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Flavour in the Dark: Investigating Dark Matter with Low-Mass Spin-0 Mediator

This work explores a simplified dark matter (DM) model featuring a spin-0 mediator with masses below 10 GeV. The parameter space is systematically divided into various mediator mass regions, and model constraints are derived using a diverse array of observables. These include flavour-changing charged and neutral current processes, rare and semileptonic decays of pseudoscalar mesons, electroweak precision observables (EWPOs), and data from fixed-target experiments. The model's potential to account for recent Belle-II data concerning invisible B-meson decays is also studied. Our investigation includes a detailed analysis of DM properties and incorporates constraints from Big Bang nucleosynthesis. We establish robust parameter bounds through both individual and simultaneous analyses, underscoring their implications for DM phenomenology. Furthermore, we illustrate mapped constraints on analogous interaction parameters in UV-complete models. This study contributes to a comprehensive exploration of constraints and theoretical implications associated with low-mass spin-0 mediators with fermionic DM models.

Field of contribution

Phenomenology

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Track Classification: Quark and lepton flavour physics