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Sterile neutrinos of the left-right symmetric model as dark matter

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The observation of neutrino oscillations provides convincing evidence for non-zero neutrino masses, indicating the existence of a New Physics beyond the Standard Model (SM). A natural generalization on the high-energy scale, theoretically motivated by the idea of Grand Unification, is the left-right symmetry (LR symmetry), in which left- and right- chiral fermions are treated in the same way. Such extension of the SM has several attractive consequences: (1) it provides sources of parity violation that could explain the baryon asymmetry of the Universe, (2) implements the seesaw mechanism that explains the small neutrino masses and neutrino oscillations, (3) predicts the existence of sterile neutrinos, the lightest one is a candidate for the role of a dark matter particle. In our work, we focused on the Minimal Left-Right Symmetric Model (MLRM) with a gauge group $SU(3)_c \times SU(2)_R \times SU(2)_L \times U(1)_{B-L}$ that is broken down to $SU(3)_c \times U(1)_{em}$ due to the non-trivial vacuum structure of the extended Higgs sector. Within this framework, we fixed a set of parameters in the extended Higgs potential by "tuning" them to match the observed Higgs boson mass of 125 GeV, while taking into account existing experimental constraints on the masses of additional non-standard Higgs bosons and massive vector bosons $W_R^{\pm}$ and Z_R. We also considered the parameterization of mixing in the lepton sector in detail, investigated the possibility of sterile neutrinos as a warm dark matter, taking into account astrophysical, cosmological, and accelerator constraints.

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