## Workshop on Machine Learning for Cosmic-Ray Air Showers



UNIVERSITY OF DELAWARE BARTOL RESEARCH INSTITUTE

Contribution ID: 34

Type: Talk

## Extraction of the Muon Signals Recorded with the Surface Detector of the Pierre Auger Observatory Using Recurrent Neural Networks

Wednesday, 2 February 2022 11:30 (30 minutes)

We present a method based on the use of Recurrent Neural Networks to extract the muon component from the time traces registered with water-Cherenkov detector (WCD) stations of the Surface Detector of the Pierre Auger Observatory. With the current design of the WCDs it is not straightforward to separate the contribution of muons to the time traces from those of photons, electrons and positrons in cosmic ray showers dominated by electromagnetic particles. Separating the muon and electromagnetic components is crucial for determining the nature of the primary cosmic ray and properties of hadronic interactions at ultra-high energies. We trained the neural network to extract the muon and the electromagnetic components from the WCD traces using a large set of simulated air showers, with energies between  $10^{18.5}$  eV and  $10^{20}$  eV and zenith angles below 60 degrees. The performance of this method is studied on experimental data of the Pierre Auger Observatory. It is shown that the predicted muon lateral distributions agree with the parameterizations obtained by the AGASA collaboration.

## **Type of Contribution**

talk

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