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Effect of the regular galactic magnetic field on the propagation of galactic cosmic rays in the Galaxy

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Supernova remnants (SNRs) are believed to be the sources of galactic cosmic rays (GCRs). Occurrences of supernovae are obviously discrete in both space and time. Hence we have to take into account this discreteness of the SN occurrences when we investigate the propagation process of GCRs from parent SNRs to the solar system. Recently, we proposed a new and fully three-dimensional numerical method with stochastic differential equations to calculate the age distribution and the path length distribution (PLD) of GCRs reflecting the discreteness of the SN occurrences (Miyake, Muraishi, and Yanagita, A&A, 573, 2015). The resultant age and the energy dependence of B/C calculated from the obtained PLD by the weighted slab model are consistent with recent observations. These findings were obtained under a simplified assumption of an isotropic diffusion model for the propagation of GCR neglecting the effects anticipated from an anisotropic diffusion under the interstellar magnetic field (ISMF). It may be interesting to see the effects of the ISMF on the propagation processes of GCR.

In this study, we have investigated numerically the propagation process of GCRs in the Galaxy with the regular ISMF proposed by Jansson and Farrar (ApJ, 757, 2012). Here we assume the spatial diffusion process is anisotropic with respect to the direction of the regular ISMF. We also assume the spatial diffusion coefficient is inversely proportional to the strengths of the ISMF. We found that significantly larger values of the diffusion coefficient depending on the degree of anisotropy were required to reproduce the observed energy dependence of the B/C ratio. The expected energy dependence of the age and the PLD are also affected by the changes in values of the anisotropic diffusion coefficients. The details of these results will be presented.

Collaboration

– not specified –

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