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On the Cross-Field Diffusion of Galactic Cosmic Rays into the Magnetic Flux Rope

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A Coronal Mass Ejection (CME) associated with an X17 solar flare reached Earth on October 29, 2003, causing an 11 % decrease in the intensity of high-energy galactic cosmic rays recorded by the prototype muon detector network. The CME also produced a strong enhancement of the directional anisotropy in the cosmic ray intensity. Based upon an expanding cylinder model, we use the anisotropy data to derive the three-dimensional geometry of the cosmic ray depleted region formed behind the interplanetary shock in this event. We find that the derived geometry of the cosmic ray cylinder is fairly consistent with that derived independently from the *in situ* interplanetary magnetic field observation using the Magnetic Flux Rope (MFR) model [1]. On the other hand, the cosmic ray cylinder model assumes a priori the Gaussian distribution of cosmic ray density as a function of the radial distance from the cylinder axis. The analysis of the cross-field diffusion of cosmic rays into the MFR, however, tells us that the distribution is better described by the Bessel function with the time dependent amplitude [2]. We fit this new model to the intensity decrease recorded during the MFR period, aiming to obtain the observational constraint on the magnitude of the cross-field diffusion coefficient.

References

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