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Exploring General Vector Mediators in Inelastic Dark Matter Models

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Despite the robust cosmological and astrophysical evidence confirming the existence of a non-baryonic matter component in the Universe, the underlying nature of Dark Matter (DM) remains a mystery. Among the several possible scenarios, light DM candidates thermally produced in the early Universe are especially interesting, since their abundance could be set via the standard freeze-out mechanism. Additionally, new light states can present a rich phenomenology and are attracting increasing attention due to recent experimental capabilities to probe dark sectors with feeble interactions. In particular, inelastic DM (iDM) candidates are an appealing option, since they can avoid CMB bounds as well as indirect and direct detection searches. Although such models have been intensively studied in the literature, the usual scenario is to consider a secluded dark photon mediator. In this work, we consider the case of iDM with general vector mediators and explore the consequences of such a choice in the relic density computation, as well as for the cosmological and experimental bounds. We also provide a numerical Python library to compute the relic densities for user-defined gauge charges.

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