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# Gas and Cosmic-Ray Properties in the MBM 53-55 Molecular Clouds and the Pegasus Loop as Revealed by HI Line Profiles, Dust, and Fermi-LAT Gamma-Ray Data

*Friday 14 October 2022 10:00 (15 minutes)*

Although diffuse gamma-ray emission is a powerful probe to study the interstellar medium (ISM) and Galactic cosmic rays (CRs), the uncertainty of the interstellar gas density has always been an issue. To overcome this difficulty, we newly used a component decomposition of the 21-cm HI line emission and used the resulting gas maps in an analysis of gamma-ray data for the MBM 53, 54, and 55 molecular clouds and the Pegasus loop. First, we decomposed the ISM gas into several phases using detailed correlations with the HI line profiles from the HI4PI survey, the Planck dust-emission model, and the Fermi-LAT gamma-ray data. Then, we fitted the CR spectra directly measured at/near the Earth and the measured gamma-ray emissivity spectrum simultaneously. In the analysis, the Fermi-LAT data has played a crucial role as a robust tracer of the total ISM gas density and CR intensity. On the ISM side, we found the fraction of optical depth correction to the HI column density and CO-dark H2 to be nearly equal. On the CR side, we obtained a spectral break in the interstellar proton spectrum at about 7 GeV and found the gamma-ray emissivity normalization agrees with the AMS-02 spectrum within 10%. In this contribution, we will present the analysis/results based on the paper recently accepted (arXiv:2207.00214).

## Track

Diffuse

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