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Enabling Forbidden Dark Matter

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The thermal relic density of dark matter is conventionally set by two-body annihilations. We point out that in many simple models, $3 \rightarrow 2$ annihilations can play an important role in determining the relic density over a broad range of model parameters. This occurs when the two-body annihilation is kinematically forbidden, but the $3 \rightarrow 2$ process is allowed; we call this scenario “Not-Forbidden Dark Matter”. We illustrate this mechanism for a vector portal dark matter model, showing that for a dark matter mass of $m\chi \sim \text{MeV} - 10 \text{ GeV}$, $3 \rightarrow 2$ processes not only lead to the observed relic density, but also imply a self-interaction cross section that can solve the cusp/core problem. This can be accomplished while remaining consistent with stringent CMB constraints on light dark matter, and can potentially be discovered at future direct detection experiments.

Summary

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