



Contribution ID: 412

Type: **Talk**

TeV Gamma-Ray Diffuse Emissions in the Galactic Center Region with CTAO LST-1

Monday 21 July 2025 14:05 (15 minutes)

Imaging Atmospheric Cherenkov Telescopes (IACTs), including H.E.S.S., MAGIC, and VERITAS, have detected very-high-energy gamma rays from the central region of the Milky Way. The PeVatron hypothesis posits that the supermassive black hole Sagittarius A* ($Sgr A^*$) accelerates cosmic rays to PeV energies, producing a diffuse gamma-ray emission extending up to tens of TeV across the central molecular zone. However, previous IACT studies have yielded inconsistent results due to methodological differences, complicating direct comparison and interpretation. H.E.S.S. initially suggested a power-law spectrum within the sector-annulus region (20-60 pc) around $Sgr A^*$, whereas the MAGIC telescopes recently presented a 2-sigma hint of a spectral cutoff at ~ 20 TeV for the total ridge emission (~ 200 pc), although H.E.S.S. and VERITAS have not obtained a sign of cut-off for that emission.

The first Large-Sized Telescope (LST-1) at the Northern site of the Cherenkov Telescope Array Observatory (CTAO) offers enhanced TeV sensitivity, despite its higher energy threshold, at large zenith angles. Its wide field of view (~ 4.5 deg) enables more uniform Galactic ridge coverage than other Northern IACTs. In this study, LST-1 observations reconfirm a spectral cutoff around 20 TeV with a significance of about 3 sigma over a pure power law, demonstrating its capability of TeV observations of extended sources and refining our understanding of cosmic-ray acceleration in the Galactic Center.

Collaboration(s)

CTAO LST Project

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Session Classification: GA

Track Classification: Gamma-Ray Astrophysics