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Polarization effects in weak elastic Neutral Current with Non Standard Interactions

New physics beyond the Standard Model (SM) may appear in the form of unknown couplings, typically termed non-standard neutrino interactions (NSIs) can manifest in neutrino interactions. To explain such a process, NSI offers a general "Effective Field Theory"(EFT)-style framework. While the elements of a given model may differ in weak interactions, they are broadly categorized as charge current (CC) NSI and neutral current (NC) NSI. Many authors have previously studied NSI in the weak sector. However, most studies focused on neutrino oscillation, their masses, and their electromagnetic properties; the effects of NSI in $\nu - N$ interactions are still unexplored. Recently, Papoulias et al. studied the effects of NSI in $\nu - N$ elastic cross-section. In this work, we examine polarisation observables to see the effects due to NSI in neutral current elastic scatterings. The longitudinal and transverse polarisation shows a substantial deviation from the Standard Model(SM) predictions, though the model dependence is there. Thus, non-zero NSI couplings can be measured through experiments that measure the spin-asymmetry, which shows deviation from SM results.
Additionally, measurement of the polarization of the final proton in NC elastic scattering within the framework of NSI gives additional information about the strange axial form factor(g_A^s), which contributes to the accurate determination of the electromagnetic structure of the proton. Strange quarks also contribute to other observables, such as the nucleon's spin, mass, and internal momentum distributions. The contribution of strange quarks in the region of few GeV neutrino energy by switching off NSI is also examined.

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