# INFLATIONARY MODELS IN THE SO(10) GUT SCHEME

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The central theme of this thesis is the discussion about the cosmological inflation model based on a supersymmetric SO(10) Grand Unified Theory (GUT). There are many GUTs and inflation models, but there are almost no their unified theories. We applied some Inflation models to the SO(10) GUT models developed by Fukuyama et al. and checked it by observational data such as Wilkinson Microwave Anisotropy Probe (WMAP). Firstly, we applied the single field inflation model to the renormalizable minimal SO(10) GUT model to avoid the gravitino problem. This problem led us to consider some alternatives to the thermal leptogenesis scenario if we try to keep the gravitino mass around the weak scale. So we considered the non-thermal leptogenesis scenario in the framework of SO(10) GUT model, and we got the different predictions for low-energy phenomenology dependent on the types of see-saw mechanism. Next, we applied the smooth hybrid inflation model to the simple supersymmetric SO(10) GUT in 5 dimension orbifold to avoid the unnatural tiny coupling we got as the result in the single field inflation model and the gauge coupling unification problem in the renormalizable minimal SO(10) GUT model. In this GUT model, the gauge coupling unification is successfully realized at $M_{GUT} = 4.6 \times 10^{17}$ GeV after incorporating the threshold corrections of the Kaluza-Klein modes, with the compactification scale (assumed to be the same as the PS symmetry breaking scale) $M_c = v_{PS} = 1.2 \times 10^{16}$ GeV. We show that this orbifold GUT model can naturally leads us to the smooth hybrid inflation, which tunes out to be consistent with the WMAP 5-year data with the predicted $M_{GUT}$ and $v_{PS}$ in the model. In this way, we see that the two distinct objects, Cosmology and Particle Physics, are unified and reveal new harmony of Nature.