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Dirac Fermionic Dark Matter Confronting the Latest Data

We study the case of Dirac fermionic dark matter (DM). It is well known that the Dirac fermionic DM is seriously constrained from the experiment of spin-independent (SI) elastic cross sections with nuclei in the direct search. To evade the tree level interaction, the quantum numbers of the Dirac DM are taken to be $I_3 = Y = 0$. We find that there is a cancellation in one-loop diagrams, which reduces the cross section and makes the Dirac DM viable in the direct search. For a generic isospin I , we survey the Dirac DM mass constrained by the latest results of the LUX and PandaX-II experiments in the direct search, the observed DM relic density, and the Fermi-LAT data analysis in the indirect search. The velocity averaged cross sections of DM annihilation to the standard model (SM) gauge bosons are significantly enhanced by the Sommerfeld effect. The contributions are further analyzed separately according to the spin configurations of the DM pair. Our predictions can be verified by the future experiments.

Experimental Collaboration

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