Cosmic Rays And Particle Physics

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A Thin Cosmic Rain Michael W. Friedlander 2002-11-01 A scientific history of "cosmic rays" chronicles the discovery of a steady "rain" of atomic nuclei, beginning with the birth of subatomic particle physics in the 1890s and moving through the subsequent uncovering of muons, pions, kaons, hyperons, and other particles.
Particle Physics Reference Library Christian W. Fabjan 2020 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.
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.
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.
Particle Physics and the Universe L Bergström 2001-03-09 It is generally felt in the cosmology and particle astrophysics community that we have just entered an era which later can only be looked back upon as a golden age. Thanks to the rapid technical development, with powerful new telescopes and other detectors taken into operation at an impressive rate, and the accompanying advancement of theoretical ideas, the picture of the past, present and future Universe is getting ever clearer. Some of the most exciting new findings and expected future developments are discussed in this invaluable volume. The topics covered include the physics of the early Universe and ultra-high energy processes. Emphasis is also put on neutrino physics and astrophysics, with the evidence for non-zero neutrino masses emerging from both solar neutrinos and atmospheric neutrinos covered in great depth. Another field with interesting new results concerns the basic cosmological parameters, where both traditional methods and the potential of new ones, like deep supernova surveys and acoustic peak detections in the cosmic microwave background, are thoroughly discussed. Various aspects of the dark matter problem, such as gravitational lensing estimates of galaxy masses, cluster evolution and hot cluster electron distortions of the thermal microwave background spectrum, are also discussed, as are particle physics candidates of dark matter and methods to detect them. Cosmic rays of matter and antimatter are included as a topic, and so is the problem of the enigmatic dark energy of the vacuum. Contents: Cosmology with Clusters of Galaxies (N A Bahcall)Radiochemical Solar Neutrino Experiments and Implications (T A Kirsten)Evidence for Neutrino Oscillation Observed in Super-Kamiokande (Y Totsuka)High Energy Cosmic Neutrinos (S W Barwick)Discovery of the Cosmic Microwave Background (D T Wilkinson & P J E Peebles)Starlight in the Universe (P Madau)Acceleration of Ultra High Energy Cosmic Rays (R D Blandford)Dark Matter and Dark Energy in the Universe (M S Turner)Dark Matter Tomography (J A Tyson)Status of Models for Gamma Ray Bursts (M J Rees)and other papers Readership: High energy physicists, astrophysicists and cosmologists. Keywords:Particle;Universe;Cosmic;Dark Matter;Cosmos
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.
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.
Proceedings on the Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1966
Solar Cosmic Rays L.I. Miroshnichenko 2013-06-29 It turned out to be really a rare and happy occasion that we know exactly 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.
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.
Cosmic Rays in the Earth’s Atmosphere and Underground Lev Dorman 2013-03-19 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.
Guide to Literature of Elementary Particle Physics Jayme Tiomno 1949
Cosmic Radiations: From Astronomy to Particle Physics Giorgio Giacomelli 2012-12-06 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 2012-12-30 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.
Cosmic Rays and Particle Physics Thomas K. Gaisser 1990
Origin of Cosmic Rays J.L. Osborne 2012-12-06 Proceedings of the NATO Advanced Study Institute, Durham, England, August 26-September 6, 1974
Probing Particle Physics With Neutrino Telescopes Perez De Los Heros Carlos 2019-12-23 This book introduces the reader to how fundamental topics in particle physics can be studied with the largest neutrino telescopes currently in operation. Due to their large size, reaching cubic-kilometer volumes, and their wide energy response, these unusual detectors can provide insight on neutrino oscillations, dark matter searches or searches for exotic particles, new neutrino interactions or extra dimensions, among many other topics.Lacking a man-made neutrino 'beam', neutrino telescopes use the copious flux of neutrinos continuously produced by cosmic rays interacting in the Earth's atmosphere, as well as neutrinos from astrophysical origin. They have therefore access to neutrinos of higher energies and much longer baselines than those produced in present accelerators, being able to search for new physics at complementary scales than currently available in particle physics laboratories around the world.Written by carefully chosen experts in the field, the book introduces each topic in a pedagogical way apt not only to professionals, but also to students or the interested reader with a background in physics.
Cosmic Ray Conference: Invited, Rapporteur And Highlight Papers - Proceedings Of The Xxiii International Mathews T 1994-01-29 The new millennium brings with it new challenges and possibilities. A globalised world in which education will be the key to cross-national relations necessitates a fundamental understanding of the way education is practised in different cultures across the world.The Reflective Spin is the first book of its kind — about university teachers, about professionals sharing their experiences in improving learning and teaching practices. The writers of the cases generously share their concerns, struggles, knowledge and insights as they examine the values, assumptions, presuppositions and perspectives about learning and teaching in higher education. Readers will benefit from this sharing of a new reflective experience in a multi-layered, multi-faceted and multi-perspective context.
Proceedings of the Symposium on Cosmic Rays, Elementary Particle Physics, and Astrophysics Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1965
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.
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.
Introduction to Particle and Astroparticle Physics Alessandro De Angelis 2015-09-05 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 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.
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.
Solar, Stellar and Galactic Connections between Particle Physics and Astrophysics Alberto Carramiñana 2007-03-23 This book collects extended and specialized reviews on topics linking astrophysics and particle physics at a level between a graduate student and a young researcher. The book also includes three reviews on observational techniques used in forefront astrophysics and short articles on research performed in Latin America. The reviews, updated and written by specialized researchers, describe the state of the art in the related research topics.
Cosmic Rays and Particle Physics Thomas K. Gaisser 1990 Cambridge English Worldwide offers an exciting new approach for students from ten to sixteen.
Cosmic Rays and Particle Physics T. K. Gaisser 1979
Cosmic Rays and Particle Physics Thomas K. Gaisser 2016-06-02 Fully updated for the second edition, this book introduces the growing and dynamic field of particle astrophysics. It provides an overview of high-energy nuclei, photons and neutrinos, including their origins, their propagation in the cosmos, their detection on Earth and their relation to each other. Coverage is expanded to include new content on high energy physics, the propagation of protons and nuclei in cosmic background radiation, neutrino astronomy, high-energy and ultra-high-energy cosmic rays, sources and acceleration mechanisms, and atmospheric muons and neutrinos. Readers are able to master the fundamentals of particle astrophysics within the context of the most recent developments in the field. This book will benefit graduate students and established researchers alike, equipping them with the knowledge and tools needed to design and interpret their own experiments and, ultimately, to address a number of questions concerning the nature and origins of cosmic particles that have arisen in recent research.
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
Physics and Astrophysics of Ultra High Energy Cosmic Rays M. Lemoine 2008-01-11 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.
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.
Cosmic Rays for Particle and Astroparticle Physics S Giani 2011-06-29 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 extend 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. Errata(s) Nuclear and Non-Ionizing Energy-Loss for Coulomb Scattered Particles from Low Energy up to Relativistic Regime in Space Radiation Environment: Page 17 to Page 22 (245 KB) Contents:Broader Impacts Activites and Treatments:VHE Spectral Energy Distribution of Crab Nebula Compared with the Prediction of a Synchrotron Self-Compton Emission Model (V G Sinitsyna, A Y Alaverdian, A S Boldyrev, S S Borisov, R M Mirsafatikhov and V Y Sinitsyna)Nuclear and Non-Ionizing Energy-Loss for Coulomb Scattered Particles from Low Energy Up to Relativistic Regime in Space Radiation Environment (M J Boschini, C Consolandi, M Gervasi, S Giani, D Grandi, V Ivanchenko, S Pensotti, P G Rancoita and M Tacconi)Study of the Natural Radioactivity Influence on ARGO-YBJ Detector (I Bolognino, C Cattaneo, E Giroletti, G Liguori, P Salvini, P Vallania and C Vigorito)High-Accuracy Determination of Fabry-Perot Effective Mirror Spacing Used for the Receivers of Atmospheric Monitoring in VHE Gamma Ray Astronomy (S Maltezos, E Fokitis, N Maragos, V Gika, A Georgakopoulou, E Koubli and G Koutsourakis)AMS-02 Photon Data Reduction Approach (G Boella, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, E Memola, S Pensotti, P G Rancoita and M Tacconi)CZELTA: An Overview of the Czech Large-Area Time Coincidence Array (K Smolek, J Čermák, J Hubík, S Pospíšil, P Přidal, J Smejkal, I Štekl, F Blaschke, P Lichard and V Vícha)Calibration of the CMS Electromagnetic Calorimeter with First LHC Data (V Sola)On the Detectability of Cosmic Ray Electron Spectral Features in the Microwave/mm-Wave Range (A Tartari, M Gervasi, G Sironi, M Zannoni and S Spinelli)Science in the Schools – the Extreme Energy Events Project (M Abbrescia, R Antolini, R Baldini Ferroli, G Bencivenni, E Bressan, A Chiavassa, C Cical, L Cifarelli, F Coccetti, D De Gruttola, S DePasquale, M DIncecco, F L Fabbri, V Frolov, M Garbini, C Gustavino, D Hatzifotiadou, P La Rocca, F Librizzi, A Maggiora, H Menghetti, S Miozzi, R Moro, M Panareo, G Piragino, F Riggi, F Romano, G Sartorelli, E Scapparone, M Selvi, S Serci, E Siddi, M C S Williams, A Zichichi and R Zuyeuski)A Cosmic Ray Detector Array for Schools in the Cambridge Region (S A Wotton, M J Goodrick, B Hommels and M A Parker)Observation of Electroscalar Radiation During a Solar Eclipse (O A Zaymidoroga and D V Podgainy)Young Researchers Focus on the Extreme Energy Universe (James L Pinfold)Cosmic Rays Experimental Observations and Searches:Galactic Cosmic Ray Production in Tycho's SNR and Geminga (V G Sinitsyna, A Y Alaverdian, S S Borisov, S I Nikolsky and V Y Sinitsyna)The CUORICINO and CUORE Neutrinoless Double Beta Decay Experiments (T I Banks)Results from DAMA/LIBRA (R Bernabei, P Belli, F Montecchia, F Nozzoli, F Cappella, A d'Angelo, A Incicchitti, D Prosperiy, R Cerulli, C J Dai, H L He, X H Ma, X D Sheng, Z P Yez and R G Wang)Recent Results from the Fermi Large Area Space Telescope (Emanuele Bonamente)Gamma-Ray Activity of Cygnus X-3 at Energy Range of 1-100 TeV During 15 Year Observations of SHALON (V G Sinitsyna, A Y Alaverdian, S S Borisov, S I Nikolsky and V Y Sinitsyna)Signatures of Middle Aged, Nearby Pulsars in the Cosmic Ray Lepton Spectrum? 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Model Status and Discovery Potential (Jonathan Pochon)The CR Connection: UHE Primaries and Secondaries from UHECR Sources (A M Taylor)η Carinae: A Very Large Hadron Collider (R Walter, C Farnier & J-C Leyder)Cosmic Rays from Exotic Sources:Gamma Rays from Dark Matter (T Bringmann)Introducing CLUMPY: A Public Code for Gamma-Ray Emission from Dark Matter Annihilation in the Galaxy (C Combet, A Charbonnier and D Maurin)Cosmic Rays and Dark Matter Indirect Detection (Timur Delahaye)Neutrinos from Dark Matter (M H Reno)Charged Cosmic Rays from Dark Matter (P Salati)Gamma-Ray and Neutrino Signatures of Unstable Dark Matter (David Tran)Gamma-Ray Anisotropies from Decaying Dark Matter (C Weniger) Readership: Postgraduate students, researchers and engineers. Keywords:Astroparticle;Particle;Space Physics;Cosmic Ray Physics;Heliosphere;Dark Matter;Double-Beta DecayKey Features:Complete review of the fieldUp-to-date results and informationBroad vision for the future in the field, indication of future research direction

Cosmic Rays at Earth P.K.F. Grieder 2001-08-10 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.

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.

Simulations and Software Developments for Cosmic-Ray and Particle Physics Experiments in Underground Laboratories □□□ 2017-01-27 This dissertation, "Simulations and Software Developments for Cosmic-ray and Particle Physics Experiments in Underground Laboratories" by □□□, Hei-man, Tsang, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled SIMULATIONS AND SOFTWARE DEVELOPMENTS FOR COSMIC-RAY AND PARTICLE PHYSICS EXPERIMENTS IN UNDERGROUND LABORATORIES submitted by Tsang Hei Man for the Degree of Master of Philosophy at The University of Hong Kong in October 2007 The aim of the Daya Bay Reactor Neutrino Experiment is to measure θ, the last 13 unknown mixing angle that characterizes the neutrino oscillation phenomenon, to a sensitivity level of 0.01 or better in sin θ with a confidence level of 90%. To 13 achieve such an accuracy, background suppression is essential. While the Daya Bay Experiment will be performed underground to shield against low energy cosmic-ray muons, the measurement can also be a□ected by, for example, spallation neutronsby cosmic-ray muons and natural radioactivity in the surrounding environment. TheAberdeenTunnelExperimentinHongKongaimstomeasurebackgroundra- diationinasimilarundergroundenvironment. Inparticular, thespallationneutrons induced by cosmic-ray muons will be measured using a muon tracker and a neutron detector. In addition to muon-induced background, gamma radiations from natural 238 232 radioactivesources, forexampletheradio-nuclidesinthe U seriesand Thseries 40 and K, can also, potentially, create chance coincidence in the detectors, which is similar to a muon-induced signal expected in the Daya Bay Experiment. Inthisstudy, theperformanceofGEANT4, asimulationtoolforparticlephysics experiments, in gamma simulations was first validated by comparison with experi- mentalmeasurementandothersimulationmethods, includingafiniteelementsimu- lation. Then, someGEANT4simulationstudiesonthenecessityofleadshieldingfor reducing low energy gamma background from rock in the Aberdeen Tunnel Experi- ment was performed. The use of lead shielding in the Aberdeen Tunnel Experiment can be avoided by choosing suitable time windows for the detectors. The e□ect of background gamma radiation from radio-nuclides in the rock on Resistive Plates Chambers (RPC) in the Daya Bay Experiment was also assessed by means of a GEANT4 simulation of the RPC setup in the Daya Bay Experiment. The results were consistent with previous experimental measurements and suggest that the chance coincidence of RPCs by gamma can be reduced significantly by the use of spacers and requiring multiple coincidence.ThedataacquisitionsoftwaredevelopmentfortheAberdeenTunnelExperiment was described. Finally, a discussion on the o□ine analysis program for the recon- struction of muon tracks and muon angular distribution written for the Aberdeen Tunnel Experiment was presented. A simple test for verifying the o□ine analysis program was also performed. DOI: 10.5353/th_b3955703 Subjects: Particles (Nuclear physics) Cosmic rays Gamma rays

Cosmic Rays Zbigniew Szadkowski 2018-08-22 Measurements in present experiments have dramatically advanced our understanding of ultrahigh-energy cosmic rays. The suppression of the flux at the highest energies is now confirmed without any doubt, and strong limits have been placed on the photon and neutrino components. There are indications for a small, large-scale anisotropy both below and above the energy of the angle and for a correlation on smaller angular scales at E > 5.5*1019 eV. Around 3*1018 eV, there is a distinct change of slope with energy, and the shower-to-shower variance decreases. Interpreted with the leading LHC-tuned shower models, this implies a gradual shift to a heavier composition, and a number of fundamentally different astrophysical model scenarios have been developed to describe this evolution.

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.

Nonlinear Cosmic Ray Diffusion Theories Andreas Shalchi 2009-06-04 If charged particles move through the interplanetary or interstellar medium, they interact with a large-scale magnetic ?eld such as the magnetic ?eld of the Sun or the Galactic magnetic ?eld. As these background ?elds are usually nearly constant in time and space, they can be approximated by a homogeneous ?eld. If there are no additional ?elds, the particle trajectory is a perfect helix along which the par- cle moves at a constant speed. In reality, however, there are turbulent electric and magnetic?elds dueto the interstellaror solar wind plasma. These ?elds lead to sc- tering of the cosmic rays parallel and perpendicular to the background ?eld. These scattering effects, which usually are of diffusive nature, can be described by s- tial diffusion coef?cients or, alternatively, by mean free paths. The knowledge of these parameters is essential for describing cosmic ray propagation as well as d- fusive shock acceleration. The latter process is responsible for the high cosmic ray energies that have been observed. The layout of this book is as follows. In Chap. 1, the general physical scenario is presented. We discuss fundamental processes such as cosmic ray propagation and acceleration in different systems such as the solar system or the interst- lar space. These processes are a consequence of the interaction between charged cosmic particles and an astrophysical plasma (turbulence). The properties of such plasmas are therefore the subject of Chap. 2.

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.

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

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