INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

In this thesis we explore the possibility of explaining neutrino masses and mixing from discrete, non-Abelian flavor symmetric scenarios. To elucidate, the recent observation on reactor mixing angle θ_{13} by several experiments like Daya Bay, RENO, Double Chooz and T2K, we exploit A_4 flavor symmetry based models. We show that a minimal modification is sufficient to deviate from the widely popular tribimaximal mixing in the lepton sector to generate nonzero θ_{13} of observed amount and hence we study its several phenomenological consequences. In this regard, we have studied two models based on A_4 flavor symmetric type-I and type-I+II seesaw. Here we minimally modify the existing Altarelli-Feruglio A_4 model by incorporating a scalar singlet, transforming non-trivially under A_4. This contributes in the neutrino mass matrices to deviate it from its tribimaximal configuration, ensuring generation of nonzero θ_{13}. Here we also make predictions for absolute neutrinos masses, effective mass parameter appearing in the neutrinoless double beta decay, Dirac and/or Majorana phases. We also obtain interesting sum rules for neutrino masses. Furthermore, we successfully reproduce observed lepton asymmetry of the universe in such scenarios due to the presence of heavy right handed neutrinos and scalar triplets in the theory. We study the role of nonzero θ_{13} and flavor structures of the Yukawa couplings in leptogenesis. In the type-I+II seesaw we also show that complex vev of a scalar field responsible for generating nonzero θ_{13} can correlate all the CP phases (Dirac and Majorana) involved in the theory. Next, we study an A_4 based inverse seesaw scenario and find that a typical flavor structure of the small lepton number violating term responsible in explaining neutrino mass can completely dictate lepton mixing. Due to the mixing between light and heavy neutrino states in the framework, we have also studied the non-unitarity effects which contribute to lepton flavor violating processes, neutrinoless double beta decay etc. Finally to establish a connection between two seemingly uncorrelated sector (Standard Model and dark matter sector), we extend the flavor symmetry to the dark matter sector as well. Here we find that a global U(1) flavor symmetry establishes a correlation between the relic abundance of dark matter and nonzero θ_{13} which can be probed at various ongoing and future direct and collider search experiments.