

Spontaneous Leptogenesis in Type I Seesaw

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Type-I seesaw models with a spontaneously broken B-L symmetry provide a natural framework for spontaneous leptogenesis driven by a Majoron. The kinetic background of the Majoron acts as a CP-violating source, generating a lepton asymmetry both through the decay of right-handed neutrinos and through equilibration via inverse-decay processes. We construct the Boltzmann equations in a fully consistent manner, incorporating both effects, to enable a quantitative analysis. When the neutrino Yukawa coupling is large enough to maintain B-L violating interactions in thermal equilibrium, the resulting asymmetry closely tracks its equilibrium value. In contrast, when this condition is not satisfied, a nontrivial interplay emerges between decay and inverse-decay dynamics, determined by the Yukawa coupling strength and the initial abundance of right-handed neutrinos.

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