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A realistic model for Dark Matter interactions in the neutrino portal paradigm

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Summary

We discuss a simple extension of the Standard Model (SM) that provides an explicit realization of the dark-matter (DM) neutrino-portal paradigm. The dark sector is composed of a scalar Φ and a Dirac fermion Ψ, with the latter assumed to be lighter than the former. These particles interact with the SM through the exchange of a set of heavy Dirac fermion mediators that are neutral under all local SM symmetries, and also under the dark-sector symmetry that stabilizes the Ψ against decay. We show that this model can accommodate all experimental and observational constraints provided the DM mass is below ˜35 GeV or is in a resonant region of the Higgs or Z boson. We also show that if the dark scalar and dark fermion are almost degenerate in mass, heavier DM fermions are not excluded. We note that in this scenario DM annihilation in the cores of astrophysical objects and the galactic halo produces a monochromatic neutrino beam of energy m_Ψ, which provides a clear signature for this paradigm. Other experimental signatures are also discussed.

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