High Energy Physics - Phenomenology

Constraints on Enhanced Dark Matter Annihilation from IceCube Results

Ivone F. M. Albuquerque, Leandro J. Beraldo e Silva, Carlos Pérez de los Heros

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Excesses on positron and electron fluxes measured by ATIC, and the PAMELA and Fermi--LAT telescopes can be explained by dark matter annihilation in our Galaxy. However, this requires large boosts on the dark matter annihilation rate. There are many possible enhancement mechanisms, such as the Sommerfeld effect or the existence of dark matter clumps in our halo. If enhancements on the dark matter annihilation cross section are taking place, the dark matter annihilation in the core of the Earth should also be enhanced. Here we use recent results from the IceCube 40-string configuration to probe generic enhancement scenarios. We present results as a function of the dark matter-proton interaction cross section, $\sigma_{\chi p}$ weighted by the branching fraction into neutrinos, $f_{\nu\bar{\nu}}$, as a function of a generic boost factor, B_F, which parametrizes the expected enhancement of the annihilation rate. We find that dark matter models which require annihilation enhancements of $\mathcal{O}(100)$ or more and that annihilate significantly into neutrinos are excluded as the explanation for these excesses. We also determine the boost range that can be probed by the full IceCube telescope.

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