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$B \rightarrow K + \textit{invisible}$ in a model with axion-like particles

An axion-like particle a (ALP) can explain the excess of $B \rightarrow K + \textit{invisible}$ events at Belle-II. However, many analyses of ALP scenarios are over-simplified. We revisit the $B \rightarrow K + a$ transition rate in a popular minimal and UV complete model with two Higgs doublets (2HDM) and a complex singlet (DFSZ model). To this end we compare our results with previous studies which derived the $\bar{b}sa$ vertex from the $\bar{b}sA$ vertex, where A is the heavy pseudoscalar of the 2HDM, in terms of an a - A mixing angle. We find this approach to work only at one-loop level, while the two-loop contribution can no more be found in this way and furthermore can be sizable. Meanwhile, employing instead the low-energy axion effective theory leads to a divergent and basis-dependent amplitude. We clarify the ambiguities and identify which low-energy framework is consistent with the DFSZ model.

Secondary track

T09 - Beyond the Standard Model

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