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Cosmological neutrino counting, light WIMPs, and nuclear physics KENNETH NOLLETT, University of South Carolina, GARY STEIGMAN, The Ohio State University — Constraints from big-bang nucleosynthesis (BBN) and the cosmic microwave background (CMB) limit the allowed number of neutrinolike particle species (of which only three can participate in the standard-model weak interaction) through their influence on the expansion rate of the universe. However, thermally-populated "light WIMPs" with mass < 20 MeV that couple to neutrinos or to the electromagnetic plasma would alter these limits. We have examined the observational consequences of light WIMPs for BBN and the CMB, assuming alternately that the WIMPs couple strongly either to the electromagnetic plasma or to the neutrinos. Light WIMPs that couple to neutrinos are disfavored compared with the standard model, while WIMPs that couple to the plasma are slightly favored over the standard model and could make a fourth thermally-populated neutrino species consistent with current data. In either case, current data imply a lower limit on the WIMP mass of 0.5 MeV to about 5 MeV, depending on the WIMP properties. We present the derived constraints and comment on their coupling to the underlying nuclear rates, particularly that of $d(p,\gamma)^3$He.

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