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Neutrino mass spectrum from the seesaw mechanism with the second Higgs doublet added

Neutrino oscillation experiments showed that neutrinos have tiny but non-zero masses. The seesaw mechanism is the most fruitful explanation of the light neutrino masses and mixings, which connects the tiny neutrino masses with heavy right-handed neutrino masses. After spontaneous symmetry breaking of the Standard Model gauge group one obtains a (n_L+n_R) x (n_L+n_R) Majorana mass matrix M_nu for the neutrinos. The mixing between the n_R right-handed singlet fermions and the neutral parts of the n_L lepton doublets gives masses to the neutrinos which are of the size expected from neutrino oscillations.

The diagonalization of the mass matrix gives rise to a split spectrum consisting of heavy and light states of neutrinos given by U^T M_nu U=diag(m^{light}*{n_L}, m^{heavy}*{n_R}). We analyse two cases of the minimal extension of the Standard Model when one or two right-handed fields are added to the three left-handed fields. A second Higgs doublet is included in our model.

We calculate the one-loop radiative corrections to the mass parameters which produce mass terms for the neutral leptons. In both cases we numerically analyse light neutrino masses as functions of the heavy neutrino masses. Parameters of the model are varied to find light neutrino masses that are compatible with experimental data of solar Delta m^2_□ and atmospheric Delta m^2_atm neutrino mass differences for normal and inverted hierarchy. We choose values for the parameters of the tree-level by numerical scans, where we look for the best agreement between computed and experimental neutrino oscillation angles. Different mixing angles between the Higgs fields give different mass spectra of light neutrinos and different distributions of neutral Higgs masses.

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