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Quantum and Medium Effects in Resonant Leptogenesis

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Abstract content

Leptogenesis offers a very attractive explanation for the origin of the baryon asymmetry of the universe. Such scenarios based on leptonic CP-violation can be realized already within minimalistic seesaw extensions of the standard model. Apart from model building issues the answer to the question of whether a given model can explain the observed amount of baryon number density depends also on the detailed kinematic evolution of the asymmetry. The CP-violation of a particle theory leads to an asymmetry only if it is accompanied by an out-of-equilibrium evolution. Most model specific analyses employ conventional Boltzmann equations (BEs) to implement this condition. In this context various issues arise which can be addressed in the framework of non-equilibrium quantum field theory (NEQFT). Here, the relevance of quantum and medium effects is investigated for thermal leptogenesis. The focus is on the applicability of conventional BEs omnipresent in existing analyses. Within NEQFT, issues such as the justification of the quasi-particle picture arise naturally in subsequent approximations when Boltzmann like equations are derived. This specific problem is particularly important in the case of resonant leptogenesis where relevant particle masses are almost degenerate and the particles can become indistinguishable due to medium effects. It is found that Boltzmann like equations may (only) be obtained in certain cases. But it is possible to account for corrections due to quantum and medium effects in these scenarios by certain modifications. Peculiar implications of these corrections are found in the resonant regime.

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