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Strong constraints on thermal relic dark matter from Fermi-LAT observations of the Galactic Center

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The extended excess towards the Galactic Center (GC) in gamma rays inferred from Fermi-LAT observations has been interpreted as being due to dark matter (DM) annihilation. In a recent paper my collaborators and I performed a new likelihood analyses of the GC and showed that when including templates for the stellar galactic and nuclear bulges, the GC shows no significant detection of a DM annihilation template, even after generous variations in the Galactic diffuse emission (GDE) models and a wide range of DM halo profiles. We include Galactic diffuse emission models with combinations of 3D inverse Compton maps, variations of interstellar gas maps, and a central source of electrons. For the DM profile, we include both spherical and ellipsoidal DM morphologies and a range of radial profiles from steep cusps to kiloparsec-sized cores, motivated in part by hydrodynamical simulations. Our derived upper limits on the dark matter annihilation flux place strong constraints on DM properties. In the case of the pure b-quark annihilation channel, our limits on the annihilation cross section are more stringent than those from the Milky Way dwarfs up to DM masses of ~TeV, and rule out the thermal relic cross section up to ~300 GeV. Better understanding of the DM profile, as well as the Fermi-LAT data at its highest energies, would further improve the sensitivity to DM properties.

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