

## Neutrino mass and the early universe

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The long-existing problem of neutrino mass and mixing can be connected to cosmological phenomena, such as the leptogenesis and the existence of dark matter (DM). In the extension of the type I seesaw model with two right-handed (RH) neutrinos, the seesaw Yukawa can drive the DM production, even with the competition from gravitational effect and constraints from leptogenesis. However, the DM production driven by the seesaw Yukawa is not compatible with the testability of the traditional type I seesaw model, which motivates us to seek a variation. By considering two Higgs doublets, a new type Ib seesaw model is proposed, which can explain the neutrino mass, dark matter and leptogenesis simultaneously while keeping its testability. Moreover, the type Ib seesaw model allows a different approach to dark matter production and stability through a  $U(1)'$  extension.

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