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Galactic Cosmic Rays Modulation near Heliopause from Numerical Simulations

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We investigate the possibility of the modulation of galactic cosmic ray (GCR) in the outer heliosheath (OHS) by means of the numerical simulations. The transport of GCR in the heliosphere is simulated by solving the Parker transport equation through a stochastic method, and the plasma background of the heliosphere is obtained from a global MHD-neutral simulation. The results confirm that no modulation effects are observed in the OHS due to the weak scattering of GCR particles by the fluctuation in the local interstellar magnetic field (LIMF). It is reasonable to assume that the heliopause is a free escape boundary for GCR. Moreover, we carry out the simulations to approximate the recent observed sudden step-like increase of GCR flux during the heliopause crossing of Voyager 1. The results indicate that the extremely small cross-field GCR transport in the OHS may hinder most of the GCR particles outside of the heliosphere. Drifts along heliopause and heliospheric current sheet enhance the inward GCR transport from the OHS, leading to the increase of GCR intensity inside heliosphere. The formed sharp step-like increase in GCR flux near the heliopause agrees with the recent Voyager 1 observations.

Collaboration

– not specified –

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682

Primary author: Dr GUO, Xiaocheng (University of Alabama in Huntsville)**Co-author:** Prof. FLORINSKI, Vladimir (University of Alabama in Huntsville)**Presenter:** Dr GUO, Xiaocheng (University of Alabama in Huntsville)**Session Classification:** Parallel SH 02 Outer Helio**Track Classification:** SH-TH