Cosmic Rays Fluka

Technical Evaluation of the NASA Model for Cancer Risk to Astronauts Due to Space RadiationLife Sciences : Radiation Environment and ModellingCalorimetry in Particle PhysicsMonte Carlo Particle Transport MethodsCosmic Rays and Particle PhysicsBackground Due to Cosmic Protons in Gamma-Ray Telescopes (Final Report)Solar Particle Radiation Storms Forecasting and AnalysisLaser Interferometer Space AntennaHigh Energy Cosmic RaysCosmic Ray AstrophysicsPhysics and Astrophysics of NeutrinosFrontiers of Cosmic Ray ScienceGamma-ray and Cosmic-ray Detectors, Techniques, and MissionsNonlinear Cosmic Ray Diffusion TheoriesSolar Cosmic RaysFlukaVery High Energy Cosmic Ray InteractionsCosmic Rays at EarthAstrophysics from the MoonCosmic Rays and EarthRadiation Protection and ShieldingSpace Radiation and Astronaut SafetyEmission of Radio Waves in Particle ShowersOrigin and Acceleration of Cosmic RaysSpace Life SciencesAdvanced Monte Carlo for Radiation Physics, Particle Transport Simulation and ApplicationsExtensive Air ShowersCharged Particles in OncologyCosmic Rays in the Earth's Atmosphere and UndergroundCORDIS FocusCERN.Proceedings of the International Cosmic Ray Conference25th International Cosmic Ray Conference, Vol 8Handbook of Particle Detection and ImagingStress Challenges and Immunity in SpaceCosmic Rays and Dark MatterVery High Energy Cosmic-ray InteractionsCosmic Rays in the Galaxy, Black Holes, Dark Matter and Dark EnergyCosmic Rays and AstrophysicsRevista de

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Technical Evaluation of the NASA Model for Cancer Risk to Astronauts Due to Space Radiation

Life Sciences : Radiation Environment and Modelling

The year 1998 marked the 50th anniversary of the invention of the neutron monitor, a key research tool in the field of space physics and solar-terrestrial relations. In honor of this occasion a workshop entitled 'Cosmic Rays and Earth' was organized to review the detection of cosmic rays at the surface and in the lower atmosphere of Earth, including the effect that this radiation has on the terrestrial environment. A special focus was the role of neutron monitors in the investigation of this radiation, on the science enabled by the unique dataset of the worldwide network of neutron monitors, and on continuing opportunities to use these data to solve outstanding problems. This book is the principal product of that workshop, integrating the contribu tions of all participants. Following a general summary of the workshop prepared by the editors, the volume leads off with a keynote article by Professor John Simpson describing his invention of the neutron monitor in 1948 and the early scientific discoveries made with this instrument.

Calorimetry in Particle Physics

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.

Monte Carlo Particle Transport Methods

The purpose of the School was to promote cosmic ray physics and astrophysics within the Latin American community. These proceedings aim to provide a comprehensive overview of the theoretical and experimental aspects of Cosmit Ray Physics and Astrophysics. The list of lecture topics includes: experimental techniques, primary spectrum and composition of cosmic rays; high-energy interactions; gamma ray astronomy and GRBs; neutrino astrophsyics; cosmic ray detectors; simulation; solar modulation, and present status of the development and results from several present-day observations such as the Pierre Auger, IceCube, HESS, KASCADE, etc. The proceedings will provide students with a common background, and will give them an updated panorama.

Cosmic Rays and Particle Physics

Background Due to Cosmic Protons in Gamma-Ray Telescopes (Final Report)

Observations of neutrinos being emitted by the supernova SN1987A, star neutrinos, and atmospheric neutrinos have provided new insights into astronomy, as well as new unresolved phenomena such as the solar neutrino problem, spurring investigative studies among particle physicists and astrophysicists. One of

the most important features of this book is its enumeration of a number of basic properties of neutrinos and their relationship to Grand Unified Theories, focusing on the origin of the neutrino's mass and the generation mixing of neutrinos. All the kamiokande results, detector performances, and complete references are included.

Solar Particle Radiation Storms Forecasting and Analysis

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

Laser Interferometer Space Antenna

High Energy Cosmic Rays

The International Conference on Calorimetry in Particle Physics has become the major forum for state-of-the-art developments of calorimetry techniques. The tenth conference was attended by about 150 physicists from 20 countries and covered all aspects of calorimetric particle detection and measurements, with emphasis on high energy physics experiments as well as experiments in nuclear physics and astrophysics. The proceedings contain three parts: introductory papers, contributed papers and a summary. The introductory papers start with a historical review of the development of calorimetry technology, and continue with overviews of the current status of calorimetry in high energy physics and astrophysics, which are followed by discussions on calorimetry in future accelerator facilities, such as linear colliders and the Super B Factory. A "hot" technology regarding the "energy flow concept" is also dealt with.

Cosmic Ray Astrophysics

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.

Physics and Astrophysics of Neutrinos

Frontiers of Cosmic Ray Science

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.

Gamma-ray and Cosmic-ray Detectors, Techniques, and Missions

Nonlinear Cosmic Ray Diffusion Theories

Stress of either psychological or physical nature can activate and/or paralyse humans' innate and adaptive immunity. However, adequate immunity is crucial to the maintenance of health on earth and in space. During space flight, human physiology and health are challenged by complex environmental stressors which might be at their most pronounced during lunar or interplanetary missions. While previous publications have addressed the physiological changes that occur during space flight, this book goes further, by adopting an interdisciplinary approach to analyze the complex interaction of living conditions in space, the immune system, and astronauts' health. It is explained how such analysis of the consequences of stress for the immune system may help in preventing, diagnosing, and counteracting immune-related alterations in health on earth as well as in space

Solar Cosmic Rays

Fluka

With this book we try to reach several more-or-less unattainable goals namely: To compromise in a single book all the most important achievements of Monte Carlo calculations for solving neutron and photon transport problems. To present a book which discusses the same topics in the three levels known from the literature and

gives us useful information for both beginners and experienced readers. It lists both well-established old techniques and also newest findings.

Very High Energy Cosmic Ray Interactions

Cosmic Rays at Earth

The 25th International Cosmic Ray Conference marked the golden jubilee of this series of conferences. Held under the auspices of the IUPAP Commission C4, it was hosted by the Space Research Unit of the Department of Physics of the Potchefstroom University for Christian Higher Education.The proceedings present the newest developments and highlights of cosmic ray production and propagation, the extragalactic realm now being explored using neutrino and gamma ray astronomy. These fields are strongly related to high energy physics.

Astrophysics from the Moon

Cosmic Rays and Earth

Radiation Protection and Shielding

Space Radiation and Astronaut Safety

NASA's current missions to the International Space Station (ISS) and potential future exploration missions involving extended stays by astronauts on the lunar surface, as well as the possibility of near- Earth object (NEO) or Mars missions, present challenges in protecting astronauts from radiation risks. These risks arise from a number of sources, including solar particle events (SPEs), galactic cosmic rays (GCRs), secondary radiation from surface impacts, and even the nuclear isotope power sources transported with the astronauts. The serious early and late radiation health effects potentially posed by these exposures are equally varied, ranging from early signs of radiation sickness to cancer induction. Other possible effects include central nervous system damage, cataracts, cardiovascular damage, heritable effects, impaired wound healing, and infertility. Recent research, much of which has been sponsored by NASA, has focused on understanding and quantifying the radiation health risks posed by space radiation environments. Although many aspects of the space radiation environments are now relatively well characterized, important uncertainties still exist regarding biological effects and thus regarding the level and types of risks faced by astronauts. This report presents an evaluation

of NASA's proposed space radiation cancer risk assessment model, which is described in the 2011 NASA report, Space Radiation Cancer Risk Projections and Uncertainties--2010. The evaluation in Technical Evaluation of the NASA Model for Cancer Risk to Astronauts Due to Space Radiation considers the model components, input data (for the radiation types, estimated doses, and epidemiology), and the associated uncertainties. This report also identifies gaps in NASA's current research strategy for reducing the uncertainties in cancer induction risks.

Emission of Radio Waves in Particle Showers

Origin and Acceleration of Cosmic Rays

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.

Space Life Sciences

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 identifled 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-level 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.

Advanced Monte Carlo for Radiation Physics, Particle Transport

Simulation and Applications

Extensive Air Showers

This book focuses on the state of the art of Monte Carlo methods in radiation physics and particle transport simulation and applications. Special attention is paid to algorithm development for modeling, and the analysis of experiments and measurements in a variety of fields.

Charged Particles in Oncology

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.

Cosmic Rays in the Earth’s Atmosphere and Underground

CORDIS Focus

CERN.

Proceedings of the International Cosmic Ray Conference

25th International Cosmic Ray Conference, Vol 8

This thesis offers the first laboratory validation of microscopic simulations of radio emission from particle showers, including a detailed description of the simulation study. It presents a potential future avenue for resolving the mass composition of cosmic rays via radio detection of air showers. Particle showers are created from cascading interactions when high-energy particles collide with matter, e.g. with air in the case of cosmic radiation, or with a particle detector in the case of experiments at CERN. These showers can consist of billions of particles, mostly electrons, positrons and photons. They emit radio waves when the absorbing medium is in a magnetic field, and this radio emission can be used as a novel

means of detecting and drawing inferences on the shower and the primary particle. The new method is currently being established in cosmic ray research, where large antenna arrays may soon replace or complement traditional particle detectors. In thi s study, a complete microscopic simulation of a radio-emission experiment conducted at Stanford Linear Accelerator Center (SLAC), Stanford/USA, is performed, and the underlying physical models are validated. The model is subsequently applied to the Square Kilometre Array (SKA) project, which is a large interferometer for radio astronomy. It is demonstrated that the SKA, with some modifications, might also be used for cosmic ray research based on radio detection of high-energy particles from the cosmos.

Handbook of Particle Detection and Imaging

Stress Challenges and Immunity in Space

This brief explores the biological effects of long-term radiation on astronauts in deep space. As missions progress beyond Earth's orbit and away from the protection of its magnetic shielding, astronauts risk constant exposure to higher levels of galactic cosmic rays and solar particle events. The text concisely addresses the full spectrum of biomedical consequences from exposure to space

radiation and goes on to present possible ways to mitigate such dangers and protect astronauts within the limitations of existing technologies.

Cosmic Rays and Dark Matter

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.

Very High Energy Cosmic-ray Interactions

High-energy charged particles represent a cutting-edge technique in radiation oncology. Protons and carbon ions are used in several centers all over the world for the treatment of different solid tumors. Typical indications are ocular malignancies, tumors of the base of the skull, hepatocellular carcinomas and various sarcomas. The physical characteristics of the charged particles (Bragg peak) allow sparing of much more normal tissues than it is possible using conventional X-rays, and for this reason all pediatric tumors are considered eligible for protontherapy. Ions heavier than protons also display special radiobiological characteristics, which make them effective against radioresistant and hypoxic tumors. On the other hand, protons and ions with high charge (Z) and energy (HZE particles) represent a major risk for human space exploration. The main late effect of radiation exposure is cancer induction, and at the moment the dose limits for astronauts are based on cancer mortality risk. The Mars Science Laboratory (MSL) measured the dose on the route to Mars and on the planet's surface, suggesting that a human exploration missions will exceed the radiation risk limits. Notwithstanding many studies on carcinogenesis induced by protons and heavy ions, the risk uncertainty remains very high. In this research topic we aim at gathering the experiences and opinions of scientists dealing with high-energy charged particles either for cancer treatment

or for space radiation protection. Clinical results with protons and heavy ions, as well as research in medical physics and pre-clinical radiobiology are reported. In addition, ground-based and spaceflight studies on the effects of space radiation are included in this book. Particularly relevant for space studies are the clinical results on normal tissue complications and second cancers. The eBook nicely demonstrates that particle therapy in oncology and protection of astronauts from space radiation share many common topics, and can learn from each other.

Cosmic Rays in the Galaxy, Black Holes, Dark Matter and Dark Energy

Cambridge English Worldwide offers an exciting new approach for students from ten to sixteen.

Cosmic Rays and Astrophysics

LISA (Laser Interferometer Space Antenna) is a joint NASA/ESA mission to detect and observe gravitational waves in space. Topics discussed in this sixth symposium include: fundamental gravitational physics and astrophysics of LISA, gravitational data analysis, LISA instrumentation, LISA Pathfinder, and ground-based gravitational wave antennas.

Revista de la Real Academia de Ciencias Exactas, Físicas, Químicas y Naturales de Zaragoza

Solar energetic particles (SEPs) emitted from the Sun are a major space weather hazard motivating the development of predictive capabilities. This book presents the results and findings of the HESPERIA (High Energy Solar Particle Events forecasting and Analysis) project of the EU HORIZON 2020 programme. It discusses the forecasting operational tools developed within the project, and presents progress to SEP research contributed by HESPERIA both from the observational as well as the SEP modelling perspective. Using multi-frequency observational data and simulations HESPERIA investigated the chain of processes from particle acceleration in the corona, particle transport in the magnetically complex corona and interplanetary space, to the detection near 1 AU. The book also elaborates on the unique software that has been constructed for inverting observations of relativistic SEPs to physical parameters that can be compared with space-borne measurements at lower energies. Introductory and pedagogical material included in the book make it accessible to students at graduate level and will be useful as background material for Space Physics and Space Weather courses with emphasis on Solar Energetic Particle Event Forecasting and Analysis. This book is published with open access under a CC BY license.

ROMANCE ACTION & ADVENTURE MYSTERY & THRILLER BIOGRAPHIES & HISTORY CHILDREN'S YOUNG ADULT FANTASY HISTORICAL FICTION HORROR LITERARY FICTION NON-FICTION SCIENCE FICTION