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Cosmic Ray Interactions, Propagation, and Acceleration in Space Plasmas

The book consists of four Chapters. Chapter 1 shortly describes main properties of space plasmas and primary CR, different types of CR interactions with space plasmas components (matter, photons, and frozen in magnetic fields). Chapter 2 considers the problem of CR propagation in space plasmas described by the kinetic equation and different types of diffusion approximations (diffusion in momentum space and in pitch-angle space, anisotropic diffusion, anomaly CR diffusion and compound diffusion, the influence of magnetic clouds on CR propagation, non-diffusive CR particle pulse transport). Chapter 3 is devoted to CR non-linear effects in space plasmas caused by CR pressure and CR kinetic stream instabilities with the generation of Alfvén turbulence (these effects are important in galaxies, in the Heliosphere, in CR and gamma-ray sources and in the processes of CR acceleration). In Chapter 4 different processes of CR acceleration in space plasmas are considered: the development of the Fermi statistical mechanism, acceleration in the turbulent plasma, Alfvén mechanism of magnetic pumping, induction mechanisms, acceleration during magnetic collapse and compression, cumulative acceleration mechanism near the zero lines of a magnetic field, acceleration in shear flows, shock-wave diffusion (regular) acceleration. The book ends with a list providing more than 1,300 full references, a discussion on future developments and unsolved problems, as well as Object and Author indexes. This book will be useful for experts and students in CR research, Astrophysics and Geophysics, and in Space Physics.

Contents: Preface. Acknowledgments. Frequently used Abbreviations and Notations.- 1. Cosmic Ray Interactions in Space Plasmas.- 2. Cosmic Ray Propagation in Space Plasmas.- 3. Cosmic Ray Nonlinear Effects in Space Plasmas.- 4. Cosmic Ray Acceleration in Space Plasmas.- Conclusion and Problems.- References. Object Index. Author Index.

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