

T violating effects in $\nu_\tau(\bar{\nu}_\tau)$ –nucleon quasielastic scattering

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The future experiments like SHiP, DsTau, and DUNE are proposed to study the properties and the production cross sections of the τ lepton and its corresponding neutrino (ν_τ). Recently we have performed [1,2,3], a theoretical study of the production cross section as well as the polarization observables of the τ lepton and the final nucleon/hyperon produced in the quasielastic $\nu_\tau(\bar{\nu}_\tau) - N$ scattering in the few GeV energy region relevant to the above experiments. The τ lepton produced in $\nu_\tau - N$ scattering decays to leptons and pions through the leptonic and hadronic decay modes. In this energy region, the production cross section of τ , its decay and the characteristics of the decay products depend significantly on the τ polarization. The production cross section and polarization of τ lepton are calculated using weak nucleon form factors which are determined using various symmetry properties of the weak currents in the vector and axial vector sectors, assuming G and T invariances. We have studied the effect of G and T violating terms in the transition matrix element on the cross sections and the τ polarization in quasielastic $\nu_\tau(\bar{\nu}_\tau) - N$ scattering induced by $\Delta S = 0$ and $\Delta S = 1$ weak currents. In the case of $\Delta S = 1$ reactions, we have also studied the SU(3) symmetry breaking effects.

[1] A. Fatima, M. Sajjad Athar and S. K. Singh, Phys. Rev. D 102, 113009 (2020).

[2] A. Fatima, M. Sajjad Athar and S. K. Singh, [arXiv:2106.14590 [hep-ph]].

[3] A. Fatima, M. Sajjad Athar and S. K. Singh, Phys. Rev. D 98, 033005 (2018).

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CP and T violation

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