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Baryogenesis by Heavy Scalar Field in the Inflationary Universe

The observed Universe made up of only baryonic matter indicates that the standard model of particle physics should be modified to break symmetry between particles and antiparticles. This symmetry breaking is expected to generate unequal number of leptons and antileptons in the reheating era after the inflationary epoch generating the required baryon asymmetry.

To model this scenario in the inflationary Universe, we include in the Lagrangian a complex massive scalar field with mass in the order of the Hubble rate. The phase of this complex scalar field is capable of generating CP-violation. The dynamics of this complex scalar field is coupled with the dynamics of the inflaton field. In additon, we include leptonic symmetry breaking terms in the Lagrangian capable of generating baryon asymmetry at a later stage. An analysis of this model shows the possibility of the generation of leptonic asymmetry in the reheating regime after the inflationary epoch and barynoic asymmetry at a later stage. The baryon-to-photon ratio appears to approach a very small number, less than 10^{-9}, which requires tuning of several model paramerters.

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