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Spin-1 Thermal Targets for Dark Matter Searches at Fixed Target Experiments

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Sub-GeV dark matter (DM) has been gaining significant interest in recent years, since it can account for the thermal relic abundance while evading nuclear recoil direct detection constraints. Such light DM must carry a larger energy to be probed, either directly or through missing energy/momentum, making beam dump and fixed target experiments ideal for this mass range. Here, we extend the previous literature, which mainly focuses on the predicted experimental signals of scalar and fermionic DM, to a set of models for spin-1 DM including a family of simplified models (involving one DM candidate and one mediator –the dark photon) and ultraviolet complete models based on a non-abelian gauge group. In this analysis, we identify the parameters consistent with the observed relic abundance, compute the relevant constraints from existing experiments, and predict the sensitivity of future experiments such as the upcoming LDMX. We find that spin-1 DM is testable by future experiments, and will be the first DM models probed by LDMX.

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