Cosmic Rays And Particle Physics

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Proceedings of the Symposium on Cosmic Rays, Astrophysics, Geophysics and Elementary Particle Physics ; 11 1969

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.

SYMPOSIUM ON COSMIC RAYS, ASTROPHYSICS, GEOPHYSICS AND ELEMENTARY PARTICLE PHYSICS, 11TH, DELHI, 7-11 OCT. 1969 INDIA. DEPT. OF ATOMIC ENERGY. COSMIC RAY COMMITTEE. 1969

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 affected 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 effect 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.Thedataacquisitionsoftwaredevelopmentfortheaberdeen TunnelExperiment was described. Finally, a discussion on the offline 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 offline analysis program was also performed. DOI: 10.5353/th_b3955703 Subjects: Particles (Nuclear physics) Cosmic rays Gamma rays

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.

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

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? (I Büsching and Okker C deJager)Highlights from the ARGO-YBJ Experiment (P Camarri)Status of MAGIC and Recent Results (A de Angelis and V Scalzotto)Recent HESS Results (B Degrange)Atmospheric Evaluation with LIDAR for MAGIC (C Fruck, J Hose, R Mirzoyan and M Teshima)The AMS-02 Silicon Tracker (S Haino)From the Knee to the Ankle: From Galactic to Extragalactic Origin of Cosmic Rays? (Andreas Haungs)High Energy Cosmic-Ray Photons and Helium (Stanislav Borisov, Sergey Voronov, Arkady Galper and Alexander Karelin)Status of UHE CR Orbital Fluorescence Detector TUS (P Klimov, G Garipov, B Khrenov, N Kalmykov, V Morozenko, M Panasyuk, S Sharakin, A Shirokov, I Yashin, S Biktemerova, A Grinyuk, D Naumov, L Tkachev, A Tkachenko, O Saprykin, I Park, J Lee, G Na, O Martinez and H Salazar)The Observation of the Light Component Spectrum in the 5–250 TeV Region by the ARGO-YBJ Experiment (S M Mari and P Montini)Status and Plans of the LUCIFER Experiment (F Orio)In-Flight Measurement of the Aabsolute Energy Scale of the Fermi Large Area Telescope (M Pesce-Rollins)The Synergy between Astroparticle and Collider Physics in the Search for Dark Matter (James L Pinfold)PICASSO: Search for Dark Matter in the Spin-Dependent Sector (M-C Piro)Recent Results from VERITAS (John Quinn)Recent Results from the PAMELA Experiment (S B Ricciarini)First Results of LHCF; Very Forward Particles at LHC Collision (T Sako)Status and Recent Results from the CREAM Experiment (E S Seo, H S Ahn, P Bhoyar, J Eaton, O Ganel, J H Han, A Haque, K C Kim, M H Kim, M H Lee, S E Lee, L Lutz, A Malinin, O Ofoha, S S Ryu, B P Smith, A Vartanyan, P Walpole, J Wu, J H Yoo, Y S Yoon, T Anderson, N B Conklin, S Coutu, M Geske, S I Mognet, L Barbier, J T Link, J W Mitchell, A Barrau, M Bunerd, B Coste, L Derome, M Mangin-Brinet, A Putze, Y Sallaz-Damaz, R Bazer-Bachi, J J Beatty, T J Brandt, G Bigongiari, P Maestro and R Zei)On the Possibility of Registering UHE EAS Cherenkov Light by the TUS Detector (O P Shustova, N N Kalmykov and B A Khrenov)TeV Gamma-Rays from NGC 1275 Detected in 15 Year Observation of SHALON Telescope (V G Sinitsyna, S I Nikolsky and V Y Sinitsyna)Constraints on Extragalactic Background Light from Distant Quasars 3C454.3 (z = 0.859 and 1739+522 (z = 1.375) Detected by SHALON (V G Sinitsyna, S I Nikolsky and V Y Sinitsyna)Status of the High Altitude Water Cherenkov (HAWC) Gamma Ray Observatory (Wayne Springer)Light Nuclei and Isotope Abundances in Cosmic Rays. Results from AMS-01 (N Tomassetti)Cosmic Rays Propagation and Environment:The AMS-02 Proton Spectra and the Geomagnetic Field (P Bobik, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, K Kudela, S Pensotti and P G Rancoita)Stereo Observations of the Energetic Heavy Ions During the Minimum of Solar Cycle 23 (R Bučík, U Mall, A Korth and G M Mason)Electron and Positron Solar Modulation and Prediction for AMS02 (P Bobik, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, K Kudela, S Pensotti and P G Rancoita)How to Use Molecular Clouds to Study the Propagation of Cosmic Rays in the Galaxy (S Gabici)Proton Modulation in the Heliosphere for Different Solar Conditions and Prediction for AMS-02 (P Bobik, G Boella, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, K Kudela, E Memola, S Pensotti, P G Rancoita and M Tacconi)Proton and Antiproton Modulation in the Heliosphere for Different Solar Conditions and AMS-02 Measurements Prediction (P Bobik, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, K Kudela, S Pensotti and P G Rancoita)A Consistent Interpretation of Recent CR Nuclei and Electron Spectra (Giuseppe Di Bernardo, Carmelo Evoli, Daniele Gaggero, Dario Grasso, Luca Maccione and Mario Nicola Mazziotta)Cosmic Rays for Heliospheric Space Weather Storm Prediction (Frank Jansen and Jörg Behrens)Energetic Particles in the Magnetosphere of Earth: Selected Results and Problems (Karel Kudela, Leonid L Lazutin and Yuri I Logachev)Cosmic Rays of Leptons from Pulsars and Supernova Remnants (Roberto A Lineros)High Energy Phenomena in the Low Atmosphere; Particle Fluxes from Thunderstorm Clouds (Ashot Chilingarian and Bagrat Mailyan)The Cosmic-Ray Populations of Nearby Galaxies (P Martin)USINE: A New Public Cosmic Ray Propagation Code (Basic Phenomenology, Sample Results, and a Bit of USINE) (D Maurin)Propagation of Galactic Cosmic Rays and the AMS-02 Experiment (Miguel Pato, Dan Hooper and Melanie Simet)Galactic Cosmic Rays in the Dynamic Heliosphere (Marius Potgieter, Stefan Ferreira and Du Toit Strauss)A Markov Chain Monte Carlo Technique to Sample Transport and Source Parameters of Galactic Cosmic Rays (A Putze, L Derome, F Donato and D Maurin)PAMELA Through a Magnetic Lens (J P Roberts)Analysis of Possibility of Cosmic Rays Proton Anisotropy Phase and Amplitude and Electron Spectra Description at TeV-Region within the Bounds of the Same Set of Sources (Olga Strelnikova, Vladimir Ptuskin and Lyubov Sveshnikova)Interstellar Gamma Rays and Cosmic Rays: New Insights from FERMI-LAT and Integral (A W Strong)Energy Loss for Electrons in the Heliosphere and Local Interstellar Spectrum for Solar Modulation (P Bobik, G Boella, M J Boschini, C Consolandi, S Della Torre, M Gervasi, D Grandi, M Elmo, K Kudela, E Memola, S Pensotti, P G Rancoita, D Rozza and M Tacconi)Cosmic Rays from Astrophysical Sources:Cosmic Ray Acceleration in Supernova Remnants (P Blasi)γ-Rays from Heavy Nuclei Accelerated in Supernova Remnants (D Caprioli, P Blasi and E Amato)Anisotropies in the Cosmic-Ray Electron Spectrum: A Way to Discriminate between Exotic and Astrophysical Sources? (I Cernuda)Cosmic-Ray Electrons and Positrons from Gamma-Ray Pulsars (M Dormody)Galactic Electrons and Positrons at the Earth: New Estimate of the Primary and Secondary Fluxes (J Lavalle)The 'PAMELA Anomaly' Indicates a Nearby Cosmic Ray Accelerator (P Mertsch and S Sarkar)Observations of Intermediate Synchrotron Peaked Blazars with the Fermi-LAT (C Monte)Shock Acceleration in Partially Neutral Plasmas (G Morlino, E Amato, P Blasi and D Caprioli)Pulsar Electrons Detection in AMS-02 Experiment. 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

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

Particle Astrophysics, Second Edition D. H. Perkins 2008-12-04 The last years have seen a symbiosis of the fields of elementary particle physics and the astrophysics of the early universe. This text presents the background of the subjects and the latest developments at a level suitable for final year undergraduates and beginning graduate students. The first chapters cover the properties and interactions of elementary particles followed by discussion of the early universe, including inflation, dark matter and dark energy, and the growth of the galactic structure. The final chapters discuss cosmic rays and particle physics in the stars. The close relation between particle interactions and large scale development of the cosmos is a constant theme in the text, with emphasis on the interplay between experiment and theory. This book is an enlarged and updated version of the first edition published five years ago. In a rapidly evolving field, emphasis has of course been placed on the most recent developments. However, the opportunity has also been taken to re-arrange the material and present it in more detail and at somewhat greater length.

Instruments and Methods for the Radio Detection of High Energy Cosmic Rays Frank Schröder 2012-12-14 Cosmic rays consist of elementary particles with enormous energy which originate from outside our solar system and constantly hit the Earth's atmosphere. Where do these cosmic rays originate? How does nature accelerate the cosmic-ray particles to energies with orders of magnitude beyond the limits of manmade particle accelerators? What can we learn by measuring the interactions of the cosmic rays with the atmosphere? Digital radio-antenna arrays offer a promising, complementary measurement method for high-energy cosmic rays. This thesis reports on substantial advances in the development of the radio technique, which will be used to address these questions in future experiments.

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.

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.

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

Proceedings of the Ninth Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1966

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, Elementary Particle Physics and Astrophysics V.A. Kamath 1968

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.

Proceedings on the Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1966

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.

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.

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.

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

Guide to Literature of Elementary Particle Physics Jayme Tiomno 1949

Proceedings of the Tenth Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1967 India. Department of Atomic Energy. Cosmic Ray Committee 1968

Proceedings of International Symposium on Cosmic Rays and Particle Physics 1984

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

Research in Elementary Particle Physics and Cosmic Ray Physics 2014 Progress is reported in the areas of neutrino physics and experimental cosmic ray physics,

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.

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.

Handbook of Particle Physics M.K. Sundaresan 2017-12-19 Literally thousands of elementary particles have been discovered over the last 50 years, their properties measured, relationships systematized, and existence and behavior explained in a myriad of cleverly constructed theories. As the field has grown so impressively, so has its jargon. Until now, scientists in other fields have had no single resource from which they can quickly reference an idea, acronym, or term and find an accessible definition and explanation. The Handbook of Particle Physics fills that void. This unique work contains, in encyclopedic form, terms of interest in particle physics, including its peculiar jargon. It covers the experimental and theoretical techniques of particle physics along with terms from the closely related fields of astrophysics and cosmology. Designed primarily for non-specialists with a basic knowledge of quantum mechanics and relativity, the entries preserve a degree of rigor by providing the relevant technical and mathematical details. Clear and engaging prose, numerous figures, and historical overviews complement the handbook's convenience both as a reference and as an invitation into the fascinating world of particle physics.

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.

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.

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 affected 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 effect 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 offline 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 offline analysis program was also performed. DOI: 10.5353/th_b3955703 Subjects: Particles (Nuclear physics) Cosmic rays Gamma rays

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.

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.

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.

Proceedings on the Tenth Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics Symposium on Cosmic Rays, Elementary Particle Physics and Astrophysics 1968

Cosmic Rays and Particle Physics T. K. Gaisser 1979