CME geometry derived from the network observation of the galactic cosmic ray intensity 3

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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 muon detectors. The CME also produced a strong enhancement of the cosmic ray directional anisotropy. 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 shock in this event. We find that the derived geometry is well consistent with that derived independently from the in-situ interplanetary magnetic field (IMF) observations using a Magnetic Flux Rope model. On the other hand, the cosmic ray cylinder model assumes a priori the Gaussian distribution of cosmic ray density as a function of radial distance from the cylinder axis. By analyzing the perpendicular diffusion of cosmic rays into an expanding cylinder, we show that the distribution function is better described by the Bessel function with the time dependent magnitude. We fit this new model to the intensity decrease recorded during the Magnetic Flux Rope period, aiming to derive the observational constraint on the magnitude of the perpendicular diffusion coefficient.