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How atoms respond to general dark matter-electron interactions

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Conventional dark matter (DM) searches are looking for scattering events between DM particles of the galactic halo and nuclei in a detector target. For kinematic reasons, they lose sensitivity to masses below typically a few GeV. The most prominent strategy to probe sub-GeV masses is to search for DM-electron scatterings.
In modelling these interactions, the literature has been dominated by the "standard model of sub-GeV DM", in which the interactions are mediated by a "dark photon", the gauge boson of a new, broken U(1) symmetry. By avoiding this model dependence using effective theory methods, we can study more general, previously unexplored DM-electron interactions and how they excite and ionize atoms. In this general framework, new atomic response functions arise, which we compute for xenon and argon targets for the first time. Such new responses have interesting implications, not just for astroparticle, but also condensed matter physics.

Abstract Track

Astroparticle physics

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