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The Potential of Muon Telescopes in Multi-Messenger Astronomy

Muon telescopes, distributed worldwide, serve as ground-based particle detectors that are simple, cost-effective, and highly robust. They typically consist of planes made from plastic scintillators or resistive plate chambers. Positioned on the Earth's surface, these detectors are mainly sensitive to secondary muons, which originate from the interactions of primary cosmic rays with the upper atmosphere.

Currently, the global network of muon telescopes is a valuable tool for monitoring solar activity, which modulates the flux of primary cosmic rays and transients such as coronal mass ejections producing solar energetic particles and Forbush decreases.

Beyond solar physics, muon telescopes may also have potential applications in multi-messenger astronomy. High-energy astrophysical events, producing gamma-ray bursts, high-energy neutrinos, and gravitational waves, could leave detectable imprints in the muon telescope network. Analyzing these signals may unveil unexpected properties of astrophysical sources.

This study examines the counting rate of the YangBaJing muon telescope, investigating possible correlations with GRB-221009A and KM3-230213A, the most energetic gamma-ray burst and neutrino event ever recorded, respectively. A preliminary analysis of the statistical significance of these signals is conducted, highlighting the importance of establishing a global network of muon telescopes with publicly available data to enhance similar multi-messenger studies.

Collaboration(s)

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