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Investigating what the Milky Way's dwarfs have to tell us about the Galactic Center extended excess

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The Milky Way's Galactic Center may harbor the signal of annihilating dark matter in a gamma-ray excess, though dwarf galaxies remain dark in their expected commensurate emission. We incorporate Milky Way dark matter halo profile uncertainties, as well as an accounting of diffuse gamma ray emission uncertainties in dark matter annihilation models for the Galactic Center Extended gamma-ray excess (GCE) detected by the Fermi Gamma Ray Space Telescope. The range of particle annihilation rate and masses expand when including these unknowns. However, two of the most precise empirical determinations of the Milky Way halo's local density and density profile leave the signal region to be in considerable tension with dark matter annihilation searches from combined dwarf galaxy analyses for single-channel dark matter annihilation models. Accordingly, we quantify this tension in a joint likelihood analysis. We also show that astrophysical models and a representative self-interacting dark matter model avoid the tensions between the GCE signal and lack of a signal from the dwarfs. Since these arguments disfavor the interpretation of the GCE as prompt annihilation of dark matter, we set limits on the cross section for that process.

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