

Ratchet Baryogenesis during reheating

Thursday 27 August 2015 14:20 (20 minutes)

We propose a new baryogenesis scenario, which occurs during reheating after inflation. During reheating, the oscillation of the inflaton field breaks thermal equilibrium, providing one of the necessary conditions for baryogenesis. The inflaton field is assumed to couple to a complex scalar field which carries baryon number, whose self coupling breaks B, C and CP, providing the remaining two conditions for baryogenesis. The dynamics of our scenario utilizes the so-called “ratchet mechanism” found in models of biological molecular motors. There, the driving force of the ratchet movement (of molecular motors) usually comes from the oscillatory change of temperature in the non-equilibrium state. In the present scenario this driving force is provided by the oscillation of the inflaton field. Baryon number is generated by the phase of the complex scalar field being driven in a preferred direction due to the oscillatory energy provided by the inflaton and the “ratchet” of the self-coupling potential. We argue that for the inflaton potential supported by recent Planck results, this scenario allows for the generation of a baryon-to-photon ratio compatible with observations.

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Session Classification: Particle Cosmology

Track Classification: Particle Cosmology Theory and Experiment