

Cosmic Ray Elemental Spectra and Atmospheric Neutrino Fluxes

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Atmospheric neutrinos are produced when cosmic rays interact with Earth's atmosphere. The relationship between the cosmic ray spectrum and the neutrino spectrum is especially important around the cosmic ray all-particle knee. These energies correspond to the regime in which astrophysical neutrinos begin to dominate the neutrino flux, so accurate modeling of the cosmic-ray spectrum around the knee can be used to help separate background from signal. Currently, direct measurements of elemental spectra reach their upper energy limit just below the all-particle knee, requiring extrapolation in order to probe the transitional neutrino source energy regime. In this work, the cosmic ray knee is modeled as a transition between acceleration sources, each with a rigidity dependent acceleration limit. Cosmic-ray particles reach the limit at $Z * E_{max}$ where Z is the particle charge and E_{max} is the proton's limit. Utilizing the Matrix Cascade Equations code, the cosmic-ray elemental spectra were used to calculate resulting atmospheric neutrino fluxes. Various parameterizations to model cosmic rays are explored, and the effects of the resulting elemental spectra on the neutrino fluxes are investigated. The neutrino results are also compared to experimental data.

Keywords

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Collaboration

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Subcategory

Theoretical Results

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