National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: STUDY OF BARYOGENESIS VIA LEPTOGENESIS IN EXTENSION OF STANDARD MODEL WITH TRIPLET HIGGS SCALARS
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Venue	: Committee Room (MC - 212), Hybrid mode, Join Via link: https://calendar.app.google/fCnZPLFnVjhqqLiM7
Date and Time	: 12 Dec 2024 (5 pm)
Abstract	: Two of the most intriguing shortcomings of the Standard Model (SM) are its inability to explain the baryon asymmetry of the universe (BAU) and justify the existence of neutrino mass. We study three models based on the type-II seesaw mechanism. The parameter space study provides a better understanding of the neutrino mass matrix. With the first model containing two triplet scalars, we study unflavoured and two-flavored leptogenesis with explicit charge and parity (CP) violation. The triplet scalars, having two distinct decay modes, provide two tree-level branching ratios. We investigate the effect of the branching ratio-hierarchy on the production of CP asymmetry and the efficiency of leptogenesis. Hierarchical branching ratios tend to suppress the CP asymmetry required for successful leptogenesis, which has been compensated by introducing extra CP-violating phases. We further enhanced the efficiency by considering flavor interactions. We have also achieved low-scale leptogenesis by lowering the triplet scalar's mass in the TeV scale. Then, we study a model with two triplet scalars based on $A_{4}\times Z_{4}$ symmetry, resulting in spontaneous CP violation (SCPV) by the involvement of one singlet scalar and two scalar fields. The flavor symmetry of the model prohibits accomplishing baryogenesis through unflavoured leptogenesis. Therefore, we perform a rigorous study on flavored triplet leptogenesis, incorporating density matrix equations. Again, we study the interplay of the SCPV phase and the triplet scalar's hierarchical branching ratios to generate adequate CP asymmetry to achieve successful baryogenesis. In a minimal model based on $A_{4}\times Z_{2}$ symmetry, with one right-handed neutrino and one triplet scalar, we study CP asymmetry generated from the interference of the tree-level and one-loop vertex diagram involving the triplet scalar. The study of right-handed neutrino-mediated leptogenesis shows an enhancement in the baryon asymmetry due to flavor interplay. Due to insufficient knowledge of seesaw parameters, the CP violations in high-energy phenomena and the same in the lepton sector, measurable in low-energy scale, are believed not to be generally related. In this context, we establish a correlation between low and high-scale CP violations.