

A study of gamma-rays from local Giant Molecular Clouds and its implications on the cosmic-ray flux

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The spectral properties of the cosmic-ray (CR) spectrum in the interstellar medium can be understood by comparing the results of gamma-ray observation with the direct local CR measurements. Among the best candidates for such studies are giant molecular clouds (GMCs) of the Gould Belt star formation region, since these clouds are usually located outside of the Galactic plane where associated γ -ray emission can be easily discriminated from the Galactic diffuse emission.

Based on Fermi-LAT and HAWC data, we report the average CR spectrum of seven nearby GMCs using the Planck dust opacity map as a spatial template. We find that this spectrum in Fermi-LAT's 3-1000 GeV range is well described by a power-law with a spectral index of 2.70 ± 0.01 and the normalization of the spectrum is slightly higher than one expected from direct measurements of local CRs by the AMS02 experiment, which can imply non-homogeneous distribution of CRs at least within 1 kpc of the Local Galaxy. In addition to this, we also present combined limits in HAWC's 1-100 TeV energy range with 95% C.I. using ~ 3 years of data.

Author: Dr BAGHMANYAN, Vardan (Institute of Nuclear Physics PAN)

Co-author: Dr AYALA SOLARES, Hugo Alberto (The Pennsylvania State University)

Presenter: Dr BAGHMANYAN, Vardan (Institute of Nuclear Physics PAN)

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