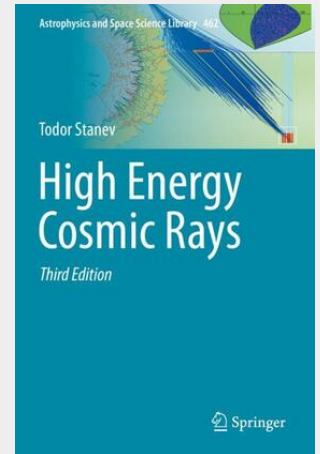


High Energy Cosmic Rays

This book on high-energy cosmic rays deals in its first part with the standard model of cosmic rays, describing how they are born in a wide range of cosmic processes, how they are accelerated and how they interact with matter, magnetic fields and radiation during their journey across the Galaxy. In its second part the book presents contemporary challenges in very high energy cosmic rays, with focus on their detection in the Earth's atmosphere and underground, as well as new developments in gamma-ray and neutrino astronomy. A decade after the publication of the second edition of this book, there are many new experimental results in the fields of high energy neutrino astronomy and in the whole energy range of detection of gamma-rays. There have also been many attempts for studies for multi-messenger events in these and all other fields. These new experimental efforts and their results are covered in this third edition. This is accompanied by a general analysis of these new results and the additional knowledge that they bring to our understanding of cosmic rays and their propagation in our Galaxy and extragalactic space. A large part of the interpretation of these new findings is related to the development of the hadronic interaction models that we use to understand and describe the experimental results. The author describes the relation between the new high energy physics experiments and such models. In addition to the discussion of new research, descriptions and graphs of the previous edition have been updated where appropriate. The third edition ends with a discussion of some possible and already planned experiments for future observations and an explanation of their importance for the better understanding of all processes that lead to the increase of our knowledge of high energy cosmic rays. Students and lecturers of advanced undergraduate courses on cosmic rays and astroparticle physics as well as post-graduates and researchers will continue to find this book a valuable source of learning and reference.

Cosmic rays are an essential part of the universe. Their origin is related to many important astrophysical processes, such as star formation, stellar evolution, supernova explosions and the state of interstellar matter in the Galaxy. Cosmic Ray Physics reviews our present knowledge of cosmic rays, describing how they are born in a wide range of cosmic processes, how they are accelerated and how they interact with matter, magnetic fields and radiation during their journey across the Galaxy. The book also describes the detection of cosmic rays, and the processes which take place, both at the top and within the Earth's atmosphere. The author also describes the very important area of the underground detection of very high energy cosmic rays and particles such as neutrinos. The book is divided into two parts, the first describing the standard model of cosmic rays and contemporary challenges, and the second part dealing with very high energy cosmic rays that cannot be detected directly in satellite and balloon experiments, and with gamma-ray and neutrino astronomy. It is in this particular aspect of the book that the greatest developments have taken place during the 5 years since the first edition was completed. Consequently, it is in the chapters cosmic ray showers, their spectrum, on high energy neutrinos, and on gamma-ray astronomy of this revised and updated 2nd edition that a considerable amount of new material has been incorporated with more minor revisions and updating taking place in the first part of the book. Students and lecturers of advanced undergraduate courses on cosmic rays and astroparticle physics as well as post graduates and researchers will continue to find this book a valuable source of learning and reference.



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