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Searches for ultra-high-energy photons with the Pierre Auger Observatory

The Pierre Auger Observatory, the largest air-shower experiment in the world designed to investigate ultrahigh-energy (UHE, E

 $gtrsim10^{17}$ eV) cosmic rays, offers unparalleled sensitivity to UHE photons. These are expected from interactions of UHE cosmic rays with background radiation fields, as well as from more exotic scenarios such as the decay of super-heavy dark matter (SHDM) particles. They may also originate in the environment of cosmic-ray sources, making their detection instrumental for multi-messenger studies of cosmic-ray acceleration and transient astrophysical phenomena. In this contribution, we present the search for photons above $10^{16.7}$ eV exploiting high-quality data from the Pierre Auger Observatory. These analyses yield the most stringent upper limits on the diffuse flux of UHE photons, placing strong constraints on astrophysical models and exotic scenarios such as SHDM decay. We also report on targeted searches in coincidence with gravitational wave events detected by LIGO/Virgo, underscoring the pivotal role of the Observatory in advancing multimessenger astronomy at the highest energies. Improved sensitivity is foreseen by exploiting the new data from the Pierre Auger Observatory upgrade, AugerPrime.

Secondary track

Authors: Dr GONZALEZ PINTOS, Nicolas Martin (Universitá degli studi di Torino - INFN Sezione di Torino); COL-LABORATION, The Pierre Auger

Presenter: Dr GONZALEZ PINTOS, Nicolas Martin (Universitá degli studi di Torino - INFN Sezione di Torino)

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