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Ultrahigh energy tau neutrinos: propagation and tau energy loss

MARY HALL RENO, University of Iowa, SHARADA IYER DUTTA, SUNY Stony Brook, YIWEN HUANG, University of Iowa — Astrophysical sources of ultrahigh energy cosmic rays may also be sources of ultrahigh energy neutrinos, including tau neutrinos from $\nu_\mu \rightarrow \nu_\tau$ oscillations over astrophysical distances. A mountain or small column depth of Earth acts as a neutrino converter for $\nu_\tau \rightarrow \tau$, and a tau decay in the atmosphere, after it has emerged from the Earth, produces an air shower. We evaluate ν_τ and τ propagation through 10-100 km of rock using a stochastic evaluation of $\nu_\tau \rightarrow \tau$ conversion and tau electromagnetic energy loss. We compare our results with the analytic approaches commonly used to estimate air shower event rates. We find that the analytic approach typically does well only for $E_\tau < 10^{10}$ GeV. We discuss the implications for recent analytic evaluations of shower event rates.

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