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Charged lepton flavor violating light Dark Matter and muonium invisible decay

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We explore lepton flavor violating (LFV) dark matter (DM) interactions within an effective field theory framework, considering the operators of the form $\bar{\ell}_j \Gamma \ell_i, \mathtt{DM}^2$ for $(ij) = (\mu e, , \tau e, , \tau \mu)$ and where DM can be scalar, fermion, and vector. We analyze the three-body decay $\ell_i \to \ell_j + \mathtt{DM} + \mathtt{DM}$, showing its utility in probing operator structure and DM mass. Using current bounds on LFV decays with invisible final states, we set strong constraints on the effective scale. For the μe case, we also study the radiative decay $\mu \to e + \mathtt{DM} + \mathtt{DM} + \gamma$, and examine muonium invisible decays, which can be significantly enhanced. A future observation of paramuonium invisible decay would provide a clear signal of such LFV DM interactions.

Collaboration you are representing

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