

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

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In studying the interstellar medium (ISM) and Galactic cosmic rays (CRs), uncertainty of the interstellar gas density has always been an issue. To overcome this difficulty, we newly considered HI line profiles in the analysis of gamma-ray data from the Fermi Large Area Telescope (LAT) for the MBM 53, 54, and 55 molecular clouds and the Pegasus loop. We decomposed the ISM gas into intermediate-velocity clouds, cold and optically thick HI, warm and optically thin HI, CO-bright H<sub>2</sub>, and CO-dark H<sub>2</sub> using detailed correlations with the HI line profiles from the HI4PI survey, the Planck dust-emission model, and the Fermi-LAT gamma-ray data. We then fitted the CR spectra measured directly at/near the Earth and the measured gamma-ray emissivity spectrum simultaneously to constrain the local interstellar spectrum. In this contribution, we will present the analysis, and discuss the obtained CR and ISM gas properties.

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Gamma rays

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