Cosmic Rays And Particle Physics

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Particles and Astrophysics Maurizio Spurio 2014-10-06 This book is an introduction to “multi-messenger” astrophysics. It covers the many different aspects connecting particle physics with astrophysics and cosmology and introduces astrophysics using numerous experimental findings recently obtained through the study of high-energy particles. Taking a systematic approach, it comprehensively presents experimental aspects from the most advanced laboratories and detectors, as well as the theoretical background. The book is aimed at graduate students and post-graduate researchers with a basic understanding of particle and nuclear physics. It will also be of interest to particle physicists working in accelerator/collider physics who are keen to understand the mechanisms of the largest accelerators in the Universe. The book draws on the extensive lecturing experience of Professor Maurizio Spurio from the University of Bologna.
Introduction To Ultrahigh Energy Cosmic Ray Physics Pierre Sokolsky 2018-03-08 Cosmic ray physics has recently attracted a great deal of attention from the high energy physics community because of the discovery of new sources and the advent of new techniques. The result of a series of lectures prepared for graduate students and postdoctoral

researchers, this book is a general introduction to experimental techniques and results in the field of ultrahigh energy cosmic rays. It succinctly summarizes the rapidly developing field, and provides modern results that include data from newer detectors. Combining experiment and theory, the text explores the results of a single, easy-to-understand experiment to tie together various issues involved in the physics of ultrahigh energy cosmic rays.

Cosmic Rays in the Earth's Atmosphere and Underground Lev I. Dorman 2004-08-24 The present monograph as well as the next one (Dorman, M2005) is a result of more than 50 years working in cosmic ray (CR) research. After graduation in December 1950 Moscow Lomonosov State University (Nuclear and Elementary Particle Physics Division, the Team of Theoretical Physics), my supervisor Professor D. I. Blokhintsev planned for me, as a winner of a Red Diploma, to continue my education as an aspirant (a graduate student) to prepare for Ph. D. in his very secret Object in the framework of what was in those time called the Atomic Problem. To my regret the KGB withheld permission, and I, together with other Jewish students who had graduated Nuclear Divisions of Moscow and Leningrad Universities and Institutes, were faced with a real prospect of being without any work. It was our good fortune that at that time there was being brought into being the new Cosmic Ray Project (what at that time was also very secret, but not as secret as the Atomic Problem), and after some time we were directed to work on this Project. It was organized and headed by Prof. S. N. Vernov (President of All-Union Section of Cosmic Rays) and Prof. N. V. Pushkov (Director of IZMIRAN); Prof. E. L. Feinberg headed the theoretical part of the Project.

Cosmic Ray Physics Veronica Bindi 2023-03-09 This book introduces you to the physics of cosmic rays, charged particles which reach us from known - and maybe unknown - sources in the cosmos. Starting from a brief history of this fascinating field, it reviews what we know about the creation of elements in the Big Bang and inside stars. It explains cosmic accelerators reaching fabulous energies. It follows the life cycle of cosmic rays all the way from their sources to detection near, on or below Earth. The central three chapters cover what we know about them at the level of the solar system, the Milky Way and the Universe at large. Up-to-date experimental results are presented in detail, showing how they are obtained and interpreted. The book provides an accessible overview of this lively and diversified research field. It will be of interest to undergraduate physics students beginning their studies on astronomy, cosmology, and particle physics. It is also accessible to the general public by concentrating mathematical and technical detail into Focus Boxes.

Introduction to Particle and Astroparticle Physics Alessandro De Angelis 2018-06-19 This book introduces particle physics, astrophysics and cosmology. Starting from an experimental perspective, it provides a unified view of these fields that reflects the very rapid advances being made. This new edition has a number of improvements and has been updated to describe the recent discovery of gravitational waves and astrophysical neutrinos, which started the new era of

multimessenger astrophysics; it also includes new results on the Higgs particle. Astroparticle and particle physics share a common problem: we still don’t have a description of the main ingredients of the Universe from the point of view of its energy budget. Addressing these fascinating issues, and offering a balanced introduction to particle and astroparticle physics that requires only a basic understanding of quantum and classical physics, this book is a valuable resource, particularly for advanced undergraduate students and for those embarking on graduate courses. It includes exercises that offer readers practical insights. It can be used equally well as a self-study book, a reference and a textbook.
The Birth of Particle Physics Laurie M. Brown 1986-10-31 A distinctive collection of essays, discussions, and personal descriptions of the evolution of particle physics.
High Energy Cosmic Rays Todor Stanev 2010-03-10 Offers an accessible text and reference (a cosmic-ray manual) for graduate students entering the field and high-energy astrophysicists will find this an accessible cosmic-ray manual Easy to read for the general astronomer, the first part describes the standard model of cosmic rays based on our understanding of modern particle physics. Presents the acceleration scenario in some detail in supernovae explosions as well as in the passage of cosmic rays through the Galaxy. Compares experimental data in the atmosphere as well as underground are compared with theoretical models
Experimental Techniques in Nuclear and Particle Physics Stefaan Tavernier 2010-02-06 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.
Solar Cosmic Rays L.I. Miroshnichenko 2013-06-29 It turned out to be really a rare and happy occasion that we know exact1y when and how a new branch of space physics was born, namely, a physics of solar cosmic rays. It happened on February 28 and March 7, 1942 when the fIrst "cosmic ray bursts" were recorded on the Earth, and the Sun was

unambiguously identifIed for the fIrst time as the source of high-velocity 10 particles with energies up to > 10 eV. Just due to such a high energy these relativistic particles have been called "solar cosmic rays" (SCR), in distinction from the "true" cosmic rays of galactic origin. Between 1942 and the beginning ofthe space era in 1957 only extremely high energy solar particle events could be occasionally recorded by cosmic ray ground-Ievel detectors and balloon borne sensors. Since then the detection techniques varied considerably and the study of SCR turned into essential part of solar and solar-terrestrial physics.

Black Holes & Cosmic Rays Dhruba Jyoti Gogoi 2018-01-10 This book contains three articles mainly in Physics. The first article contains introductory information about Muon, a particle which is generated in cosmic ray shower and available on the ground level. The second article is based on the Black Hole. In this article a very basic introduction to Black Holes including its types is given. The third article is a general science article in which you will get to know whether the theoretical physics is converging to an end or not. Hope you will like these articles.

Astroparticle Physics Claus Grupen 2020-01-27 Describes the branch of astronomy in which processes in the universe are investigated with experimental methods employed in particle-physics experiments. After a historical introduction the basics of elementary particles, Explains particle interactions and the relevant detection techniques, while modern aspects of astroparticle physics are described in a chapter on cosmology. Provides an orientation in the field of astroparticle physics that many beginners might seek and appreciate because the underlying physics fundamentals are presented with little mathematics, and the results are illustrated by many diagrams. Readers have a chance to enter this field of astronomy with a book that closes the gap between expert and popular level.

Particle and Astroparticle Physics Alessandro De Angelis 2021-05-27 This book presents more than 200 problems, with detailed guided solutions, spanning key areas of particle physics and astrophysics. The selected examples enable students to gain a deeper understanding of these fields and also offer valuable support in the preparation for written examinations. The book is an ideal companion to Introduction to Particle and Astroparticle Physics: Multimessenger Astronomy and its Particle Physics Foundations, written by Alessandro De Angelis and Mário Pimenta and published in its second edition in Springer’s Undergraduate Lecture Notes in Physics series in 2018. It can, however, also be used independently. The present book is organized into 11 chapters that match exactly those in the companion textbook, and each of the exercises is given a title to facilitate identification of the subject within that book. Some new exercises have been added because they are considered helpful on the basis of the experience gained by teachers while using the textbook. Beyond students on relevant courses, exercises and solutions in particle and astroparticle physics are of value

for physics teachers and to all who seek aid to self-training.
An Amateur's Guide to Particle Physics Zimmerman 2003-11
Cosmic Rays at Earth P.K.F. Grieder 2001-07-27 In 1912 Victor Franz Hess made the revolutionary discovery that ionizing radiation is incident upon the Earth from outer space. He showed with ground-based and balloon-borne detectors that the intensity of the radiation did not change significantly between day and night. Consequently, the sun could not be regarded as the sources of this radiation and the question of its origin remained unanswered. Today, almost one hundred years later the question of the origin of the cosmic radiation still remains a mystery. Hess' discovery has given an enormous impetus to large areas of science, in particular to physics, and has played a major role in the formation of our current understanding of universal evolution. For example, the development of new fields of research such as elementary particle physics, modern astrophysics and cosmology are direct consequences of this discovery. Over the years the field of cosmic ray research has evolved in various directions: Firstly, the field of particle physics that was initiated by the discovery of many so-called elementary particles in the cosmic radiation. There is a strong trend from the accelerator physics community to reenter the field of cosmic ray physics, now under the name of astroparticle physics. Secondly, an important branch of cosmic ray physics that has rapidly evolved in conjunction with space exploration concerns the low energy portion of the cosmic ray spectrum. Thirdly, the branch of research that is concerned with the origin, acceleration and propagation of the cosmic radiation represents a great challenge for astrophysics, astronomy and cosmology. Presently very popular fields of research have rapidly evolved, such as high-energy gamma ray and neutrino astronomy. In addition, high-energy neutrino astronomy may soon initiate as a likely spin-off neutrino tomography of the Earth and thus open a unique new branch of geophysical research of the interior of the Earth. Finally, of considerable interest are the biological and medical aspects of the cosmic radiation because of it ionizing character and the inevitable irradiation to which we are exposed. This book is a reference manual for researchers and students of cosmic ray physics and associated fields and phenomena. It is not intended to be a tutorial. However, the book contains an adequate amount of background materials that its content should be useful to a broad community of scientists and professionals. The present book contains chiefly a data collection in compact form that covers the cosmic radiation in the vicinity of the Earth, in the Earth's atmosphere, at sea level and underground. Included are predominantly experimental but also theoretical data. In addition the book contains related data, definitions and important relations. The aim of this book is to offer the reader in a single volume a readily available comprehensive set of data that will save him the need of frequent time consuming literature searches.
Nuclear and Particle Astrophysics México) Mexican School on Nuclear Astrophysics (1997 : Guanajuato 1998-08-13 What

is the Universe made of? How old is it? How does a supernova explode? Can we detect black holes? And where do cosmic rays originate? This volume provides a comprehensive and pedagogical introduction to modern ideas and challenging problems in nuclear and particle astrophysics. Based on a graduate school, specially written articles by eight leading experts cover a wealth of exciting topics, including the search for black holes, nucleosynthesis and neutrino transport in supernovae, the physics of neutron stars, massive neutrinos, cosmic ray physics and astrophysics, and physical cosmology. Together, they present the Universe as a laboratory for testing cutting-edge physics and bridge the gap between conference proceedings and specialised monographs. This volume provides an invaluable resource for graduate students and active researchers in nuclear and particle physics, astrophysics and cosmology.

Cosmic Ray Astrophysics Reinhard Schlickeiser 2013-03-14 In the first part, the book gives an up-to-date summary of the observational data. In the second part, it deals with the kinetic description of cosmic ray plasma. The underlying diffusion-convection transport equation, which governs the coupling between cosmic rays and the background plasma, is derived and analyzed in detail. In the third part, several applications of the solutions of the transport equation are presented and how key observations in cosmic ray physics can be accounted for is demonstrated.

Handbook of Particle Detection and Imaging Claus Grupen 2012-01-08 The handbook centers on detection techniques in the field of particle physics, medical imaging and related subjects. It is structured into three parts. The first one is dealing with basic ideas of particle detectors, followed by applications of these devices in high energy physics and other fields. In the last part the large field of medical imaging using similar detection techniques is described. The different chapters of the book are written by world experts in their field. Clear instructions on the detection techniques and principles in terms of relevant operation parameters for scientists and graduate students are given.Detailed tables and diagrams will make this a very useful handbook for the application of these techniques in many different fields like physics, medicine, biology and other areas of natural science.

Cosmic Rays and Particle Physics Thomas K. Gaisser 1991-01-25 Over recent years there has been marked growth in interest in the study of techniques of cosmic ray physics by astrophysicists and particle physicists. Cosmic radiation is important for the astrophysicist because in the farther reaches of the universe. For particle physicists, it provides the opportunity to study neutrinos and very high energy particles of galactic origin. More importantly, cosmic rays constitue the background, and in some cases possibly the signal, for the more exotic unconfirmed hypothesized particles such as monopoles and sparticles. Concentrating on the highest energy cosmic rays, this book describes where they originate, acquire energy, and interact, in accreting neutron stars, supernova remnants, in large-scale shock waves. It also describes their interactions in the atmosphere and in the earth, how they are studied in surface and very large

underground detectors, and what they tell us.
Cosmic Rays and Particle Physics Thomas K. Gaisser 1990
Astroparticle Physics Claus Grupen 2005-05-19 Describes the branch of astronomy in which processes in the universe are investigated with experimental methods employed in particle-physics experiments. After a historical introduction the basics of elementary particles, Explains particle interactions and the relevant detection techniques, while modern aspects of astroparticle physics are described in a chapter on cosmology. Provides an orientation in the field of astroparticle physics that many beginners might seek and appreciate because the underlying physics fundamentals are presented with little mathematics, and the results are illustrated by many diagrams. Readers have a chance to enter this field of astronomy with a book that closes the gap between expert and popular level.
Astroparticle Physics: Theory and Phenomenology Günter Sigl 2016-12-05 This books aims at giving an overview over theoretical and phenomenological aspects of particle astrophysics and particle cosmology. To be of interest for both students and researchers in neighboring fields of physics, it keeps a balance between well established foundations that will not significantly change in the future and a more in-depth treatment of selected subfields in which significant new developments have been taking place recently. These include high energy particle astrophysics, such as cosmic high energy neutrinos, the interplay between detection techniques of dark matter in the laboratory and in high energy cosmic radiation, axion-like particles, and relics of the early Universe such as primordial magnetic fields and gravitational waves. It also contains exercises and thus will be suitable for both introductory and advanced courses in astroparticle physics.
Astrophysics at Ultra-High Energies Maurice Mandel Shapiro 2007 This book introduces young researchers to the exciting field of ultra-high energy astrophysics including charged particles, gamma rays and neutrinos. At ultra-high energy the radiation is produced by interactions of cosmic ray particles accelerated in explosive events such as supernovae or hypernovae, black holes or, possibly, the big bang. Through direct contact with senior scientists, now actively planning the next generation of experiments/models, the excitement and motivation for research at ultra-high energy was conveyed. The underpinning of these fields is a synthesis of knowledge and techniques from nuclear and particle physics, astronomy and cosmology. Informing the participants of this background, how it was derived, and the new challenges for the future are the major goal. Further, the course has helped to foster new astrophysical research and promoted contacts, which have resulted in new collaborations. Sample Chapter(s). Chapter 1: Gamma-Ray Burst: Discoveries With Swift (352 KB). Contents: Powerful Astrophysical Sources: Gamma Ray Bursts: Discoveries with Swift (A Wells); Gamma Ray Burst Phenomenology in the Swift Era (P M(r)sziros); The Nature of Dark Matter (P L Biermann & F Munyaneza); Cosmic Rays: Particle Acceleration and Propagation in the Galaxy (V S Ptuskin); GRB as Sources of Ultra-High Energy Particles (P

M(r)sziros); The KASCADE-Grande Experiment (F Cossavela et al.); Gamma Ray and Neutrino Astronomy: Study of Galactic Gamma Ray Sources with Milagro (J Goodman); The GLAST Mission and Observability of Supernovae Remnants (O Tibolla); First Results from AMANDA using TWR System (A Silvestri); and other papers. Readership: Academics in astrophysics, high energy, cosmology and earth science."

Introduction to Particle and Astroparticle Physics Alessandro De Angelis 2015-11-17 This book, written by researchers who had been professionals in accelerator physics before becoming leaders of groups in astroparticle physics, introduces both fields in a balanced and elementary way, requiring only a basic knowledge of quantum mechanics on the part of the reader. The early history of particle physics cannot be distinguished from the history of cosmic rays. With the advent of accelerators, however, the importance of cosmic rays in particle physics was lost. This situation persisted until the 1990s, when novel techniques allowed breakthrough discoveries, and exploration of new physics scales now requires returning to cosmic rays. The new profile of scientists in fundamental physics ideally involves the merging of knowledge in astroparticle and particle physics, but the duration of modern experiments is such that people cannot simultaneously be practitioners in both. Introduction to Particle and Astroparticle Physics is designed to bridge the gap between the fields. It can be used as a self-training book, a consultation book, or a textbook providing a “modern” approach to particles and fundamental interactions.

Proceedings of International Symposium on Cosmic Rays and Particle Physics 1984

Cosmic Rays for Particle and Astroparticle Physics S. Giani 2011 The conference was aimed at promoting contacts between scientists involved in solar-terrestrial physics, space physics, astroparticle physics and cosmology both from the theoretical and the experimental approach. The conference was devoted to physics and physics requirements, survey of theoretical models and performances of detectors employed (or to be employed) in experiments for fundamental physics, astroparticle physics, astrophysics research and space environment - including Earth magnetosphere and heliosphere and solar-terrestrial physics. Furthermore, cosmic rays have been used to extent the scientific research experience to teachers and students with air shower arrays and other techniques. Presentations included the following subjects: advances in physics from present and next generation ground and space experiments, dark matter, double-beta decay, high-energy astrophysics, space environment, trapped particles, propagation of cosmic rays in the Earth atmosphere, Heliosphere, Galaxy and broader impact activities in cosmic rays science. The open and flexible format of the Conference was conducive to fruitful exchanges of points of view among participants and permitted the evaluation of the progresses made and indicated future research directions. The participants were experienced researchers but also graduate students

(MSc and PhD) and recent postdoctoral fellows.

Physics and Astrophysics of Ultra High Energy Cosmic Rays M. Lemoine 2001-12-14 The International School on Physics and Astrophysics of Ultra High Energy Cosmic Rays (UHECR2000) was held at the Observatoire de Paris–Meudon on June 26-29, 2000. This was the ?rst international school speci?cally dedicated to ultra high energy cosmic rays. Its aim was to familiarize with and attract students, physicists and astronomers into this quickly developing newresearch ?eld. The mysterious and currently unknown origin of the most energetic par- cles observed in Nature has triggered in recent years theoretical speculations ranging from electromagnetic acceleration to as yet undiscovered physics - yond the Standard Model. It has also lead to the development of several new detection concepts and experimental projects, some of which are currently - der construction. By its nature, the ?eld of ultra high energy cosmic rays is therefore highly interdisciplinary and borrows from astrophysics and cosmology, via particle physics, to experimental physics and observational astronomy. One main aspect of the school was to emphasize and take advantage of this interd- ciplinarity. The lectures were grouped into subtopics and are reproduced in this volume in the following order: After a general introductory lecture on cosmic rays follow two contributions on experimental detection techniques, followed by three lectures on acceleration in astrophysical objects. The next four contri- tions cover all major aspects of propagation and interactions of ultra high energy radiation, including speculative issues such as newinteractions.

Problems and Solutions in Nuclear and Particle Physics Sergio Petrera 2019-07-16 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. 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.

The Origin of Cosmic Rays V. L. Ginzburg 2013-10-22 The Origin of Cosmic Rays examines the astrophysical phenomena that cause cosmic rays. The title details the concerns in the study of tracing the sources of cosmic rays. The text presents the primary cosmic rays on earth, and then proceeds to tackling ling the cosmic magnetic bremsstrahlung radio emission and cosmic rays in the universe. Next, the selection deals with the motion of cosmic rays in the interstellar medium and the origin of cosmic rays. The text also talks about the quantitative galactic theory of the origin of cosmic

rays. The book will be of great use to astronomers, astrophysicists, and scientists who studies phenomena that involves celestial bodies.

Cosmic Rays and Particle Physics

Cosmic Rays and Particle Physics Thomas K. Gaisser 1990 Cambridge English Worldwide offers an exciting new approach for students from ten to sixteen.

Particle Physics Brian R. Martin 2017-01-17 An accessible and carefully structured introduction to Particle Physics, including important coverage of the Higgs Boson and recent progress in neutrino physics. Fourth edition of this successful title in the Manchester Physics series Includes information on recent key discoveries including: An account of the discovery of exotic hadrons, byond the simple quark model; Expanded treatments of neutrino physics and CP violation in B-decays; An updated account of ‘physics beyond the standard model’, including the interaction of particle physics with cosmology Additional problems in all chapters, with solutions to selected problems available on the book’s website Advanced material appears in optional starred sections

Nuclear and Particle Physics Brian R. Martin 2019-04-15 Updated and expanded edition of this well-known Physics textbook provides an excellent Undergraduate introduction to the field This new edition of Nuclear and Particle Physics continues the standards established by its predecessors, offering a comprehensive and highly readable overview of both the theoretical and experimental areas of these fields. The updated and expanded text covers a very wide range of topics in particle and nuclear physics, with an emphasis on the phenomenological approach to understanding experimental data. It is one of the few publications currently available that gives equal treatment to both fields, while remaining accessible to undergraduates. Early chapters cover basic concepts of nuclear and particle physics, before describing their respective phenomenologies and experimental methods. Later chapters interpret data through models and theories, such as the standard model of particle physics, and the liquid drop and shell models of nuclear physics, and also discuss many applications of both fields. The concluding two chapters deal with practical applications and outstanding issues, including extensions to the standard model, implications for particle astrophysics, improvements in medical imaging, and prospects for power production. There are a number of useful appendices. Other notable features include: New or expanded coverage of developments in relevant fields, such as the discovery of the Higgs boson, recent results in neutrino physics, research to test theories beyond the standard model (such as supersymmetry), and important technical advances, such as Penning traps used for high-precision measurements of nuclear masses. Practice problems at the end of chapters (excluding the last chapter) with solutions to selected problems provided in an appendix, as well as an extensive list of references for further reading. Companion website with solutions (odd-numbered problems for students, all problems for

instructors), PowerPoint lecture slides, and other resources. As with previous editions, the balanced coverage and additional resources provided, makes Nuclear and Particle Physics an excellent foundation for advanced undergraduate courses, or a valuable general reference text for early graduate studies.

High Energy Cosmic Rays Todor Stanev 2012-03-01 Offers an accessible text and reference (a cosmic-ray manual) for graduate students entering the field and high-energy astrophysicists will find this an accessible cosmic-ray manual Easy to read for the general astronomer, the first part describes the standard model of cosmic rays based on our understanding of modern particle physics. Presents the acceleration scenario in some detail in supernovae explosions as well as in the passage of cosmic rays through the Galaxy. Compares experimental data in the atmosphere as well as underground are compared with theoretical models

Extensive Air Showers Peter K. F. Grieder 2010-08-09 Extensive air showers are a very unique phenomenon. In the more than six decades since their discovery by Auger and collaborators we have learned a lot about these extremely energetic events and gained deep insight into high-energy phenomena, particle physics and astrophysics. In this Tutorial, Reference Manual and Data Book Peter K. F. Grieder provides the reader with a comprehensive view of the phenomenology and facts of the various types of interactions and cascades, theoretical background, experimental methods, data evaluation and interpretation and air shower simulation. He discusses astrophysical aspects of the primary radiation and addresses remaining puzzling questions that cannot yet be answered. They remain as a challenge for present and future research in the field. The book is split into two volumes. Volume I deals mainly with the basic theoretical framework of the processes that determine an air shower and ends with a summary of ways and means to extract information from air shower observations on the primary radiation. It also presents a compilation of data of our current knowledge of the high energy portion of the primary spectrum and composition. Volume II contains mainly compilations of data of experimental and theoretical nature as well as predictions from simulations of individual air shower constituents. Also included are chapters dedicated exclusively to special processes and detection methods. Extensive up-to-date reference lists appear at the end of each chapter. Researchers and students working in the field of cosmic ray detection and astroparticle physics will appreciate finding this book in their library.

Origin of Cosmic Rays J.L. Osborne 2012-12-06 Proceedings of the NATO Advanced Study Institute, Durham, England, August 26-September 6, 1974

Neutrinos, Dark Matter and Co. Claus Grupen 2021-06-07 In this essential, Claus Grupen discusses astroparticle physics in a short historical outline and describes the latest results without going into mathematical detail. As an introduction to this new field of research, he gives an overview of what happens in the sky, between stars and between galaxies. By now,

many things are quite well understood, but with every solution found, new questions arise - the author also deals with this spectrum of questions with some answers. Today, astroparticle physics is an active, interdisciplinary field of research that includes and combines astronomy, cosmic rays and elementary particle physics. This Springer essential is a translation of the original German 1st edition essentials, Neutrinos, Dunkle Materie und Co. by Claus Grupen, published by Springer Fachmedien Wiesbaden GmbH, part of Springer Nature in 2021.The translation was done with the help of artificial intelligence (machine translation by the service DeepL.com). A subsequent human revision was done primarily in terms of content, so that the book will read stylistically differently from a conventional translation. Springer Nature works continuously to further the development of tools for the production of books and on the related technologies to support the authors

The Particle Odyssey Frank Close 2004-11-11 1. The world of particle physics 2. Voyage into the atom 3. The structure of the atom 4. The extraterrestrials 5. The cosmic rain 6. The challenge of the big machines 7. The particle explosion 8. Colliders and image chambers 9. From charm to top 10. The 'whys' of particle physics 11. Futureclash 12. Particles at work Table of particles Further reading/acknowledgements Picture credits Index

Why the Universe Exists New Scientist 2017-09-21 As you read this, billions of neutrinos from the sun are passing through your body, antimatter is sprouting from your dinner and the core of your being is a chaotic mess of particles known only as quarks and gluons. If the recent discovery of the Higgs boson piqued your interest, then Why The Universe Exists will take you deeper into the world of particle physics, with leading physicists and New Scientist exploring how the universe functions at the smallest scales. Find out about hunt for dark matter and why there is something rather than nothing. Discover how accelerators such as the Large Hadron Collider in Switzerland are rewinding time to the first moments after the big bang, and how ghostly neutrino particles may hold the answers to the greatest mysteries of the universe. ABOUT THE SERIES New Scientist Instant Expert books are definitive and accessible entry points to the most important subjects in science; subjects that challenge, attract debate, invite controversy and engage the most enquiring minds. Designed for curious readers who want to know how things work and why, the Instant Expert series explores the topics that really matter and their impact on individuals, society, and the planet, translating the scientific complexities around us into language that's open to everyone, and putting new ideas and discoveries into perspective and context.

Cosmic Radiations: From Astronomy to Particle Physics Giorgio Giacomelli 2001-11-30 Non-accelerator particle physicists, especially those studying neutrino oscillation experiments, will read with profit the in-depth discussions of new results and their interpretations. new guidelines are also set out for new developments in this and related fields. Discussions are presented of neutrino oscillations, neutrino astronomy, high energy cosmic rays, gravitational waves,

magnetic monopoles and dark matter. The future large-scale research projects discussed include the experiments on long baseline neutrino beams from CERN to Gran Sasso and Fermilab to the Soudan mine; large underwater and under-ice experiments; the highest energy cosmic rays; gravitational waves; and the search for new particles and new phenomena. From Ultra Rays to Astroparticles Brigitte Falkenburg 2015-01-29 The scope of the book is to give an overview of the history of astroparticle physics, starting with the discovery of cosmic rays (Victor Hess, 1912) and its background (X-ray, radioactivity). The book focusses on the ways in which physics changes in the course of this history. The following changes run parallel, overlap, and/or interact: - Discovery of effects like X-rays, radioactivity, cosmic rays, new particles but also progress through non-discoveries (monopoles) etc. - The change of the description of nature in physics, as consequence of new theoretical questions at the beginning of the 20th century, giving rise to quantum physics, relativity, etc. - The change of experimental methods, cooperations, disciplinary divisions. With regard to the latter change, a main topic of the book is to make the specific multi-diciplinary features of astroparticle physics clear.