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Theoretical uncertainties of muon transport calculations for very large volume neutrino telescopes

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Underground cosmic-ray experiments, including very large volume neutrino telescopes, depend on a precise description of the interaction cross sections of muons, which can travel large distances before reaching the detector. High-energy muons lose their energy almost exclusively via four processes: ionization, electron-positron pair production, bremsstrahlung and inelastic nuclear interaction. At low energies, ionization is the dominant process, while above energies of about a TeV, the three other processes dominate the energy loss. We discuss the uncertainties of the cross sections of the energy loss processes used in the simulation chain of current very large volume neutrino telescopes and review recent theoretical improvements.

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