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Reheating, Matter, Dark Matter –All you need is Neutrino Decays

The decays of heavy Majorana neutrinos and their superpartners shortly after inflation simultaneously give rise to three crucial ingredients for the hot early universe: (1) the entropy inherent to the thermal radiation that dominates the overall energy density, (2) the matter-antimatter asymmetry and (3) dark matter. For characteristic neutrino parameters baryogenesis can be accomplished by means of nonthermal leptogenesis. At the same time the reheating temperature is controlled by the neutrino lifetime in such a way that thermal production of the gravitino, which we assume to be the lightest superparticle, automatically yields the observed amount of dark matter. This connection between the neutrino sector and supergravity results in constraints on superparticle masses in terms of neutrino masses and vice versa. In order to generate a sufficient neutrino abundance after inflation we consider, as an example, neutrino production in the course of tachyonic preheating associated with spontaneous B - L breaking. Our scenario is sensitive to the light neutrino masses and the supergravity mass spectrum and can hence be tested by colliders and in cosmological observations.

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