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Investigating upward-going showers using the Fluorescence Detector of the Pierre Auger Observatory

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The Pierre Auger Collaboration has performed a dedicated search for upward-going air showers using the Fluorescence Detector (FD), motivated by the two “anomalous” radio pulses reported by the ANITA experiment that are difficult to reconcile with expectations from the Standard Model. While ultrahigh-energy (UHE) neutrinos can traverse the Earth and initiate Earth-skimming showers interacting just beneath the surface, the steep exit angles observed in the ANITA events are inconsistent with this mechanism. To investigate a possible connection, we carried out extensive simulations to estimate the FD sensitivity to upward-going signals. Also, we used downward-going proton-initiated air showers to model the background due to not well-reconstructed showers. In this contribution, we present the methodology adopted for signal and background modelling and report the search results based on approximately 14 years of FD data collected between 2004 and 2018. We found only one candidate, consistent with the expected background, enabling us to set an upper limit on the flux of upward-going air showers. A comparison of the Auger exposure and an analytical estimate of the ANITA exposure shows that over eight events would be expected, even assuming a conservative E^{-5} spectrum. This tension disfavors the interpretation of ANITA “anomalous” events as upward-going air showers, placing constraints on Beyond Standard Model explanations.

Secondary track

T03 - Neutrino Physics

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