



Contribution ID: 559

Type: **Talk**

Advances in reconstructing the cosmic-ray energy spectrum with IceTop

Wednesday 23 July 2025 15:19 (15 minutes)

The IceTop array at the surface of the IceCube Neutrino Observatory measures extensive air showers produced by cosmic-ray particles with energies from PeV up to EeV, covering the transition region from galactic to extragalactic sources. This contribution presents significant improvements that will enhance the measurement of the IceTop energy spectrum. (I) To analyze more than a decade of data with increasing snow overburdens on the detector, an improved method to handle the time-dependent attenuation of the detector signals was developed. (II) New analysis cuts have been developed to increase the measured event rate while improving the reconstruction quality. (III) A new reconstruction that separately fits the electromagnetic and muonic components and includes information from the in-ice detector to reconstruct the geometry of an air shower allows for the reconstruction of more air showers than was previously possible: those landing outside of IceTop's boundaries up to distances of 2300m and zenith angles up to 60°. These improvements will significantly increase the event statistics and extend the IceTop spectrum towards higher energies.

Collaboration(s)

IceCube

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Session Classification: CRI

Track Classification: Cosmic-Ray Indirect