Universidad de los Andes

Phenomenological Study of Search of Heavy Neutrinos, with Displaced Vertices and Vector Boson Fusion

This dissertation is submitted for the degree of

Physicist

by

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As it was mentioned earlier the SM does not explain the reason why the mass of neutrinos is smaller than the mass of the other fermions by a factor of almost 10^{-6}. Moreover, it does not provide an explanation to the fact that only left handed netrinos had been observed in nature. In this section we are going to work on possible solutions to these problems. [1]

2.3.1 Dirac Mass

The lagrangian of a free fermion is:

$$L = \bar{\psi} \left(i\gamma^{\mu} \partial_{\mu} - m \right) \psi \tag{2.1}$$

Where ψ is the Dirac Spinor. The mass is included in the SM through the second term in the former equation, it is called "Dirac mass term":

$$m\bar{\psi}\psi \tag{2.2}$$

[1] The detailed calculation is explain in the A

We can write the Dirac Spinor as a sum of it's left- and right- chiral states:

$$m\bar{\psi}\psi = m\left(\overline{\psi_L + \psi_R}\right)(\psi_L + \psi_R) \tag{2.3}$$

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