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The Majorana nature of massive neutrinos as a possible hint for new physics

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Determining the nature - Dirac or Majorana - of massive neutrinos, possibly related to a New Physics scale beyond that predicted by the Standard Model is a fundamental problem under study. Significant experimental efforts have been made to unveil the possible Majorana nature of massive neutrinos by searching for neutrinoless double beta decay with increasing sensitivity. These constraints, together with the results from beta-decay experiments and in light of the recent (and future) cosmological observations can be combined in order to extract information on new possible couplings in the Lagrangian of particle interactions, changing the total lepton charge $L = L_e + L_\mu + L_\tau$ by two units. Further if it will be experimentally established the Majorana nature of massive neutrinos, via the observation of the $2\beta 0\nu$ -decay, it will be possible to test the compatibility of the usual 3-neutrino scenario with the possible existence of 1 or 2 additional sterile neutrino states with masses at the eV scale (the so called 3+1 and 3+2 schemes) and to study the implications of all this on the general properties of the neutrino mass matrix.

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