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Dark sector to the rescue of large cosmological neutrino masses

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We consider an extended seesaw model which generates active neutrino masses via the usual type-I seesaw and leads to a large number of massless fermions as well as a sterile neutrino dark matter (DM) candidate in the O(10–100) keV mass range. The dark sector comes into thermal equilibrium with Standard Model neutrinos after neutrino decoupling and before recombination via a $U(1)$ gauge interaction in the dark sector. This suppresses the abundance of active neutrinos and therefore reconciles sizeable neutrino masses with cosmology. The DM abundance is determined by freeze-out in the dark sector, which allows avoiding bounds from X-ray searches. Our scenario predicts a slight increase in the effective number of neutrino species $N_{\rm eff}$ at recombination, potentially detectable by future CMB missions.

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