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Searching Accretion-Enhanced Dark Matter Annihilation Signals in the Galactic Centre

Tuesday, 8 October 2024 17:00 (30 minutes)

This study reanalyzes the detection prospects of dark matter (DM) annihilation signals in the Galactic Center, focusing on velocity-dependent dynamics within a spike density near the supermassive black hole (Sgr A⊠). We investigate three annihilation processes –pp-wave, resonance, and forbidden annihilation – under semi-relativistic velocities, leveraging gamma-ray data from Fermi and DAMPE telescopes. Our analysis integrates a fermionic DM model with an electroweak axion-like particle (ALP) portal, exploring annihilation into two or four photons. Employing a comprehensive six-dimensional integration, we precisely calculate DM-induced gamma-ray fluxes near Sgr A⊠, incorporating velocity and positional dependencies in the annihilation cross-section and photon yield spectra. Our findings highlight scenarios of resonance and forbidden annihilation, where the larger ALP-DM-DM coupling constant Caχχ can affect spike density, potentially yielding detectable gamma-ray line spectra within Fermi and DAMPE energy resolution. We set upper limits for Caχχ across these scenarios, offering insights into the detectability and spectral characteristics of DM annihilation signals from the Galactic Center.

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