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A possible approach to three-dimensional cosmic-ray propagation in the Galaxy IV. Electrons and electron-induced gamma-rays

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Based on the diffusion-halo model for cosmic-ray (CR) propagation, including stochastic reacceleration due to collisions with hydromagnetic turbulence, we study the behavior of the electron component and the diffuse γ-rays (Dγ's) induced by them. The galactic parameters appearing in these studies are essentially the same as those appearing in the hadronic CR components, while we additionally need information on the interstellar radiation field, taking into account dependences on both the photon energy, $E_{\scriptsize {ph}}$, and the position, $\vct{r}$. We compare our numerical results with the data on hadrons, electrons and Dγ's, including the most recent results from FERMI, which gives two remarkable results; 1) the electron spectrum falls with energy as E_e^{-3} up to 1\,TeV, and does not exhibit prominent spectral features around 500\,GeV, in contrast to the dramatic excess appearing in both ATIC and PPB-BETS spectra, and 2) the EGRET GeV-excess in the Dγ spectrum is due neither to an astronomical origin (much harder CR spectrum in the galactic center) nor a cosmological one (dark matter annihilation or decay), but due to an instrumental problem. In the present paper, however, we focus our interest rather conservatively upon the internal relation between these three components, using {\it common} galactic parameters. We find that they are in reasonable harmony with each other within both the theoretical and experimental uncertainties, apart from the electron-anomaly problem, while some enhancement of Dγ's appears in the high galactic latitude with $|b| > 60^\circ$ in the GeV region.

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