Contribution ID: **110** Type: **Talk**

Cherenkov Telescope Array Sensitivity to the Putative Millisecond Pulsar Population responsible for the Galactic Center Excess

Wednesday 21 July 2021 12:24 (12 minutes)

The leading explanation of the *Fermi* Galactic center γ-ray excess is the extended emission from a unresolved population of millisecond pulsars (MSPs) in the Galactic bulge. Such a population would, along with the prompt γ rays, also inject large quantities of electrons/positrons ($e^{\pm}$) into the interstellar medium. These $e^{\pm}$ could potentially inverse-Compton (IC) scatter ambient photons into γ rays that fall within the sensitivity range of the upcoming Cherenkov Telescope Array (CTA). In this talk, I will present the results of an examination of the detection potential of CTA to this signature by making a realistic estimation of the systematic uncertainties on the Galactic diffuse emission model at TeV-scale γ-ray energies. We forecast that, in the event that $e^{\pm}$ injection spectra are harder than E^{-2}, CTA has the potential to robustly discover the IC signature of a putative Galactic bulge MSP population sufficient to explain the GCE for $e^{\pm}$ injection efficiencies in the range $\approx 2.9 - 74.1\%$, or higher, depending on the level of mismodeling of the Galactic diffuse emission components. On the other hand, for spectra softer than $E^{-2.5}$, a reliable CTA detection would require an unphysically large $e^{\pm}$ injection efficiency greater than $\approx 158\%$. However, even this pessimistic conclusion may be avoided in the plausible event that MSP observational and/or modeling uncertainties can be reduced. We further find that, in the event that an IC signal were detected, CTA can successfully discriminate between an MSP and a dark matter origin for the radiating $e^{\pm}$.

Keywords

Galactic Center Excess; Millisecond pulsars; gamma-rays; CTA; dark matter annihilation

Collaboration

other Collaboration

Subcategory

Theoretical Results

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Session Classification: Discussion

Track Classification: Scientific Field: DM | Dark Matter