

Testing the Millisecond Pulsar Scenario of the Galactic Center Gamma-Ray Excess With Very High Energy Gamma-Rays

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Recent analyses of Fermi Large Area Telescope data show an extended GeV γ -ray excess on top of the expected diffuse background in the Galactic center region, which can be explained by annihilating dark matter (DM) or a population of millisecond pulsars (MSPs). We propose observations of very high energy (VHE) γ -rays to distinguish the MSP scenario from the DM scenario. GeV γ -ray MSPs should release most of their energy to the relativistic e^\pm wind, which will diffuse into the Galaxy and radiate TeV γ -rays through inverse Compton scattering and bremsstrahlung processes. By calculating the spectrum and spatial distribution, we show that such emission is detectable with the next generation VHE γ -ray observatory, the Cherenkov Telescope Array (CTA), under reasonable model parameters. It is essential to search for multi-wavelength counterparts to the GeV γ -ray excess in order to solve this mystery in the high-energy universe.

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