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Neutrino in the Standard Model and beyond

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The Standard Model teaches us that in the framework of such general principles as local gauge symmetry, unification of weak and electromagnetic interactions and Brout-Englert-Higgs spontaneous breaking of the electroweak symmetry nature chooses the simplest possibilities. Two-component left-handed massless neutrino fields play crucial role in the determination of the charged current structure of the Standard Model. The absence of the right-handed neutrino fields in the Standard Model is the simplest, most economical possibility. In such a scenario Majorana mass term is the only possibility for neutrinos to be massive and mixed. Such mass term is generated by the lepton-number violating Weinberg effective Lagrangian. In this approach three Majorana neutrino masses are suppressed with respect to the masses of other fundamental fermions by the ratio of the electroweak scale and a scale of a lepton-number violating physics. The discovery of the neutrinoless double β -decay and absence of transitions of flavor neutrinos into sterile states would be evidence in favor of the minimal scenario we advocate here.

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