NEUTRINOPHILIC HIGGS DOUBLET MODELS

T. J. Kärkkäinen

Department of Physics, P.O. Box 64 FI-00014 University of Helsinki, Finland
email: timo.j.karkkainen@helsinki.fi

Even though the absolute masses of the three current known neutrinos are unknown, their upper limits are more than million times lighter that the lightest known massive elementary particle, the electron. Other elementary particles' masses lie on MeV and GeV scales, and are a consequence of Standard Model Higgs Φ. Several proposed explanations have been presented to explain the low masses of neutrinos, one of which is the Neutrinophilic (Two) Higgs Doublet Model [1][2] (νTHDM).

If the tiny neutrino masses originate from a seesaw scenario, the neutrino Yukawa coupling must by tiny or the seesaw mass scale M must be huge. νTHDM introduces an additional Higgs doublet Φ_ν, with a petite vacuum expectation value (VEV) v_ν. The doublet is called *neutrinophilic*, since it only couples to neutrinos. This gives an additional degree of freedom to neutrino mass formula, where the combination $y_\nu^2 v_\nu^2/M$ must be $\mathcal{O}(0.1)$ eV, allowing a TeV-scale seesaw scenario.

In addition, a $\mathbb{Z}_2$ symmetry is introduced in the model, being even for every SM field and odd for right-handed neutrinos and neutrinophilic Higgs. The $\mathbb{Z}_2$ symmetry may be broken by introducing a $\Phi^\dagger\Phi_\nu$ term in Higgs potential. There is also a supersymmetric (SUSY) version of the model, where in addition to the Minimal Supersymmetric Standard Model's (MSSM) two Higgs doublets there are two neutrinophilic Higgs doublets as well.

During the talk, I will motivate νTHDM model and discuss the most interesting features of non-SUSY version of the model.

[1] E. Ma, Phys. Rev. Lett. **86** (2001) 2502 [hep-ph/0011121].
[2] S. Gabriel and S. Nandi, Phys. Lett. B **655** (2007) 141 [hep-ph/0610253].