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Hidden Vector Dark Matter Phenomenology

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Abstract

This work investigates the phenomenology of a vector dark matter model based on an additional hidden gauge symmetry, (SU(2){HS}), introduced through a scalar doublet (\Phi). The scalar potential exhibits a global (SO(4)) symmetry, which is spontaneously broken by the vacuum expectation value of (\Phi), giving mass to the new gauge bosons (A\muˆi). The resulting custodial (SO(3)) symmetry ensures their mass degeneracy and stability, making them viable dark matter candidates.

The model is tested through a statistical analysis of the dark matter relic density and direct detection cross-section. Its parameter space is explored using publicly available numerical tools, incorporating constraints from XENON1T, Planck, and LHC Higgs measurements, as well as collider searches for the additional scalar, perturbative unitarity, and vacuum stability.

The resulting likelihood analysis shows that the model can explain either part or all of the observed dark matter abundance while offering promising prospects for detection in future direct detection experiments.

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