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Neutrino Structure Functions from GeV to EeV Energies

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Accurate theory calculations for neutrino-nucleus scattering rates are essential in the interpretation of neutrino experiments, from oscillation measurements to astroparticle physics at neutrino telescopes. In the deep-inelastic (DIS) regime, neutrino structure functions can be reliably evaluated in the framework of perturbative QCD. However, large uncertainties affect these structure functions at low momentum transfer, distorting event rate predictions for energies up to 1 TeV. We present a determination of the neutrino inelastic structure functions valid for all values of Q2, from the resonance region to ultra-high energies. Our approach combines a data-driven machine learning parametrization of neutrino structure functions at low and moderate Q2 values matched to perturbative QCD calculations at large Q2. We compare our results to other calculations in the literature and outline the implications for neutrino telescopes.

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