Contribution ID: **113** Type: **Talk**

Structure Functions and Tau Neutrino Cross-Section at DUNE Far Detector

Tuesday, August 2, 2022 3:42 PM (22 minutes)

The high statistics and excellent resolution capabilities of DUNE's ^{40}Ar detector will allow us to make precise studies about phenomena that have, until now, seemed too complex to measure, like tau neutrinos (ν_τ) detection and therefore, provide a completion of the 3-flavor neutrino paradigm. Quasi-elastic scattering (QE), Δ resonance production (RES), and deep inelastic scattering (DIS) processes are known to give dominant contributions in the medium and high neutrino energy to the total cross-section of ν_τ(N) and $\bar{\nu}_\tau$(N) cross-sections. These cross-sections have large systematic uncertainties compared to the ones for ν_μ and ν_e. Studies point out that the reason for these difference is due to the model dependence of the ν_τ(N) cross-sections in treating the nuclear medium effects described by the nucleon structure functions, $F_{1N,\ldots,3N}(x, Q^2)$ for ν_μ and ν_e. These nucleon structure functions are used to calculate DIS cross-section by including kinematical corrections, but due to the addition of the τ-lepton mass another two additional nucleon structure functions become non-negligible, $F_{4N}(x, Q^2)$ and $F_{5N}(x, Q^2)$. There is a special interest in the DIS processes originated by charged leptons and (anti)neutrinos on nucleons and nuclear targets as they play an instrumental role in the quark-parton structure of the free nucleons and nucleons when they are bound in a nucleus. This talk will show the semi-theoretical and experimental approach to the estimation of the ν_τ(N) and $\bar{\nu}_\tau$(N) cross-sections in DUNE for the DIS region. We aim to look over changes in Q^2, and the contributions of the additional nucleon structure functions $F_{4N}(x, Q^2)$ and $F_{5N}(x, Q^2)$.

Attendance type

In-person presentation

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Session Classification: Joint Session

Track Classification: WG1: Neutrino Oscillation Physics