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TeV Scale See-Saw Mechanism and Neutrinoless Double Beta Decay

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It is shown that the Majorana nature of the heavy neutrinos N_j having masses in the range of $M_j \sim (100 - 1000)$ GeV and present in the TeV scale type I and inverse see-saw scenarios of neutrino mass generation, is unlikely to be observable in the currently operating and future planned accelerator experiments (including LHC) due to the existence of very strong constraints on the parameters and couplings responsible for the corresponding $|\Delta L| = 2$ processes, L being the total lepton charge. If the heavy Majorana neutrinos N_j are observed and they are associated only with the type I or inverse see-saw mechanisms and no additional TeV scale "new physics", they will behave like Dirac fermions to a relatively high level of precision, being actually pseudo-Dirac particles. The observation of effects proving the Majorana nature of N_j would imply that these heavy neutrinos have additional relatively strong couplings to the Standard Model particles (as, e.g. in the type III see-saw scenario), or that light neutrino masses compatible with the observations are generated by a mechanism other than see-saw (e.g., radiatively at one or two loop level) in which the heavy Majorana neutrinos N_j are nevertheless involved.

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