Summary

The present work study the role of the discrete symmetries to explain the mixing in the standard model by assuming discrete symmetries as extension for the standard model.

Chapter 1 :

It is a review of the basic principles of the standard model, Higgs mechanism of spontaneous symmetry breaking which is the most familiar way to generate the masses for the fundamental particles, and a brief description for the supersymmetry theory in the nature.

Chapter 2 :

In this chapter, the experimental results for the fermion mixing in the standard model is presented . The experimental data showed that the mixing in the lepton sector is maximal mixing while it is very small in the quark sector, that might stimulate future theoretical investigations.

Chapter 3 :

It is a review of discrete symmetries, will emphasis on A_4 discrete group, SUSY A_4 models, bimaximal and tri-bimaximal mixing. Also, we focused attention on the Altarelli- Ferruccio SUSY model as the basic preliminary ingredient for the proposed model.

Chapter 4 :

In this chapter, we proposed an extension for Altarelli model to explain the small mixing in the quark sector and the large hierarchy in the masses of the quarks by assuming different representation for the quarks without spoiling the results of Altarelli model. We required the Lagrangian to be invariant

under the proposed symmetry $SU(2)_L \times U(1)_Y \times A_4 \times Z_3 \times U(1)_R \times U(1)_\theta$. We determined the superpotential W_q which is invariant under the proposed symmetry. From this superpotential, we calculated the mass matrices M_u and M_d. We diagonalized these matrices to find the proper mass ratios and mixing angles in the quark sector. The obtained results are found to agree with the corresponding experimental observations. We arrived to the mathematical justification for the well-known experimental relation between the ratios of the quark masses and their mixing elements.