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Characterization of Galaxy Cluster Gamma-Rays.

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Barring a few potential exceptions, galaxy clusters (GC) are not confirmed gamma-ray sources despite theoretical expectations. We use 16 years of Fermi-LAT data to characterize the gamma-ray emission of a population of GC selected from the Planck Sunyaev-Zeldovich catalog. We employ a likelihood stacking technique to uncover the cumulative gamma-ray signal from this population. The stack of 207 target clusters significantly exceeds the cumulative likelihood of a large control field sample. Refitting our targets as extended sources consistently increases the likelihoods, indicative of large-scale GC emission rather than point source contamination. We also create a stacked spectral energy distribution (SED) and perform likelihood-based correlation analyses between the gamma-ray luminosities and X-ray data. We compare the SED to physical models to gauge the balance between hadronic and leptonic processes, gain insight into the role of cosmic rays in GC evolution, and the nature of cosmic ray acceleration in GC.

References

A stacking survey of gamma-ray pulsars, Song Y., Paglione T. A. D., Tan J., Lee-Georgescu C., Herrera D., 2023,

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