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Characterization of Prompt Atmospheric Lepton Fluxes

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The IceCube Neutrino Observatory at the South Pole functions as a detector for high-energy atmospheric muons and neutrinos produced by cosmic ray interactions in the atmosphere. At the lowest energies, pion and kaon decays contribute the most to leptonic fluxes. Above a couple of hundred TeV, the prompt decay of charmed mesons becomes more important. The production processes of these prompt leptons are neither well-understood nor well-characterized. In this work we use air showers generated by CORSIKA to study both the muon and neutrino fluxes with the hadronic interaction model, DPMJET 2.55. Atmospheric lepton fluxes at both the surface and at the depth of the IceCube detector are simulated up to 1×10^9 GeV. Muon bundle multiplicities and lateral distributions are characterized. Additionally, the sensitivity of muon and neutrino energy spectra to cosmic ray primary composition and atmosphere annual modulations are studied.

Collaboration

IceCube

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Primary authors: Mrs DVORAK, Emily (South Dakota School of Mines and Technology); Mr DIETERLE, Paul (California Institute of Technology)

Co-authors: Dr XINHUA, Bai (South Dakota School of Mines and Technology); Mr JERO, Kyle (Wisconsin IceCube Particle Astrophysics Center, University of Wisconsin - Madison); Dr DESIATI, Paolo (Wisconsin IceCube Particle Astrophysics Center, University of Wisconsin - Madison)

Presenter: Dr DESIATI, Paolo (Wisconsin IceCube Particle Astrophysics Center, University of Wisconsin - Madison)

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