Chapter 6
Conclusions

I have calculated the effective coupling constant of the muonium–antimuonium oscillation process in two different models. First, I modified the Standard Model by including three singlet right-handed neutrinos. Present experimental limits resulting from the non-observation of the oscillation process sets a lower limit on the right-handed neutrino mass scale M_R roughtly of order 1 TeV. Second, the muonium–antimuonium oscillation was investigated in the Minimal Supersymmetric Standard Model extended by inclusion of three right-handed neutrino superfields where the required lepton flavor violation has its origin in the Majorana property of the neutrino and sneutrino mass eigenstates. For a wide range of the parameters, the contribution of the graphs mediated by the sneutrino and winos $\widetilde{W}^-$ is dominant. The maximum of this contribution to the effective coupling constant is roughly two orders of magnitude below the sensitivity of current muonium–antimuonium oscillation experiments. However, there is very limited possibility that the contribution of the graphs mediated by sneutrinos and Higgsino $\widetilde{h}_B^-$ is dominant if $\tan\beta$ is very small. In this case, the contributions can even be large enough to reach the present experimental bound. Therefore, the experimental bound can provide an inequality on the model parameters, which can be translated into a lower bound on $\tan\beta$ as a function of light neutrino mass scale m_ν. The constraints from the muon and electron anomalous magnetic moments were also investigated. For this model, the muonium–antimuonium oscillation experiments give the most stringent constraints on the parameters.

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