INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Aspects of Flavor Leptogenesis in Particle Physics and Cosmology

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SHORT ABSTRACT

The dynamical generation of cosmological baryon asymmetry is one of the leading problems in the field of Particle physics and Cosmology, which the standard model of particle physics can not explain. In this thesis, we have analyzed in detail the generation of baryon asymmetry by out-of-equilibrium decay of heavy particle states responsible for neutrino mass. The relevant mechanism is known as baryogenesis via leptogenesis. In this process, heavy particle states decay out-of-equilibrium to produce lepton asymmetry, which is then converted to baryon asymmetry by sphaleron processes before they decouple. It is shown in the literature that the individual charged lepton Yukawa interactions could influence the lepton asymmetry generation when they become dominant over the expansion of the Universe at a low energy scale. In this thesis, we have investigated some beyond standard model scenarios which can influence such flavor leptogenesis setups. Firstly, we have investigated the impact of an additional flavor symmetry on charged lepton, neutrino Yukawa, and Majorana Right handed neutrino mass matrices. This eventually leads to interesting results not only in the neutrino sector but also in terms of the flavor leptogenesis scenario. The scenario predicts the normal hierarchical scheme in the neutrino mass and falsifies the leptonic sector's maximal CP asymmetry. On top of that, a successful low scale leptogenesis scenario is constructed, evading the important Davidson-Ibarra bound. Then, we propose two scenarios which not only explain the existence of dark matter, baryon asymmetry, and neutrino mass simultaneously but also provide a platform where the early universe dynamics of the dark matter can impact the lepton asymmetry of the Universe, sometimes leading to low scale leptogenesis scenarios. Considering the low scale nature of the lepton asymmetry generation, individual lepton flavors have played an important role in determining the correct amount of asymmetry in all these scenarios. Finally, we have studied the impact of prolonged reheating scenarios on the charged lepton equilibration temperatures that eventually affect the so-called individual lepton flavor regimes of flavor leptogenesis setup. As a result, allowed parameter space significantly gets altered if leptogenesis occurs during the reheating period.