods and Applications

An Introduction to Experimental Nuclear Reactions is a book with a concise and simple approach to the subject of experimental nuclear physics. The subject being very technical, it is dealt with in a lucid way so that the reader can grasp the concept and later gain hands-on experience while doing fieldwork. In this book, theoretical, experimental and instrumentation aspects are covered with an emphasis on accelerator-based techniques, which form the basis for the subject of experimental nuclear physics. Other books on similar topics either concentrate on the physics aspects or are more focussed on the instrumentation and radiation detection techniques while accelerator-related concepts are less explained. One of the main standalone features of the book is its to-the-point approach so that the beginner is not lost in the never-ending details. This book discusses the following aspects: Basic introduction to nuclear reactions Two- and three-body kinematics Accelerator-based experimental techniques Basic aspects of the accelerator and accessories Vacuum physics Radiation detector physics and its associated electronics Theoretical modelling and errors This book is mainly intended for students who aspire to pursue a career in experimental nuclear physics research or work in a nuclear accelerator laboratory. Chinmay Basu, PhD, is a researcher in the field of experimental nuclear physics, and his present interests are in the field of low-energy nuclear astrophysics. He is a professor and head of an accelerator facility at the Saha Institute of Nuclear Physics, Kolkata, India.

The continuous evolution and development of experimental techniques is at the basis of any fundamental achievement in modern physics. Strongly correlated systems (SCS), more than any other, need to be investigated through the greatest variety of experimental techniques in order to unveil and crosscheck the numerous and puzzling anomalous behaviors characterizing them. The study of SCS fostered the improvement of many old experimental techniques, but also the advent of many new ones just invented in order to analyze the complex behaviors of these systems. Many novel materials, with functional properties emerging from macroscopic quantum behaviors at the frontier of modern research in physics, chemistry and materials science, belong to this class of systems. The volume presents a representative collection of the modern experimental techniques specifically tailored for the analysis of strongly correlated systems. Any technique is presented in great detail by its own inventor or by one of the world-wide recognized main contributors. The exposition has a clear pedagogical cut and fully reports on the most relevant case study where the specific technique showed to be very successful in describing and enlightening the puzzling physics of a particular strongly correlated system. The book is intended for advanced graduate students and post-docs in the field as textbook and/or main reference, but also for any other researcher in the field who appreciates consulting a single, but comprehensive, source or wishes to get acquainted, in a as painless as possible way, with the working details of a specific technique.

From the initial observation of proton magnetic resonance in water and in paraffin, the discipline of nuclear magnetic resonance has seen unparalleled

growth as an analytical method. Modern NMR spectroscopy is a highly developed, yet still evolving, subject which finds application in chemistry, biology, medicine, materials science and geology. In this book, emphasis is on the more recently developed methods of solution-state NMR applicable to chemical research, which are chosen for their wide applicability and robustness. These have, in many cases, already become established techniques in NMR laboratories, in both academic and industrial establishments. A considerable amount of information and guidance is given on the implementation and execution of the techniques described in this book.

Design, Fabrication and Performance

Nuclear Magnetic Resonance Spectroscopy

Experimental Techniques in High-energy Nuclear and Particle Physics

Introduction to Experimental Nuclear Physics

Applications of Neutron Powder Diffraction

Experimental Techniques in Materials and Mechanics

Combines clear and concise discussions of key NMR concepts with succinct and illustrative examples Designed to cover a full course in Nuclear Magnetic Resonance (NMR) Spectroscopy, this text offers complete coverage of classic (one-dimensional) NMR as well as up-to-date coverage of two-dimensional NMR and other modern methods. It contains practical advice, theory, illustrated applications, and classroom-tested problems; looks at such important ideas as relaxation, NOEs, phase cycling, and processing parameters; and provides brief, yet fully comprehensible, examples. It also uniquely lists all of the general parameters for many experiments including mixing times, number of scans, relaxation times, and more. Nuclear Magnetic Resonance Spectroscopy: An Introduction to Principles, Applications, and Experimental Methods, 2nd Edition begins by introducing readers to NMR spectroscopy - an analytical technique used in modern chemistry, biochemistry, and biology that allows identification and characterization of organic, and some inorganic, compounds. It offers chapters covering: Experimental Methods; The Chemical Shift; The Coupling Constant; Further Topics in One-Dimensional NMR Spectroscopy; Two-Dimensional NMR Spectroscopy; Advanced Experimental Methods; and Structural Elucidation. Features classical analysis of chemical shifts and coupling constants for both protons and other nuclei, as well as modern multi-pulse and multi-dimensional methods Contains experimental procedures and practical advice relative to the execution of NMR experiments Includes a chapter-long, worked-out problem that illustrates the application of nearly all current methods Offers appendices containing the theoretical basis of NMR, including the most modern approach that uses product operators and coherence-level diagrams By offering a balance between volumes aimed at NMR specialists and the structure-determination-only books that focus on synthetic organic chemists, Nuclear Magnetic Resonance Spectroscopy: An Introduction to Principles, Applications, and Experimental Methods, 2nd Edition is an excellent text for students and post-graduate students working in analytical and bio-sciences, as well as scientists who use NMR spectroscopy as a primary tool in their work.

Experimental Techniques in High-Energy Nuclear and Particle Physics is a compilation of outstanding technical papers and reviews of the ingenious methods developed for experimentation in modern nuclear and particle physics. This book, a second edition, provides a balanced view of the major tools and technical concepts currently in use, and elucidates the basic principles that underly the detection devices. Several of the articles in this volume have never been published, or have appeared in relatively inaccessible journals. Although the emphasis is on charged-particle tracking and calorimetry, general reviews of ionization detectors and Monte Carlo techniques are also included.This book serves as a compact source of reference for graduate students and experimenters in the fields of nuclear and particle physics, seeking information on some of the major ideas and techniques developed for modern experiments in these fields.

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.

Techniques for Nuclear and Particle Physics Experiments
Rare Isotope Beams
Research Reactor Experimental Techniques
Nuclear Physics
Particle Physics Reference Library
X-Ray Diffraction

A treatment of the experimental techniques and instrumentation most often used in nuclear and particle physics experiments as well as in various other experiments, providing useful results and formulae, technical know-how and informative details. This second edition has been revised, while sections on Cherenkov radiation and radiation protection have been updated and extended.

Nuclear magnetic resonance (NMR) is widely used across many fields of science because of the rich data it produces, and some of the most valuable data come from studies of nuclear spin relaxation in solution. The first edition of this book, published more than a decade ago, provided an accessible and cohesive treatment of the field. The present second edition is a significant update, covering important new developments in recent years. Collecting relaxation theory, experimental techniques, and illustrative applications into a single volume, this book clarifies the nature of the phenomenon, shows how to study it and explains why such studies are worthwhile. Coverage ranges from basic to rigorous theory and from simple to sophisticated experimental methods. Topics include cross-relaxation, multispin phenomena, relaxation studies of molecular dynamics and structure and special topics such as relaxation in systems with quadrupolar nuclei, in paramagnetic systems and in long-living spin states. Avoiding overly demanding mathematics, the authors explain spin relaxation in a manner that anyone with a familiarity with NMR can follow. The focus is on illustrating and explaining the physical nature of relaxation phenomena. Nuclear Spin Relaxation in Liquids: Theory, Experiments and Applications, 2nd edition, provides useful supplementary reading for graduate students and is a valuable reference for NMR spectroscopists, whether in chemistry, physics or biochemistry.

I have been teaching courses on experimental techniques in nuclear and particle physics to master students in physics and in engineering for many years. This book grew out of the lecture notes I made for these students. The physics and engineering students have rather different expectations of what such a course should be like. I hope that I have nevertheless managed to write a book that can satisfy the needs of these different target audiences. The lectures themselves, of course, need to be adapted to the needs of each group of students. An engineering student will not qu- tion a statement like “the velocity of the electrons in atoms is ?1% of the velocity of light”, a physics student will. Regarding units, I have written factors h and c explicitly in all equations throughout the book. For physics students it would be preferable to use the convention that is common in physics and omit these constants in the equations, but that would probably be confusing for the engineering students. Physics students tend to be more interested in theoretical physics courses. However, physics is an experimental science and physics students should und- stand how experiments work, and be able to make experiments work. This is an open access book.

Nuclear Acoustic Resonance
Proceedings of a Study Group Meeting Held by I.A.E.A. at Bucharest 26-31 October 1964
Strongly Correlated Systems

High-resolution NMR Techniques in Organic Chemistry
Nuclear Spin Relaxation in Liquids

The application of nuclear physics methods is now widespread throughout physics, chemistry, metallurgy, biology, clinical medicine, geology, and archaeology. Accelerators, reactors, and various instruments that have developed together with nuclear physics have often been found to offer the basis for increasingly productive and more sensitive analytical techniques. Nuclear Methods in Science and Technology provides scientists and engineers with a clear understanding of the basic principles of nuclear methods and their potential for applications in a wide range of disciplines. The first part of the book covers the major points of basic theory and experimental methods of nuclear physics, emphasizing concepts and simple models that give a feel for the behavior of real systems. Using many examples, the second part illustrates the extraordinary possibilities offered by nuclear methods. It covers the Mossbauer effect, slow neutron physics, activation analysis, radiography, nuclear geochronology, channeling effects, nuclear microprobe, and numerous other topics in modern applied nuclear physics. The book explores applications such as tomography, the use of short-lived isotopes in clinical diagnoses, and nuclear physics in ecology and agriculture. Where alternative nonnuclear analytical techniques are available, the author compares the relevant nuclear method, enabling readers to judge which technique may be most useful for them. Complete with a bibliography and extensive reference list for readers who want to delve deeper into a particular topic, this book applies various methods of nuclear physics to a wide range of disciplines.

Progress and Problems in Developing Nuclear and Other Experimental Techniques for Recovering Natural Gas in the Rocky Mountain Area

Techniques for Nuclear and Particle Physics ExperimentsA How-to ApproachSpringer Science & Business Media
An Introduction to Principles, Applications, and Experimental Methods
Experimental Techniques in High Energy Nuclear and Particle Physics
Physical Principles and Techniques of Protein Chemistry

This Comprehensive Text Presents Not Only A Detailed Exposition Of The Basic Principles Of Nuclear Physics But Also Provides A Contemporary Flavour Of The Subject By Covering The Recent Developments.Starting With A Synoptic View Of The Subject, The Book Explains Various Physical Phenomena In Nuclear Physics Alongwith The Experimental Methods Of Measurement.Nuclear Forces As Encountered In Two-Body Problems Are Detailed Next Followed By The Problems Of Radioactive Decay.Nuclear Reactions Are Then Comprehensively Explained Alongwith The Various Models Of Reaction Mechanism. This Is Followed By Recent Developments Like The Pre- Equilibrium Model And Heavy Ions Induced Reaction.The Book Would Serve As A Contemporary Text For Senior Undergraduate As Well As Post Graduate Students Of Physics. Practising Scientists And Researchers In The Area Would Also Find The Book To Be A Useful Reference Source.

Radiation detection is key to experimental nuclear physics as well as underpinning a wide range of applications in nuclear decommissioning, homeland security and medical imaging. This book presents the state-of-the-art in radiation detection of light and heavy ions, beta particles, gamma rays and neutrons. The underpinning physics of different detector technologies is presented, and their performance is compared and contrasted. Detector technology likely to be encountered in contemporary international laboratories is also emphasized. There is a strong focus on experimental design and mapping detector technology to the needs of a particular measurement problem. This book will be invaluable to PhD students in experimental nuclear physics and nuclear technology, as well as undergraduate students encountering projects based on radiation detection for the first time. Key Features Provides clear, concise descriptions of key detection techniques Describes detector types with "telescopic depth", so readers can go as deep as they wish Covers real-world applications including short case studies in industry

The investigation of the properties of condensed matter using experimental nuclear methods is becoming increasingly important. An extremely broad range of techniques is used, including the use of particles, such as positrons and neutrons, ion beams, and the detection of radiation from nuclear decays or nuclear reactions. Nuclear Condensed Matter Physics: Nuclear Methods and Applications is the only book to provide a comprehensive coverage of the nuclear methods used to study the properties of condensed matter. It covers all the key techniques, including the Mossbauer effect, perturbed angular correlation, muon spin rotation, neutron scattering, positron annihilation, nuclear magnetic resonance and ion beam analysis. Numerous examples are given throughout the text to illustrate how each of the experimental methods is used in modern condensed matter physics, and practical details concerning instrumentation are included to help the reader apply each method. Nuclear Condensed Matter Physics: Nuclear Methods and Applications is an invaluable textbook for graduate students of condensed matter physics and chemistry, and is of great interest to those studying materials science and applied nuclear physics. It is also a key reference source for more experienced researchers in these and related fields, including nuclear and condensed matter physicists and solid state and inorganic chemists.