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Measurement of the high-energy muon multiplicity in cosmic-ray air showers with IceTop and IceCube using neural networks

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The IceTop and IceCube detectors at the South Pole provide the opportunity to simultaneously measure the electromagnetic and low-energy muonic component of a cosmic-ray air shower at the surface, and the penetrating muons in the deep ice. Various properties of the bundle of muons above several 100 GeV measured in IceCube are sensitive to the mass of the primary cosmic ray and contain information about the hadronic physics of the first interactions in the atmosphere. By combining a maximum-likelihood reconstruction of the energy loss of the muon bundle with a simple Convolutional or Recurrent Neural Network, the multiplicity of muons above a certain energy threshold in the shower can be estimated with reasonable accuracy. Along with information on the electromagnetic shower component as measured by IceTop, this opens the possibility for a measurement of the evolution of the average high-energy muon content of air showers with primary energies from PeV to EeV.

Type of Contribution

talk

Primary authors: VERPOEST, Stef (University of Gent); THE ICECUBE COLLABORATION

Presenter: VERPOEST, Stef (University of Gent)

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