BARYOGENESIS IN THE INFLATIONARY UNIVERSE

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As is known well, the inflationary universe model resolves most of the fundamental problems concerning the large scale structure of the universe and is now becoming a standard model for the early universe. However, there is one important problem yet to be made clear. In this model the number density of particles effectively goes to zero during the inflation and everything is created after the universe is heated up again at the end of inflation. Since the reheating temperature is much lower than the GUT temperature in general, however, it is not clear whether the observed baryon asymmetry is generated in this process.

In order to make clear this problem we investigated how baryogenesis depends on the reheating temperature T_i in the SU(5) GUT model. We numerically traced the development of the abundance of heavy bosons and the asymmetry in quarks and leptons after reheating treating T_i and the superheavy Higgs boson mass M_H as free parameters. The calculation is carried out until the asymmetry in quarks and lepton are frozen. We found that T_i should be greater than 5×10^{10}GeV for the observed asymmetry to be generated.

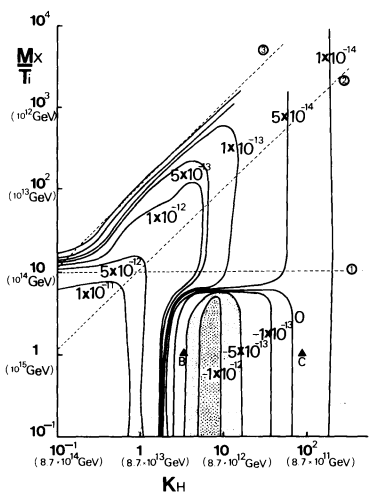

Fig. 1 The contour map of the final baryon/entropy ratio on M_H-M_X/T_i plane. The sign of n_B/s is negative in the dotted region.

Besides this general conclusion we found an interesting phenomenon. For some range of CP-breaking parameters there appear regions in M_X/T_i-M_H plane(M_X is the superheavy gauge boson mass) in which the baryon asymmetry has different signs, as shown in Fig.1. Since the boundary layer of these regions is very narrow, small fluctuations of the reheating temperature are expected to produce large fluctuations of baryon/entropy ratio. This yields a possible mechanics of generating isothermal density perturbations, and dividing the Universe into domains of baryons and antibaryons.

Reference
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