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Realistic simplified dark matter models

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We show that simplified models used to describe the interactions of dark matter with Standard Model particles do not in general respect gauge invariance and that perturbative unitarity may be violated in large regions of the parameter space. The modifications necessary to cure these inconsistencies may imply a much richer phenomenology and lead to stringent constraints on the model. We illustrate these observations by considering the simplified model of a fermionic dark matter particle and a vector mediator. The resulting constraints are typically stronger than the 'classic' constraints on DM simplified models such as monojet searches and make it difficult to avoid thermal overproduction of dark matter.

Summary

We show that simplified models used to describe the interactions of dark matter with Standard Model particles do not in general respect gauge invariance and that perturbative unitarity may be violated in large regions of the parameter space.

Primary author: VOGL, Stefan (Karlsruhe Institute of Technology)

Presenter: VOGL, Stefan (Karlsruhe Institute of Technology)

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