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Left-Right Symmetry of Neutrino less Double Beta Decay

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Editorial

Neutrino is known to be a candidate of the Majorana particle. Neutrinoless double beta decay is a weak process which takes place only when neutrinos can be identified with anti-neutrinos. In this sense the observation of neutrinoless double beta decay is to confirm the Majorana property of neutrinos. Neutrinos are usually considered to be left-handed in the Standard Model (SM) of elementary particle physics, while anti-neutrinos to be right-handed. If neutrinos are actually Mojorana particles, there should be a mixing or replacement between left-handed and right-handed particles. In this context left-right symmetric model [1] suggests that there are three additional mechanisms of weak boson exchanges to the standard mechanism (WL-WL exchange) exchanging left handed weak bosons; indeed, the λ mechanism (WL-WR exchange), η mechanism (WLWR mixing), and heavy neutrino exchange mechanism (WR-WR exchange). The study of neutrinoless double beta decay is carried out for evaluating the Majorana neutrinomass, quantitatively clarifying the lepton number violation, and showing the Majorana property of neutrinos. Although the neutrinoless double beta decay has been well studied with respect to the standard mechanism, neutrinoless double beta decay study including the right-handed weak boson has been started only several years ago. In this paper much attention is paid to the calculation of nuclear matrix elements of the neutrinoless double beta with respect to the standard mechanism, λ mechanism, and η mechanism. The nuclear matrix element plays a role of connecting the neutrino effective mass with the half-life of neutrinoless double beta decay [2]. Where Cm, CN, Cλ, Cη, CmN and on are obtained by calculating nuclear matrix elements, ηm, ηN and ηλ and ηη are associated with the effective mass of neutrino, and T au means the half-life. In conclusion the values of nuclear matrix elements of Fermi, Gamow-Teller and tensor types are presented based on interacting shell model calculation (ISM, for short). Bounds on Majorana neutrino mass and lepton number violating parameters are also derived [3]. Here it is remarkable that the neutrinoless double beta decay is a beyond-the-SM process showing the violation of lepton numbers [4].

The scalar sector consists of left- and right-handed Higgs doublets and triplets, while the conventional Higgs bidoublet is absent in this scenario. We use the Higgs doublets to implement the left-right and the electroweak symmetry breaking. On the other hand, the Higgs triplets with induced vacuum expectation values can give Majorana masses to light and heavy neutrinos and mediate 0νββ decay. In the absence of the Dirac mass terms for the neutrinos, this framework can naturally realize type-II seesaw dominance even if the right-handed neutrinos have masses of a few TeV. We study the implications of this framework in the context of 0νββ decay and gauge coupling unification.

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