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Enhanced Searches with the Pierre Auger Observatory in the Era of Multi-messenger Astrophysics

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The discovery of ultra-high energy (UHE) photons, whose production is expected through cosmic-ray interactions with the source environment, would allow the identification of the astrophysical sources of UHE cosmic rays and unveil many of the mysteries surrounding their production and propagation. The field of high energy photons has had, in the last year, a couple of exciting findings with detections up to a few PeVs. These detections both motivate the search of higher energy photons, further complete the galactic picture for high energy sources and make future multi-messenger studies that more promising. Above these energies, a photon has ever been detected. Fast radio bursts (FRBs) are mysterious radio signals, typically from extragalactic origin, with energy densities upon emission that are predicted to exceed 10^4 erg. A theoretical model for FRB emission by a flaring magnetar, also predicts the emission of high energy photons with energies between 10^{12} - 10^{17} eV. This research work intends to explore the field of high energy photon detection for $E_\gamma > 10^{16}$ eV to help to complete the multi-messenger picture of the most powerful accelerators of the galaxy and study the never before assessed association between FRBs and photons with energies higher than 10^{16} eV.

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