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Fermi-LAT detection of extended gamma-ray emission in the vicinity of SNR G045.7–00.4: evidence for escaping cosmic rays interacting with the surrounding molecular clouds

We present the analysis of Fermi Large Area Telescope (LAT) data of the gamma-ray emission in the vicinity of a radio supernova remnant (SNR), G045.7–00.4. To study the origin of the gamma-ray emission, we also make use of the CO survey data of Milky Way Imaging Scroll Painting to study the massive molecular gas complex that surrounds the SNR. The whole size of the GeV emission is significantly larger than that of the radio morphology. Above 3 GeV, the GeV emission is resolved into two sources: one is spatially consistent with the position of the SNR with a size comparable to that of the radio emission, and the other is located outside of the western boundary of the SNR and spatially coincident with the densest region of the surrounding molecular cloud. We suggest that the GeV emission of the western source may arise from cosmic rays (CRs) which have escaped the SNR and illuminated the surrounding molecular cloud. We find that the gamma-ray spectra of the western source can be consistently explained by this scenario with a total energy of $\sim 10^{50}$ erg in escaping CRs assuming the escape is isotropic.

Summary

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