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Axions

Theory, Cosmology, and Experimental Searches

Springer Science & Business Media Axions are peculiar hypothetical particles that could both solve the CP problem of quantum chromodynamics and at the same time account for the dark matter of the universe. Based on a series of lectures by world experts in this field held at CERN (Geneva), this volume provides a pedagogical introduction to the theory, cosmology and astrophysics of these fascinating particles and gives an up-to-date account of the status and prospect of ongoing and planned experimental searches.

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Low Temperature Materials and Mechanisms

CRC Press This book addresses the growing interest in low temperature technologies. Since the subject of low temperature materials and mechanisms is multidisciplinary, the chapters reflect the broadest possible perspective of the field. Leading experts in the specific subject area address the various related science and engineering chemistry, material science, electrical engineering, mechanical engineering, metallurgy, and physics.

Gauge Theories of the Strong, Weak, and Electromagnetic Interactions

Second Edition

Princeton University Press This completely revised and updated graduate-level textbook is an ideal introduction to gauge theories and their applications to high-energy particle physics, and takes an in-depth look at two new laws of nature--quantum chromodynamics and the electroweak theory. From quantum electrodynamics through unified theories of the interactions among leptons and quarks, Chris Quigg examines the logic and structure behind gauge theories and the experimental underpinnings of today's theories. Quigg emphasizes how we know what we know, and in the era of the Large Hadron Collider, his insightful survey of the standard model and the next great questions for particle physics makes for compelling reading. The brand-new edition shows how the electroweak theory developed in conversation with experiment. Featuring a wide-ranging treatment of electroweak symmetry breaking, the physics of the Higgs boson, and the importance of the 1-TeV scale, the book moves beyond established knowledge and investigates the path toward unified theories of strong, weak, and electromagnetic interactions. Explicit calculations and diverse exercises allow readers to derive the consequences of these theories. Extensive annotated bibliographies accompany each chapter, amplify points of conceptual or technical interest, introduce further applications, and lead readers to the research literature. Students and seasoned practitioners will profit from the text's current insights, and specialists wishing to understand gauge theories will find the book an ideal reference for self-study. Brand-new edition of a landmark text introducing gauge theories Consistent attention to how we know what we know Explicit calculations develop concepts and engage with experiment Interesting and diverse problems sharpen skills and ideas Extensive annotated bibliographies

Particle Dark Matter

Observations, Models and Searches

Cambridge University Press Describes the dark matter problem in particle physics, astrophysics and cosmology for graduate students and researchers.

Particles, Strings and Cosmology

11th International Symposium on Particles, Strings and Cosmology; PASCOS 2005

Springer Science & Business Media PASCOS is an interdisciplinary symposium on the interface of of Particle physics, String theory and Cosmology. Over the past two decades these three disciplines have increasingly become closer. Historically there was always a strong overlap between particle physics and cosmology. This connection has become even stronger with the realization that some of the fundamental issues in cosmology such as the presence of dark matter and dark energy may possibly find a resolution only via new theories of particle physics. At the same time string theory has begun to play an increasingly important role in particle physics as a possible framework for building unified models of particle interaction including gravity. In recent years we have seen an increasing overlap

between cosmology and string theory and currently the area of string cosmology is one of the most active fields of research. PASCOS 2005 aimed to provide coherent discussions of recent developments on the interface of the three disciplines and also on their interconnections. In particular, superstring aspects in low energy particle theory (SUSY) and cosmological applications (moduli stabilization) are extensively covered in this volume. Topics include dark matter and dark energy, baryogenesis, flavor and CP violation, neutrino physics, supersymmetry and extra dimensions, flux compactification, string model building, as well as brane cosmology.

Cosmological Probes of Light Relics

Springer Nature The wealth of recent cosmic microwave background and large-scale structure data has transformed the field of cosmology. These observations have not only become precise enough to answer questions about the universe on the largest scales, but also to address puzzles in the microscopic description of Nature. This thesis investigates new ways of probing the early universe, the properties of neutrinos and the possible existence of other light particles. In particular, based on detailed theoretical insights and novel analyses, new evidence for the cosmic neutrino background is found in the distribution of galaxies and in cosmic microwave background data. This tests the Standard Model of particle physics and the universe back to a time when it was about one second old. Furthermore, it is demonstrated that future observations will be capable of probing physics beyond the Standard Model since they can achieve a particular target which would either allow the detection of any light particles that have ever been in thermal equilibrium or imply strong bounds on their properties.

Chirality, Magnetism and Magnetoelectricity

Separate Phenomena and Joint Effects in Metamaterial Structures

Springer Nature This book discusses theoretical and experimental advances in metamaterial structures, which are of fundamental importance to many applications in microwave and optical-wave physics and materials science. Metamaterial structures exhibit time-reversal and space-inversion symmetry breaking due to the effects of magnetism and chirality. The book addresses the characteristic properties of various symmetry breaking processes by studying field-matter interaction with use of conventional electromagnetic waves and novel types of engineered fields: twisted-photon fields, toroidal fields, and magnetoelectric fields. In a system with a combined effect of simultaneous breaking of space and time inversion symmetries, one observes the magnetochiral effect. Another similar phenomenon featuring space-time inversion symmetries is related to use of magnetoelectric materials. Cross-coupling of the electric and magnetic components in these material structures, leading to the appearance of new magnetic modes with an electric excitation channel - electromagnons and skyrmions - has resulted in a wealth of strong optical effects such as directional dichroism, magnetochiral dichroism, and rotatory power of the fields. This book contains multifaceted contributions from international leading experts and covers the essential aspects of symmetry-breaking effects, including theory, modeling and design, proven and potential applications in practical devices, fabrication, characterization and measurement. It is ideally suited as an introduction and basic reference work for researchers and graduate students entering this field.

C-AD Experiments, 2000-2004

Stars as Laboratories for Fundamental Physics

The Astrophysics of Neutrinos, Axions, and Other Weakly Interacting Particles

University of Chicago Press Much of what we know about neutrinos is revealed by astronomical observations, and the same applies to the axion, a conjectured new particle that is a favored candidate for the main component of the dark matter of the universe.

Literature 1988, Part 2

Springer Science & Business Media From the reviews: "Astronomy and Astrophysics Abstracts has appeared in semi-annual volumes since 1969 and it has already become one of the fundamental publications in the fields of astronomy, astrophysics and neighbouring sciences. It is the most important English-language abstracting journal in the mentioned branches. ...The abstracts are classified under more than a hundred subject categories, thus permitting a quick survey of the whole extended material. The AAA is a valuable and important publication for all students and scientists working in the fields of astronomy and related sciences. As such it represents a necessary ingredient of any astronomical library all over the world." Space Science Reviews#1 "Dividing the whole field plus related subjects into 108 categories, each work is numbered and most are accompanied by brief abstracts. Fairly comprehensive cross-referencing links relevant papers to more than one category, and exhaustive author and subject indices are to be found at the back, making the catalogues easy to use. The series appears to be so complete in its coverage and always less than a year out of date that I shall certainly have to make a little more space on those shelves for future volumes." The Observatory Magazine#2

Neutrino Mass

Springer Science & Business Media Reviews the current state of knowledge of neutrino masses and the related question of neutrino oscillations. After an overview of the theory of neutrino masses and mixings, detailed accounts are given of the laboratory limits on neutrino masses, astrophysical and cosmological constraints on those masses, experimental results on neutrino oscillations, the theoretical interpretation of those results, and theoretical models of neutrino masses and mixings. The book concludes with an examination of the potential of long-baseline experiments. This is an essential reference text for workers in elementary-particle physics, nuclear physics, and astrophysics.

Signatures of the Artist

The Vital Imperfections That Make Our Universe Habitable

Oxford University Press How does the scientific enterprise really work to illuminate the origins of life and the universe itself? The quest to understand our universe, how it may have originated and evolved, and especially the conditions that allow it to support the existence of life forms, has been a central theme in religion for millennia and in science for centuries. In the past half-century, in particular, enormous progress in particle and nuclear physics and cosmology has clarified the essential role of imperfections - deviations from perfect symmetry or homogeneity or predictability - in establishing conditions that allow for structure in the universe that can support the development of life. Many of these deviations are tiny and seem mysteriously fine-tuned to allow for life. The goal of this book is to review the recent and ongoing scientific research exploring these imperfections, in a broad-ranging, non-mathematical approach with an emphasis on the intricate tapestry of elegant experiments that bear on the conditions for habitability in our universe. This book makes clear what we know and how we know it, as distinct from what we speculate and how we might test it. At the same time, it attempts to convey a sense of wonderment at the tuning of these imperfections and of the rapid rate at which the boundary between knowledge and speculation is currently shifting.

Encyclopedia Of Cosmology, The (In 4 Volumes)

World Scientific The Encyclopedia of Cosmology, in four volumes, is a major, long-lasting, seminal reference at the graduate student level, laid out by the most prominent, respected researchers in the general field of Cosmology. These volumes will be a comprehensive review of the most important concepts and current status in the field, covering both theory and observation. One of the attractive features of the encyclopedia is that it is accompanied by supplementary materials including videos and simulations of the numerical computation. This will help the readers to better understand and visualize the concepts discussed. This encyclopedia is edited by Dr. Giovanni Fazio from Harvard Smithsonian Center for Astrophysics, with an advisory board comprised of renowned scientists: Lars Hernquist and Abraham Loeb (Harvard Smithsonian Center for Astrophysics), and Christopher McKee (UC Berkeley). Each volume is authored/edited by a specialist in the area: Galaxy Formation and Evolution written by Rennan Barkana (Tel Aviv University), Numerical Simulations in Cosmology edited by Kentaro Nagamine (Osaka University / University of Nevada), Dark Energy written by Shinji Tsujikawa (Tokyo University of Science), and Dark Matter written by Jihn E Kim (Seoul National University).

Trends In Astroparticle Physics - Proceedings Of The Ucla International Conference

World Scientific

AGS Experiments ...

Manipulating Quantum Systems

An Assessment of Atomic, Molecular, and Optical Physics in the United States

National Academies Press The field of atomic, molecular, and optical (AMO) science underpins many technologies and continues to progress at an exciting pace for both scientific discoveries and technological innovations. AMO physics studies the fundamental building blocks of functioning matter to help advance the understanding of the universe. It is a foundational discipline within the physical sciences, relating to atoms and their constituents, to molecules, and to light at the quantum level. AMO physics combines fundamental research with practical application, coupling fundamental scientific discovery to rapidly evolving technological advances, innovation and commercialization. Due to the wide-reaching intellectual, societal, and economical impact of AMO, it is important to review recent advances and future opportunities in AMO physics. Manipulating Quantum Systems: An Assessment of Atomic, Molecular, and Optical Physics in the United States assesses opportunities in AMO science and technology over the coming decade. Key topics in this report include tools made of light; emerging phenomena from few- to many-body systems; the foundations of quantum information science and technologies; quantum dynamics in the time and frequency domains; precision and the nature of the universe, and the broader impact of AMO science.

Dark Matter in Cosmology, Quantum Measurement, Experimental Gravitation

Proceedings of the XXXIst Rencontre de Moriond, Les Arcs, Savoie, France, January 20-27, 1996

Atlantica Séguier Frontières

New Scientist

New Scientist magazine was launched in 1956 "for all those men and women who are interested in scientific discovery, and in its industrial, commercial and social consequences". The brand's mission is no different today - for its consumers, New Scientist reports, explores and interprets the results of human endeavour set in the context of society and culture.

Astronomy and Astrophysics Abstracts

Volume 42 Literature 1986, Part 2

Springer Science & Business Media From the reviews: Astronomy and Astrophysics Abstracts has appeared in semi-annual volumes since 1969 and it has already become one of the fundamental publications in the fields of astronomy, astrophysics and neighbouring sciences. It is the most important English-language abstracting journal in the mentioned branches. ... The abstracts are classified under more than hundred subject categories, thus permitting a quick survey of the whole extended material. The AAA is a valuable and important publication for all students and scientists working in the fields of astronomy and related sciences. As such it represents a necessary ingredient of any astronomical library all over the world." Space Science Reviews #1 "Dividing the whole field plus related subjects into 108 categories, each work is numbered and most are accompanied by brief abstracts. Fairly comprehensive cross-referencing links relevant papers to more than one category, and exhaustive author and subject indices are to be found at the back, making the catalogues easy to use. The series appears to be so complete in its coverage and always less than a year out of date that I shall certainly have to make a little more space on those shelves for future volumes." The Observatory Magazine #1

Flavor Physics For The Millennium (Tasi 2000) - Proceedings Of The Theoretical Advanced Study Institute In Elementary Particle Physics

World Scientific This book is devoted to the broad subject of flavor physics, embracing the question of what distinguishes one type of elementary particles from another. The articles range from the forefront of formal theory (treating the physics of extra dimensions) to details of particle detectors. Although special emphasis is placed on the physics of kaons, charmed and beauty particles, top quarks, and neutrinos, the articles also dealing with electroweak physics, quantum chromodynamics, supersymmetry, and dynamical electroweak symmetry breaking. Violations of fundamental symmetries such as time reversal invariance are discussed in the context of neutral kaons, beauty particles, electric dipole moments, and parity violation in atoms. The physics of the Cabibbo-Kobayashi-Maskawa matrix and of quark masses are described in some detail, both from the standpoint of present and future experimental knowledge and from a more fundamental viewpoint, where physicists are still searching for the correct theory.

Cosmology and the Evolution of the Universe

ABC-CLIO This volume in the Greenwood Guides to the Universe series covers the current scientific understanding of the creation and evolution of the universe. • Thematic chapters enhance understanding of the broad concepts presented • 66 illustrations make it easier for students to grasp the subjects discussed • A glossary of scientific and astrology-related terms facilitates reading and understanding • A bibliography of useful resources puts readers on the right track to learn more about the subjects discussed

Identification Of Dark Matter, The - Proceedings Of The Second International Workshop

World Scientific There is general agreement among astrophysicists that most of the matter in the universe is dark, but a wide divergence of views about what this dark matter is. This volume addresses the problem of detecting and identifying dark matter candidates from axions to black holes. Although theoretical issues are considered, the focus of the book is on observational and experimental techniques, current results and future prospects.

Particle Physics And Cosmology - Proceedings Of The Ninth Lake Louise Winter Institute

World Scientific This volume explores the recent trends in particle physics and cosmology. The invited lecturers include D Caldwell, A Linde, A B MacDonald, J Peebles, K Rolfs and D Schramm.

From the Fermi Scale to Cosmology

Frontiers Media SA

The Dark Side of the Universe

Experimental Efforts and Theoretical Framework

World Scientific The search for dark matter is one of the most relevant topics in astroparticle physics today. It involves many different experimental techniques that should collectively contribute significantly to the identification of the nature and characteristics of the dark matter constituents, offering at the same time much room for new technological developments. The theoretical framework is also essential, both for properly interpreting the different results and for suggesting the most interesting possible candidates and search strategies. This book compares the methods, the developments and the results. Contents: Astrophysics Baryonic DM Searches Experiments Neutrinos Axions Theory Search at Accelerators Low Radioactivity Techniques WIMPS Direct Searches WIMPS Indirect Searches Readership: Astrophysicists and high energy physicists. keywords:

Particles, Strings and Cosmology (PASCOS 99)

World Scientific The PASCOS (International Symposium on Particles, Strings and Cosmology) series brings together the leading experts and most active young researchers in the closely related fields of elementary particle physics, string theory and cosmology/astrophysics. These areas of research have become increasingly intertwined in recent years, each having direct impact on the others. In particular, there has been a dramatic expansion of ideas from particle theory and string theory that have vast impact on cosmology, especially our picture of the early universe and its evolution. Correspondingly, the proliferation of data regarding the early universe, and its increasing precision, has begun to strongly constrain the theoretical models. Meanwhile, observations of neutrino oscillations and cosmic ray excesses, and limits on new physics from colliders and other particle experiments, as well as the resulting restrictions on theoretical and phenomenological modeling, are becoming ever stronger. During PASCOS99, it became clear that the long-awaited era of convergence of these fields is truly at hand. The proceedings of PASCOS 99 reflect the accelerating overlap and convergence of the fields of elementary particles physics, string theory and cosmology/astrophysics. Plenary reviews by leading figures in these fields provide perspectives on these interrelationships and up-to-the-minute summaries of recent progress in the various areas. Parallel talk summaries focus on many of the topics within each field of greatest current interest and activity. Both the plenary and parallel writeups are designed to be descriptive in nature and avoid being overly technical. As a result, the volume can serve as a useful reference for students and professionals in all three fields. Careful referencing allows further pursuit of a given topic. Overall, the proceedings are unique in that they not only bring together in a single volume comprehensive overview of the great progress being made in all three of these very exciting fields, but also provide a snapshot of how particles, strings and cosmology are increasingly impacting one another. Contents: Strings, Branes and Theoretical Particle Physics Early Universe Physics: Particles and Large Scale Structure Neutrinos, Dark Matter, Cosmic Rays, Gamma Ray Bursts Particle Accelerator Experiment Readership: Graduate students and researchers in high energy physics, cosmology and astrophysics. Keywords: Particle; String; PASCOS; Cosmology; Astrophysics

Encyclopedia of Astronomy & Astrophysics

CRC Press In a unique collaboration, Nature Publishing Group and Institute of Physics Publishing have published the most extensive and comprehensive reference work in astronomy and astrophysics. This unique resource covers the entire field of astronomy and astrophysics and this online version includes the full text of over 2,750 articles, plus sophisticated search and retrieval functionality and links to the primary literature. The Encyclopaedia's authority is assured by editorial and advisory boards drawn from the world's foremost astronomers and astrophysicists. This first class resource is an essential source of information for undergraduates, graduate students, researchers and seasoned professionals, as well as for committed amateurs, librarians and lay people wishing to consult the definitive astronomy and astrophysics reference work.

Flavor Physics for the Millennium

TASI 2000 : Boulder, Colorado, US, 4-30 June 2000

World Scientific This book is devoted to the broad subject of flavor physics, embracing the question of what distinguishes one type of elementary particles from another. The articles range from the forefront of formal theory (treating the physics of extra dimensions) to details of particle detectors. Although special emphasis is placed on the physics of kaons, charmed and beauty particles, top quarks, and neutrinos, the articles also dealing with electroweak physics, quantum chromodynamics, supersymmetry, and dynamical electroweak symmetry breaking. Violations of fundamental symmetries such as time reversal invariance are discussed in the context of neutral kaons, beauty particles, electric dipole moments, and parity violation in atoms. The physics of the Cabibbo-Kobayashi-Maskawa matrix and of quark masses are described in some detail, both from the standpoint of present and future experimental knowledge and from a more fundamental viewpoint, where physicists are still searching for the correct theory.

Proceedings of the 6th International Workshop on the Identification of Dark Matter

Rhodes, Greece, 11-16 September 2006

World Scientific This volume is the latest in a prominent biannual series of scientific meetings on the exciting research topics of dark matter and, more recently, of dark energy. It contains a state-of-the-art update on detection efforts by experimental groups around the world trying to pin down exotic new forms of matter under the names of axions, neutralinos, wimps, primordial black holes, q balls, sterile neutrinos, as well as a tantalizing new form of dark energy component called phantom energy and quintessence. The book is self-contained as it also includes general reviews on recent cosmological observations OCo supernovae measurements, cosmic matter distribution surveys and cosmic radiation anisotropies OCo introducing even the uninitiated reader to this fascinating frontier of research."

Neutrino Cosmology

Cambridge University Press A self-contained guide to the role played by neutrinos in the Universe and how their properties influence cosmological and astrophysical observations.

Astronomy, Cosmology and Fundamental Physics

Proceedings of the Third ESO-CERN Symposium, Held in Bologna, Palazzo Re Enzo, May 16–20, 1988

Springer Science & Business Media In the development of Fundamental Physics on one side, and of Astronomy/Cosmology on the other side, periods of parallel, relatively independent progress seem to alternate with others of intense interaction and mutual influence. To this latter case belong the very beginnings of Modern Physics, with Galileo and Newton. There is now a widespread feeling that another of such flourishing periods may have started some ten years ago, with the advent of Unified Theories and the introduction of Inflationary Cosmologies. The interaction between the two disciplines has become tighter ever since, spurring studies of e. g. astronomical and particle Dark Matter candidates, Superstrings and Cosmic Strings, phase transitions in the Early Universe, etc. etc. Then the recent birth of Neutrino Astronomy has added further flavor to this splendid conjunction. It was indeed with the clear perception of this trend that six years ago CERN and ESO decided to jointly organize a series of symposia focusing on the interactions between Astronomy, Cosmology, and Fundamental Physics, to be held about every two years. The aim of these meetings is to bring together astronomers, cosmologists, and particle physicists to exchange information, to discuss scientific issues of common interest, and to take note of the latest developments in each discipline that are relevant to the other. The First ESO-CERN Symposium was held at CERN (Geneva) on November 21-25, 1983. Then for its Second edition the ESO-CERN Symposium moved to Garching bei Miinchen, where ESO headquarters are located, and took place on March 17-21, 1986.

An Assessment of the Science Proposed for the Deep Underground Science and Engineering Laboratory (DUSEL)

National Academies Press According to the big bang theory, our Universe began in a state of unimaginably high energy and density, contained in a space of subatomic dimensions. At that time, unlike today, the fundamental forces of nature were presumably unified and the particles present were interacting at energies not attainable by present-day accelerators. Underground laboratories provide the conditions to investigate processes involving rare phenomena in matter and to detect the weak effects of highly elusive particles by replicating similar environments to those once harnessed during the earliest states of the Earth. These laboratories now appear to be the gateway to understanding the physics of the grand unification of the forces of nature. Built to shield extremely sensitive detectors from the noise of their surroundings and the signals associated with cosmic rays, underground facilities have been established during the last 30 years at a number of sites worldwide. To date, the United States' efforts to develop such facilities have been modest and consist primarily of small underground laboratories. However, the U.S. underground community has pushed for larger underground facilities on the scale of major laboratories in other countries. An Assessment of the Deep Underground Science and Engineering Laboratory (DUSEL) addresses this matter by evaluating the major physics questions and experiments that could be explored with the proposed DUSEL. Measuring the potential impact, this assessment also examines the broader effects of the DUSEL in regards to education and public outreach, and evaluates the need associated with developing U.S. programs similar to science programs in other regions of the world.

Non-Accelerator Astroparticle Physics

World Scientific This comprehensive volume of articles from the seventh school on non-accelerator astroparticle physics presents a timely coverage of this interesting and rapidly expanding subject. The contributions enlarge and complement the earlier volumes prepared for the fourth, fifth and sixth schools. An informative, pedagogical approach has been maintained so that the book can serve as the basis for a modern course on the subject. The first section introduces the fundamentals of particle physics with a review of the standard model and beyond. The comprehensive section on neutrino physics and astrophysics covers neutrino masses and oscillations, short and long baseline neutrino experiments, atmospheric and solar neutrinos, and neutrino telescopes. The section on dark matter includes a theoretical presentation and a review of existing and potential dark matter searches. Searches for axions, magnetic monopoles, and nuclearites are also discussed. Cosmic rays and astrophysics are covered with reviews on experiments in space, extreme energy cosmic rays, and photons and antimatter in space. The theory of gravitational waves and searches for gravitational waves are considered. A section deals with the LEP legacy and future accelerators and superbeams. Large scale facilities, detectors, data acquisition and large scale computing are reviewed. The volume concludes with an in-depth look at the impact of science on the world with essays looking back on the past century of scientific progress and its effects on society. Contents: Fundamentals of Particle Interactions:Standard Model and Beyond (A Bartl & S Hesselbach)Neutrinos:Neutrino Masses, Mixing and Oscillations (S Petcov)Short and Long Baseline Neutrino Experiments (D Autiero)Atmospheric Neutrino Oscillations (G Giacomelli & M Giorgini)Solar and Reactor Neutrinos (D F Cowen)Neutrino Astronomy (J Carr)Dark Matter:Dark Matter and Dark Energy (P Ullio)Dark Matter Searches (R Bernabei)Axion Searches (K Zioutas)Magnetic Monopole Searches (G Giacomelli & L Patrizii)Cosmic Rays and Astrophysics:Cosmic Rays at Extreme Energies (R Cester)Photons and Antimatter in Space (G Barbiellini & F Longo)Astroparticle Physics from Space (S Cecchini)Gravitational Waves:Theory of Gravitational Waves (J C Miller)Gravitational Waves and Their Detection (E Coccia)Accelerator-Based Physics:The LEP Legacy (G Giacomelli & R Giacomelli)Future Accelerators, Neutrino Factories, and Muon Colliders (R A Carrigan, Jr)Large Scale Facilities:Detectors and Data Acquisition (D F Cowen)Large Scale Computing (P Capiluppi)The World of Science:Science, Technology and Society (G Giacomelli & R Giacomelli)The Universe: Today, Yesterday and Tomorrow (T Regge)One Hundred Years of Science (R A Carrigan, Jr) Readership: Advanced undergraduate and graduate students and professionals in high energy physics, astrophysics, astronomy and cosmology. Keywords:Neutrino Oscillations;Dark Matter;Cosmic Rays;Gravitational Waves and LEP LegacyKey Features:Contains comprehensive reviews of neutrino oscillations and masses, dark matter and dark matter searches, gravitational wave searches, and the world of science

Particle Dark Matter

Observations, Models and Searches

Cambridge University Press Dark matter is among the most important open problems in modern physics. Aimed at graduate students and researchers, this book describes the theoretical and experimental aspects of the dark matter problem in particle physics, astrophysics and cosmology. Featuring contributions from 48 leading theorists and experimentalists, it presents many aspects, from astrophysical observations to particle physics candidates, and from the prospects for detection at colliders to direct and indirect searches. The book introduces observational evidence for dark matter along with a detailed discussion of the state-of-the-art of numerical simulations and alternative explanations in terms of modified gravity. It then moves on to the candidates arising from theories beyond the Standard Model of particle physics, and to the prospects for detection at accelerators. It concludes by looking at direct and indirect dark matter searches, and the prospects for detecting the particle nature of dark matter with astrophysical experiments.

The Identification of Dark Matter

World Scientific The objective of the workshop series "The Identification of Dark Matter" is to assess critically the status of work attempting to identify what constitutes dark matter; in particular, to consider what techniques are currently being used, how successful they are, and what new techniques are likely to improve the prospects for identifying dark matter candidates in the future. This proceedings volume includes reviews on major particle astrophysics topics in the field of dark matter, as well as short contributed papers. Contents: Dark Matter in the Universe – Theory and Observation: The Early Universe, Nucleosynthesis and Cosmology Cosmic Microwave Background Radiation Large Scale Structure Halos, Halo Models, and Dark Matter Particle Physics and Supersymmetry Baryonic Searches: Introduction to Baryonic Dark Matter Searches Direct Observational Evidence for Baryonic Dark Matter Microlensing Evidence for Dark Matter Next Generation Astronomical Searches Non-Baryonic Searches: Introduction to Non-Baryonic Dark Matter Searches WIMP Detectors WIMP Detectors with Directional Sensitivity and Future Prospects Axion Detectors WIMP Detection by Indirect Techniques Neutrino Dark Matter Searches Next Generation Neutrino, WIMP and Axion Techniques Implications for Astrophysical Neutrino Detection Readership: Researchers and academics/lecturers in astrophysics and high energy physics. Keywords: Dark Matter; Particle Astrophysics; Nucleosynthesis; Cosmology; Halos; Particle Physics; Supersymmetry; Detectors; Neutrino

New Era For CP Asymmetries: Axions And Rare Decays Of Hadrons And Leptons

World Scientific This book is dedicated to Lev Okun, who passed away in November 2015. He was a true pioneer in probing fundamental dynamics. The book has two objectives. First is to showcase Okun's impact for decades since 1963, when he published his remarkable book Weak Interaction of Elementary Particles. Second is to present the current progress of our scientific community in the studies of our Universe. New directions and possible future developments are discussed, often using the past as a guide. The authors mostly focus on CP asymmetries in the transitions of hadrons and leptons, but they also discuss their rare decays, and talk about axions and supersymmetry, and possible connections with dark matter, extra dimensions, baryogenesis and multiverse. This book is suitable for readers who know quantum mechanics and quantum field theories in general.

Supersymmetric Grand Unified Theories

From Quarks to Strings via SUSY GUTs

Springer These course-tested lectures provide a technical introduction to Supersymmetric Grand Unified Theories (SUSY GUTs), as well as a personal view on the topic by one of the pioneers in the field. While the Standard Model of Particle Physics is incredibly successful in describing the known universe it is, nevertheless, an incomplete theory with many free parameters and open issues. An elegant solution to all of these quandaries is the proposed theory of SUSY GUTs. In a GUT, quarks and leptons are related in a simple way by the unifying symmetry and their electric charges are quantized, further the relative strength of the strong, weak and electromagnetic forces are predicted. SUSY GUTs additionally provide a framework for understanding particle masses and offer candidates for dark matter. Finally, with the extension of SUSY GUTs to string theory, a quantum-mechanically consistent unification of the four known forces (including gravity) is obtained. The book is organized in three sections: the first section contains a brief introduction to the Standard Model, supersymmetry and the Minimal Supersymmetric Standard Model. Then SUSY GUTs in four space-time dimensions are introduced and reviewed. In addition, the cosmological issues concerning SUSY GUTs are discussed. Then the requirements for embedding a 4D SUSY GUT into higher-dimensional theories including gravity (i.e. String Theory) are investigated. Accordingly, section two of the course is devoted to discussing the so-called Orbifold GUTs and how in turn they solve some of the technical problems of 4D SUSY GUTs. Orbifold GUTs introduce a new set of open issues, which are then resolved in the third section in which it is shown how to embed Orbifold GUTs into the $E(8) \times E(8)$ Heterotic String in 10 space-time dimensions.

Literature 1988, Part 1

Springer Science & Business Media From the reviews: "Astronomy and Astrophysics Abstracts has appeared in semi-annual volumes since 1969 and it has already become one of the fundamental publications in the fields of astronomy, astrophysics and neighbouring sciences. It is the most important English-language abstracting journal in the mentioned branches. ...The abstracts are classified under more than a hundred subject categories, thus permitting a quick survey of the whole extended material. The AAA is a valuable and important publication for all students and scientists working in the fields of astronomy and related sciences. As such it represents a necessary ingredient of any astronomical library all over the world." Space Science Reviews#1 "Dividing the whole field plus related subjects into 108 categories, each work is numbered and most are accompanied by brief abstracts. Fairly comprehensive cross-referencing links relevant papers to more than one category, and exhaustive author and subject indices are to be found at the back, making the catalogues easy to use. The series appears to be so complete in its coverage and always less than a year out of date that I shall certainly have to make a little more space on those shelves for future volumes." The Observatory Magazine#2

Astroparticle Physics - Proceedings Of The International School

World Scientific This volume contains papers presented at the Japan-Singapore joint seminar on Parallel Programming Systems sponsored by the Japan Society for the Promotion of Science. The papers cover recent research in Japan and Singapore on hardware systems and language processors for processing parallel programs. The areas discussed include dataflow machines, parallel functional and imperative languages, and parallel application algorithms.