

A tau scenario application to a search for upward-going showers with the Fluorescence Detector of the Pierre Auger Observatory

Executive Summary



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What is this contribution about?

Upper flux limits have been set in the context of steeply up-going air showers induced by τ -leptons using the Fluorescence Detector (FD) of the Pierre Auger Observatory.

Why is it relevant/interesting?

Recent observations of two coherent radio pulses by the ANITA detector can be interpreted as steeply upward-going cosmic-ray showers and remain unexplained. Several Beyond Standard Model (BSM) interpretations resulting in the creation of τ -leptons have been proposed. The Pierre Auger Observatory allows to verify the ANITA observation and to test the proposed interpretations

What has been done?

τ -leptons have been simulated using the *NuTauSim* code as a base, in order to obtain the distribution of possible τ -induced air showers in the field of view of the FD, in terms of shower energy and height of first interaction. The resulting distribution is folded together with the double differential exposure of the Observatory to up-going events to obtain the observatory's exposure to up-going τ -induced air showers. This is further used to calculate limits on the flux of steeply up-going τ showers at the Earth's surface.

What is the result?

A single event passed all selection criteria, which is consistent with the expected experimental background of 0.5 events. Therefore, upper flux limits to up-going τ -induced air showers have been set, which account for the observed event. As a result we find energy dependent flux limits as low as $9.82 \cdot 10^{-10} \text{ GeV cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$ for a τ primary energy in the range of $\lg E_0/\text{eV} \in [18.75, 18.875]$.

