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High-energy atmospheric neutrinos

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High-energy neutrinos, arising from decays of mesons that were produced through the cosmic rays collisions with air nuclei, form unavoidable background noise in the astrophysical neutrino detection problem. The atmospheric neutrino flux above 1 PeV should be supposedly dominated by the contribution of charmed particle decays. These (prompt) neutrinos originated from decays of massive shortlived particles, $D^{\pm}$, D^0, $\overline{D}^0$, $D_s^{\pm}$, Λ_c^+, compose the most uncertain fraction of the high-energy atmospheric neutrino flux because of poor explored processes of the charm production. Besides, an ambiguity in high-energy behavior of pion and especially kaon production cross sections for nucleon-nucleus collisions may affect essentially the calculated neutrino flux. There is the energy range where above flux uncertainties superimpose.

A new calculation presented here reveals sizable differences, up to the factor of 1.8 above 1 TeV, in muon neutrino flux predictions obtained with usage of known hadronic models, SIBYLL 2.1 and QGSJET-II. This calculation of the atmospheric neutrino flux in the energy range 10 GeV-10 PeV is made within 1D approach to solve nuclear cascade equations in the atmosphere, which takes into account non-scaling behavior of the inclusive cross-sections for the particle production, the rise of total inelastic hadron-nucleus cross-sections and nonpower law of the primary cosmic ray spectrum. This approach was recently tested in the atmospheric muon flux calculations [Astropart. Phys. 30 (2008) 219]. The results of the neutrino flux calculations are compared with the Frejus, AMANDA-II and IceCube measurement data.

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