PROCEEDINGS OF SCIENCE

Probing the morphology of the low state gamma-ray emission of M87 with H.E.S.S.

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This work aims to study the very-high-energy (VHE; 100 GeV - 100 TeV) gamma-ray emission from M 87, especially its low state emission, and probe a potential hadronic emission component in the inner Virgo Cluster. Probing a steady and extended gamma-ray signal around M 87 allows us to investigate the AGN feedback as a heating mechanism in the Virgo Cluster. We used High Energy Stereoscopic System (H.E.S.S.) observations of M 87 from 2004 to 2021 to study the source. We utilized the Bayesian block technique to identify M 87 emission states and isolate its low state. We fitted the morphology of the 120 h low state data and found no significant gamma-ray extension. We derived an upper limit on the extension that for the first time excludes the radio lobes (≈30 kpc) as the main component of the VHE gamma-ray emission from the low state of M 87. The VHE gamma-ray emission from the distinct source states of M 87 are compatible with each other and with the radio core of M 87. Based on two different models we constrained the maximum cosmic-ray to thermal pressure ratio and the total energy in CRp in the inner 20 kpc of the Virgo Cluster [1].

38th International Cosmic Ray Conference (ICRC2023)
26 July - 3 August, 2023
Nagoya, Japan

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PoS(ICRC2023)696

References

[1] Aharonian, F., Benkhali, F. A., Arcaro, et al. 2023, Constraining the cosmic-ray pressure in the inner Virgo Cluster using H.E.S.S. observations of M 87, A&A, 675, A138.https://ui.adsabs.harvard.edu/abs/2023A%26A...675A.138H/abstract