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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).

What is your topic?

CP and T violation

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