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Dissecting the Diffuse Gamma-Ray Emission of the Galaxy with the HAWC Observatory

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Galactic diffuse gamma-ray emission is the radiation produced by the interaction of high-energy cosmic rays propagating through the Milky Way with the interstellar gas and radiation fields. Its measurement allows for crucial insights into the acceleration and transport of cosmic rays throughout our Galaxy.

Here, we present a new analysis of the TeV Galactic diffuse gamma-ray emission using 8 years of HAWC data. This data was processed with the updated Pass 5 processing, enhancing the sensitivity and resolution of the instrument. For the analysis, we make use of Gammapy, an open-source package for gamma-ray astronomy, and recent models of the Galactic diffuse emission at TeV energies.

After subtracting the emission from sources using an algorithm akin to that developed for the foreseen CTAO Galactic plane survey, we find significant remaining emission throughout the galactic plane. We show the latitudinal and longitudinal flux and emissivity profiles of the emission in multiple parts of the galaxy and compare to existing models. We find significant emission beyond 3 degree latitude, consistent in shape with the prediction for the interaction of cosmic rays with the interstellar gas.

We also demonstrate that our results are consistent with recent LHAASO results when equivalent analysis methods are used.

Finally, we discuss various systematic uncertainties related to, among others, the source contamination of the measured diffuse emission and the anisotropy in the arrival direction of background cosmic rays.

Collaboration(s)

HAWC Collaboration

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