Contribution ID: **67** Type: **Talk: in-person**

Constraints on new physics with (anti)neutrino-nucleon scattering data

Monday, 16 September 2024 14:05 (20 minutes)

New physics contributions to the (anti)neutrino-nucleon elastic scattering process can be constrained by precision measurements, with controlled Standard Model uncertainties. In a large class of new physics models, interactions involving charged leptons of different flavor can be related, and the large muon flavor component of accelerator neutrino beams can mitigate the lepton mass suppression that occurs in other low-energy measurements. We employ the recent high-statistics measurement of the cross section for $\bar{\nu}_\mu p \to \mu^+ n$ scattering on the hydrogen atom by MINERvA to place new confidence intervals on tensor and scalar neutrino-nucleon interactions: $\mathfrak{Re}C_T = -1^{+14}_{-13} \times 10^{-4}$, $|\mathfrak{Im}C_T| \leq 1.3 \times 10^{-3}$, and $|\mathfrak{Im}C_S| = 45^{+13}_{-19} \times 10^{-3}$. These results represent a reduction in uncertainty by a factor of 2.1, 3.1, and 1.2, respectively, compared to existing constraints from precision beta decay.

Working Group

WG 2: Neutrino Scattering Physics

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Session Classification: Parallel: WG5

Track Classification: WG5: Neutrino Beyond PMNS