Prospects for Observing the Microquasar SS 433 with the LACT Array

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The First LHAASO Collaboration Conference in 2026

arXiv:2510.22776

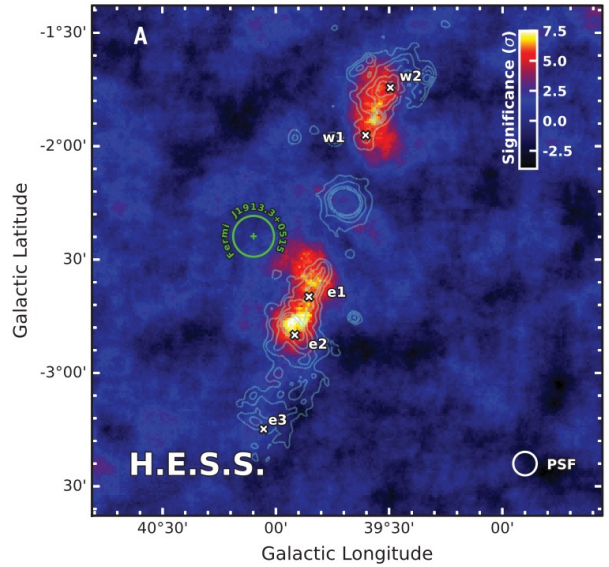
INTRODUCTION

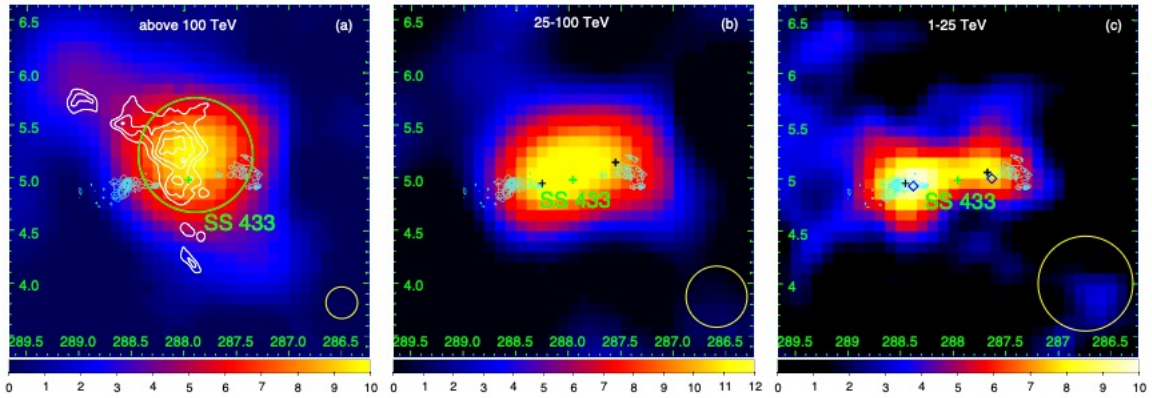
SS433: A Unique Laboratory for High-Energy Astrophysics

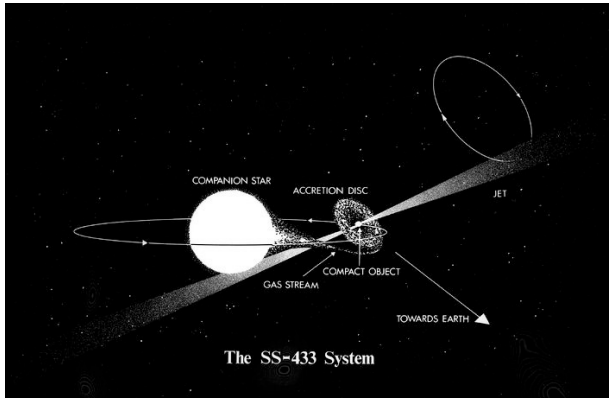
The Archetypal Microquasar: The first-ever discovered microquasar and the only known persistent **super-Eddington** accreting system in the Milky Way.

Relativistic Precessing Jets: Features twin hadronic jets launching at **0.26c** with a unique **162-day precession** period, carving a corkscrew pattern in the W50 nebula.

Galactic PeVatron Candidate: A key target for **VHE/UHE gamma-ray** observations (LHAASO/HAWC), providing a direct link between jet activity and cosmic-ray acceleration.



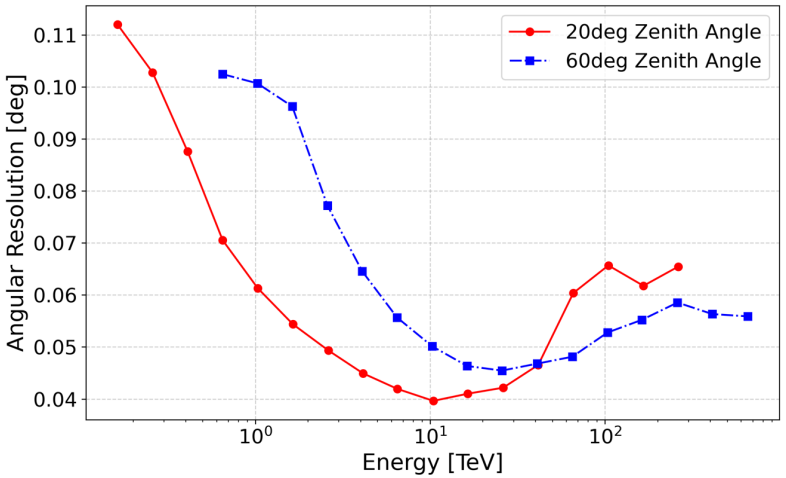




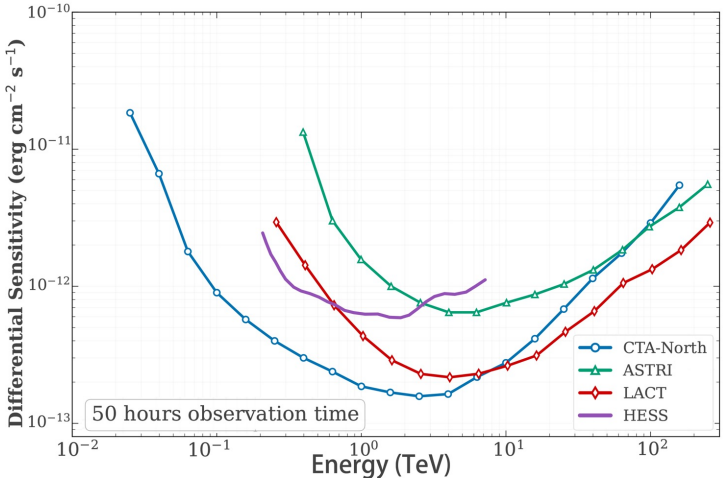
INTRODUCTION

Current instruments are limited by angular resolution or sensitivity at multi-TeV energies, often **blending the central source with the jet structures**.

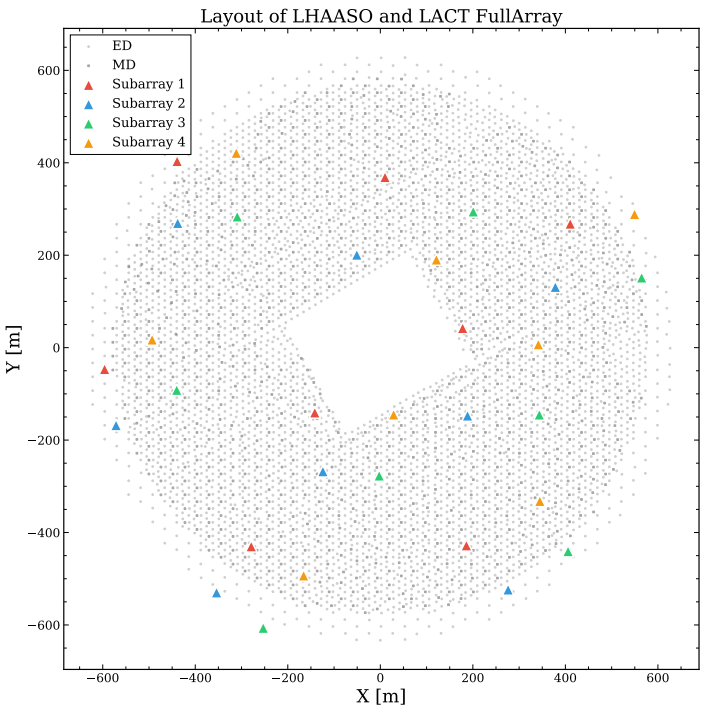
LACT (Large Array of imaging atmospheric Cherenkov Telescopes) is designed with the superior angular resolution and sensitivity needed to **spatially resolve** these structures at multi-TeV energies.

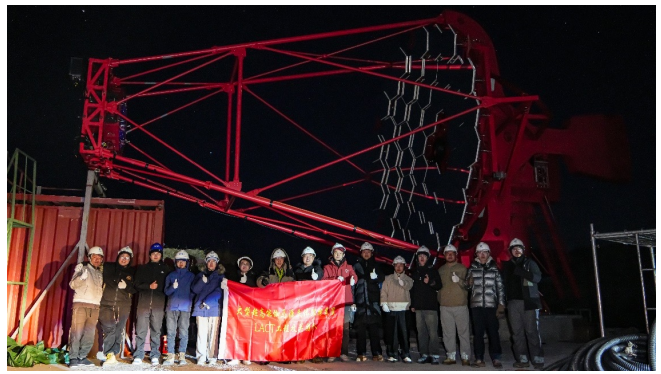


LACT angular resolution



LACT sensitivity
(at 20◦ zenith angle mode)





details see arXiv:2509.20694

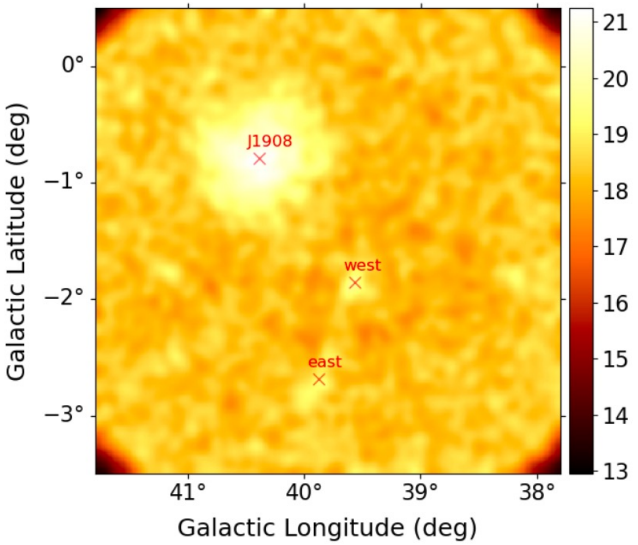
SIMULATION METHODOLOGY

Framework: Data simulation and analysis performed using the **Gammapy** software package.

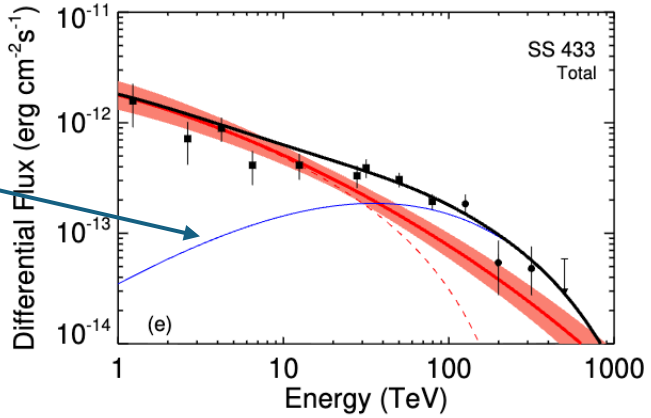
Instrument Modeling: Utilized **LACT IRFs** derived from the 32-telescope configuration as described in **Zhang et al. (2025)**.

Two-Component Jet Model: Based on **H.E.S.S. morphology**, featuring the distinct Eastern and Western jet re-brightening regions.

Central Hadronic Component: Integrated **LHAASO's UHE findings** to model a compact, hadronic-origin PeVatron at the central engine.



A counts map of the SS 433 eastern and western jets from an 100-hour simulated observation



Observational Prospects with LACT

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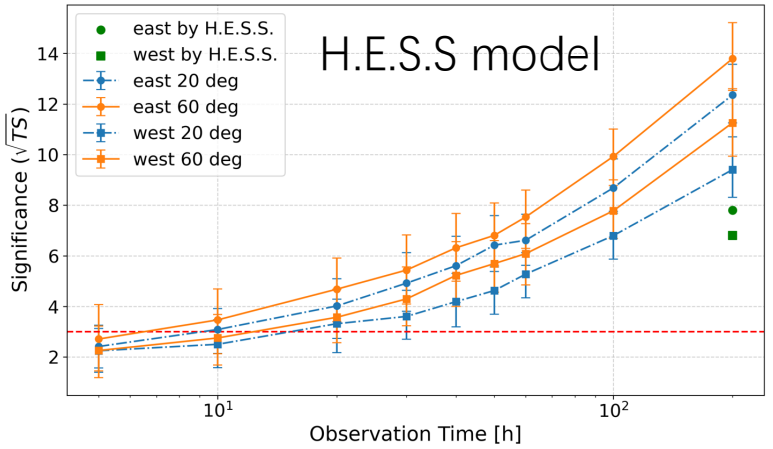
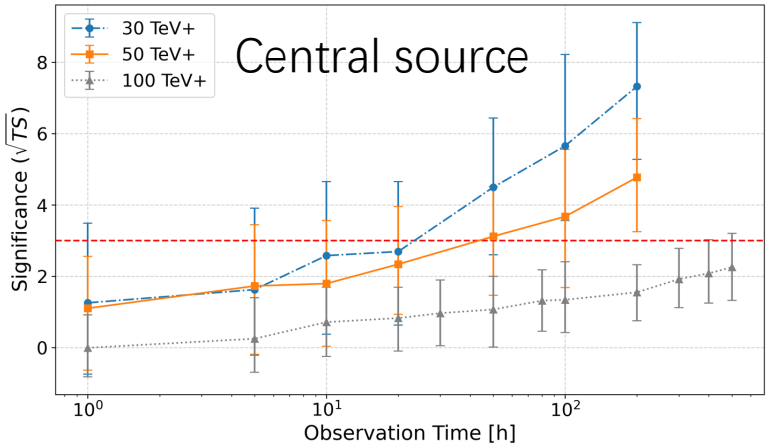
Superior Sensitivity & Resolution:
LACT achieves a 5sigma detection in **~30 hours**.
Its angular resolution allows us to spatially resolve the eastern and western jets from the central engine.
(Oct.- Apr. **160 h+ moonless observation time** per year)

Probing the Hadronic Core: Although photon counts are limited above 100 TeV, the **low-energy extension** of the LHAASO-fitted hadronic spectrum can be detected by LACT in **~100 hours**

This study demonstrates that **LACT's superior sensitivity and resolution** will enable the first spatial resolution of SS 433's jets and, through **synergy with LHAASO**, uniquely identify the hadronic origins of its ultra-high-energy emission.





Thanks