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Influence of hadronic interaction models on characteristics of the high-energy atmospheric neutrino flux

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The results for the high-energy conventional atmospheric neutrino fluxes calculated with usage of hadronic interaction models (QGSJET, SIBYLL, EPOS-LHC) display appreciable discrepancy supposedly due to difference in predictions of kaons production in nucleon-nucleus collisions. Above 100 TeV calculated spectra of muon neutrinos show the apparent dependence on the spectrum and composition of primary cosmic rays around to the knee. At energies above 1 PeV additional uncertainties appear due to production of charmed particles and also from the high-energy models of primary cosmic ray spectra which imprint on the prompt neutrino flux.

Basing on this calculation we study the influence of hadron-nuclear interactions on the neutrino-to-antineutrino flux ratios $\nu_e/\bar{\nu}_e, \nu_\mu/\bar{\nu}_\mu$ and the neutrino flavor ratio $(\nu_\mu+\bar{\nu}_{\mu)})/(\nu_e+\bar{\nu}_e)$. These neutrino flux characteristics are sensitive to π^+/π^-, K^+/K^- and π/K ratios, depending on cross-sections of the meson production in hA-collisions. The cosmic-ray composition due to p/n ratio also affects the hadronic cascade evolution and neutrino ratios.

The comparison of predicted neutrino spectra with the latest exprimental data justifies reliability the performed computation which correctly describes in whole the atmosheric neutrino production. Atmosperic muon neutrino spectra, calculated with use of Kimel-Mokhov, SIBYLL 2.1 and EPOS LHC hadronic models, are consistent with the experimental results. At energies $1-500$ TeV curves calculated for these modeles combined with Hillas-Gaisser cosmic-ray spectrum, are close to the best fit of IceCube. Calculations of the flavor ratio using SIBYLL 2.1 and QGSJET ll agree well with only experimental point at 1.7 TeV derived in IceCube experiment.

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