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A Robust Description of Hadronic Decays in Light Vector Mediator Models

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Abelian $U(1)$ gauge group extensions of the Standard Model represent one of the most minimal approaches to solve some of the most urgent particle physics questions and provide a rich phenomenology in various experimental searches. In this work, we focus on baryophilic vector mediator models in the MeV-to-GeV mass range and, in particular, present, for the first time, gauge vector field decays into almost arbitrary hadronic final states. Using only very little theoretical approximations, we rigorously follow the vector meson dominance theory in our calculations. We study the effect on the total and partial decay widths, the branching ratios, and not least on the present (future) experimental limits (reach) on (for) the mass and couplings of light vector particles in different models. We compare our results to current results in the literature. Our calculations are publicly available in a python package to compute various vector particle decay quantities in order to describe leptonic as well as hadronic decay signatures for experimental searches.

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