

## Testing of the EPOS LHC, QGSJET01, QGSJETII-03 and QGSJETII-04 hadronic interaction models via help of the atmospheric vertical muons spectra

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The recent results of the very precise measurements of the primary cosmic protons and helium nuclei energy spectra by AMS-02, PAMELA, CREAM, ATIC-2 and some other collaborations and some rather accurate estimates of these proton and helium nuclei energy spectra generated in SNR allow us to elaborate the new high accuracy original approximation of the primary nucleon energy spectra. As the accuracy of this approximation is rather high we can use it to test various models of hadronic interactions with the help of atmospheric muon energy spectra. The atmospheric vertical muon energy spectra have been calculated in terms of the EPOS LHC, QGSJET01, QGSJETII-03 and QGSJETII-04 models in the energy range  $10^2 \div 10^5$  GeV with help of the CORSIKA package and this new approximation of the primary nucleon spectrum. Results of calculations have been compared with the muon spectra observed by collaborations L3+Cosmic, LVD and MACRO. The analysis has shown that all models predict approximately two times lower intensity of the muon energy spectra. As these muons are products of decays of the most energetic  $\pi^\pm$  and  $K^\pm$  mesons in the atmosphere, we can conclude that production of these  $\pi^\pm$  and  $K^\pm$  mesons is underestimated by EPOS LHC, QGSJET01, QGSJETII-03 and QGSJETII-04 models.

**Primary author(s) :** Mr. LUKYASHIN, Anton (ITEP, NRNU MEPhI); Mrs. FEDOROVA, Galina (SINP MSU); Prof. DEDENKO, Leonid (Moscow State University, Faculty of Physics, Skobeltsyn Institute of Nuclear Physics); Prof. ROGANOVA, Tatiana (SINP MSU)

**Presenter(s) :** Mr. LUKYASHIN, Anton (ITEP, NRNU MEPhI)

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