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Neutrinoless double beta decay in a left-right symmetric model with a double seesaw mechanism

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We discuss a left-right (L-R) symmetric model with
the double seesaw mechanism at the TeV scale generating Majorana
masses for the active left-handed (LH) flavour neutrinos
$\nu_{\alpha L}$ and the heavy right-handed (RH) neutrinos $N_{\beta R}$, $\alpha, \beta = e, \mu, \tau$, which in turn mediate lepton number violating processes, including neutrinoless double beta decay.
The Higgs sector is composed of two Higgs doublets H_L, H_R and a bi-doublet Φ. The fermion sector has the usual for the L-R symmetric models quarks and leptons, along with three $SU(2)$ singlet fermion $S_{\gamma L}$. The choice of bare Majorana mass term for these sterile fermions induces large Majorana masses for the heavy RH neutrinos leading to two sets of heavy Majorana particles N_j and S_k, $j, k = 1, 2, 3$, with masses $m_{N_j} \ll m_{S_k}$. Working with a specific version of the model in which the $\nu_{\alpha L} - N_{\beta R}$ and the $N_{\beta R} - S_{\gamma L}$ Dirac mass terms are diagonal, and assuming that $m_{N_j} \sim (1 - 1000)$ GeV and $\max(m_{S_k}) \sim (1 - 10)$ TeV, $m_{N_j} \ll m_{S_k}$, we study in detail the new "non-standard" contributions to the $0\nu\beta\beta$ decay amplitude and half-life
arising due to the exchange of virtual N_j and S_k.
We find that in both cases of NO and IO light neutrino mass spectra, these contributions are strongly enhanced and are dominant at relatively small values of the lightest neutrino mass $m_{1(3)} \sim (10^{-4} - 10^{-2})$ eV over the light Majorana neutrino exchange contribution.
In large part of the parameter space, the predictions of the model for the $0\nu\beta\beta$ decay generalised effective Majorana
mass and half-life are within the sensitivity range of the
planned next generation of neutrinoless double beta decay
experiments LEGEND-200 (LEGEND-1000), nEXO, KamlAND-Zen-II, CUPID, NEXT-HD.

Poster prize

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