

Neutrinoless Double Beta Decay with Majoron Emission Revisited

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In theories of physics beyond the standard model neutrinoless double beta decays can occur with the emission of new bosons - Majorons:

$$2n \rightarrow 2p + 2e^- + \phi \quad \text{or} \quad 2n \rightarrow 2p + 2e^- + 2\phi \quad (1)$$

Observation of the neutrinoless double beta decay with Majoron emission ($0\nu\beta\beta\phi$) means that neutrinos are Majorana particles and the lepton number is violated in nature. The list of possible Majoron models with their respective Lagrangians are discussed in [1]. The different shapes of the sum of the two electron energy spectrum can be used to distinguish the different decay modes of $0\nu\beta\beta\phi$ decays from each other and the two-neutrino and neutrinoless double beta decays.

We overview theoretical study of the neutrinoless double beta decay with Majoron emission which was done in papers, e.g. [1–3]. We discuss shapes of the sum of the two electron energy spectrum for different Majoron models.

We discuss the decay rate for the ordinary Majoron model also with the term proportional to the square mass of neutrino, which was not considered in paper [1] and depend on new matrix elements. We calculate the matrix elements within improved QRPA calculations introduced in [4].

References

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