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MODULATION OF THE ALL-PARTICLE SPECTRUM OF COSMIC RAYS IN AN ANISOTROPIC DIFFUSION APPROACH

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The cosmic ray (CR) spectrum measured at Earth exhibits a knee-like feature around 4 PeV. Recently, a significant number of studies based on the analysis of experimental data from facilities like LHAASO have indicated a potential spatial dependency of this feature. We present a new diffusion model for the propagation of cosmic rays, which accounts for the spatial dependence of spectral features. This model is based on the calculation of anisotropic components of the diffusion tensor within a realistically simulated large-scale galactic magnetic field. The parameters of the model are consistent with the contemporary understanding of the structure of the large-scale galactic magnetic field and the dynamics of small-scale turbulent CR transport. We argue that transitioning to an anisotropic description of CR transport allows for accurately delineating and describing the spatial dependence of the spectral features of CRs. In this study, the authors achieved the following: The modulation of the spectra of galactic cosmic rays (GCRs) in the magnetic rigidity range of 1-30 PV (CR knee) for protons, as well as for medium and heavy nuclei groups, was demonstrated. The spatial variation of this phenomenon has been investigated. The observed modulation of the spectrum is explained by changes in the leakage mechanism.

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