

Searching for Dark Matter Annihilation in the Milky Way Halo at High Latitudes

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The Milky Way halo is the brightest source of dark matter annihilation on the sky. Indeed, the potential strength of the Galactic dark matter signal can supersede that expected from dwarf galaxies and galaxy groups even in regions away from the Inner Galaxy. We present the results of a search for dark matter annihilation in the smooth Milky Way halo for $|b| > 20^\circ$ and $r < 50^\circ$ using 413 weeks of Fermi Pass 8 data within the energy range of $\sim 0.8\text{--}50$ GeV. We exclude thermal dark matter with mass below ~ 70 GeV that annihilates to $b\bar{b}$ at the 95% confidence level using the p6v11 cosmic-ray foreground model, providing the strongest limits on the annihilation cross section in this mass range. These results exclude the region of dark matter parameter space that is consistent with the excess of $\sim \text{GeV}$ photons observed at the Galactic Center for the $b\bar{b}$ annihilation channel and, for the first time, put the $\tau^+\tau^-$ explanation under tension. We explore how these results depend on uncertainties in the foregrounds by varying over a set of reasonable models.

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