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Exploring Left-Right symmetry in Cosmic Microwave Background

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We investigate the doublet variant left-right symmetric model (LRSM) using the cosmic microwave background (CMB). The masses of neutrinos and other fermions are determined solely by their interactions with the Higgs bidoublet in this model. Light neutrinos, as Dirac particles, introduce additional relativistic degrees of freedom that interact in the early universe, particularly in the right sector through gauge interactions. By applying Planck 2018 constraints and considering future CMB Stage IV experiments, we conclude that a W_R boson mass below 4.06 TeV is ruled out with 2σ C.L., consistent with constraints from LHC dijet resonance searches. Moreover, even when accounting for additional relativistic degrees of freedom in the TeV range, the Planck 2018 limit at a 1σ confidence level excludes a significantly larger parameter space beyond the reach of current direct search experiments. We also analyze the implications of these constraints on dark matter in this framework, where a dominant dark matter component is represented by a right-handed real fermion quintuplet in the universe.

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