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Searching for UHECR-associated gamma-ray sources with LHAASO-WCDA

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The origin of ultra-high-energy cosmic rays (UHECRs; >10 EeV) is unknown. Gamma-rays and neutrinos produced in CR-induced hadronic interactions can serve as the smoking gun pointing back to sources. Motivated by the fact that IceCube-measured diffuse TeV neutrino flux is comparable to Waxman-Bahcall bound derived from the detected UHECR flux, we assume a common origin of UHECRs and TeV neutrinos, and expect TeV hadronic gamma-rays associated with UHECRs as well, the detection probability of which depends on UHECR source density. Here we use LHAASO-WCDA to search for TeV gamma-rays associated with UHECRs. A detailed data analysis based on LHAASO-WCDA sky map and UHECR events detected by Telescope Array results in non-detection of gamma-ray signals. A lower limit is put on the source number density, $n_s > 10^{-3.5} \text{ Mpc}^{-3}$, with 95% C.L.

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