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Constraining the mass-spectra in the presence of a light sterile neutrino from absolute mass-related observables

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The framework of three-flavor neutrino oscillation is a well-established phenomenon. However, results from short-baseline experiments, such as the *Liquid Scintillator Neutrino Detector (LSND)* and *MiniBooster Neutrino Experiment (MiniBooNE)*, suggest the potential existence of an additional light neutrino state characterized by a mass-squared difference of approximately $1, \mathrm{eV}^2$. This new neutrino state as it devoid of all Standard Model (SM) interactions, is commonly referred to as a "sterile" state. Additionally, a sterile neutrino with a mass-squared difference of 10^{-2} eV^2 has been proposed to reduce the tension between the results obtained from the *Tokai to Kamioka (T2K)* and the *NuMI Off-axis ν_e Appearance (NOνA)* experiments. Furthermore, the absence of the predicted upturn in the solar neutrino spectra below 8 MeV can be explained by postulating an extra light sterile neutrino state with a mass-squared difference around $10^{-5}, \mathrm{eV}^2$. The hypothesis of an additional light sterile neutrino state introduces four distinct mass spectra depending on the sign of the mass-squared differences. The implications of these scenarios on observables dependent on the absolute mass of neutrinos, namely, the sum of the light neutrino masses (Σm_ν) from cosmology, the effective mass of the electron neutrino from beta decay (m_β), and the effective Majorana mass $(m_{\beta\beta})$ from neutrinoless double beta decay. It is interesting that some scenarios are already disfavored by current constraints on the above variables. Furthermore, the implications for the projected sensitivity of experiments such as the *Karlsruhe Tritium Neutrino Experiment (KATRIN)* and future experiments like *Project-8* and the *next Enriched Xenon Observatory (nEXO)* will be very interesting.

Track type

Neutrino Physics

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