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Probing Light Inelastic Dark Matter from Direct Detection

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Different dark matter (DM) candidates could have different types of DM-lepton and/or DM-quark interactions. For direct detection experiments, this leads to diversity in the recoil spectra, where both DM-electron and DM-nucleus scatterings may contribute. Furthermore, kinematic effects such as those of the inelastic scattering can also play an important role in shaping the recoil spectra. In this work, we systematically study signatures of the light exothermic inelastic DM from the recoil spectra including both the DM-electron scattering and Migdal effect. Such inelastic DM has mass around (sub-)GeV scale and the DM mass-splitting ranges from 1keV to 30keV. We analyze the direct detection sensitivities to such light inelastic DM. For different inelastic DM masses and mass-splittings, we find that the DM-electron recoil and Migdal effect can contribute significantly and differently to the direct detection signatures. Hence, it is important to perform combined analysis to include both the DM-electron recoil and Migdal effect. We further demonstrate that this analysis has strong impacts on the cosmological and laboratory bounds for the inelastic DM.

Collaboration (if any)

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