

# Study on multi-ELVES in the Pierre Auger Observatory

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Since 2013, the four sites of the Fluorescence Detector (FD) of the Pierre Auger Observatory record ELVES with a dedicated trigger. These UV light emissions are correlated to distant lightning strikes. The length of recorded traces has been increased from 100  $\mu\text{s}$  (2013), to 300  $\mu\text{s}$  (2014-16), to 900  $\mu\text{s}$  (2017-present), to progressively extend the observation of the light emission towards the vertical of the causative lightning and beyond. A large fraction of the observed events shows double ELVES within the time window, and, in some cases, even more complex structures are observed. The nature of the multi-ELVES is not completely understood but may be related to the different types of lightning in which they are originated. For example, it is known that Narrow Bipolar Events can produce double elves, and Energetic In-cloud Pulses, occurring between the main negative and upper positive charge layer of clouds, can induce double and even quadruple ELVES in the ionosphere. This report shows the seasonal and daily dependence of the time gap, amplitude ratio, and correlation between the pulse widths of the peaks in a sample of 1000+ multi-ELVES events recorded during the period 2014-20. The events have been compared with data from other satellite and ground-based sensing devices to study the correlation of their properties with lightning observables such as altitude and polarity.

## Keywords

## Collaboration

Auger

## other Collaboration

## Subcategory

Experimental Results

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