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A combined explanation of $b \rightarrow s\ell\ell$ anomalies and $B \rightarrow \pi K$ puzzle within SMEFT

Two categories of four-fermion SMEFT operators are semileptonic (two quarks and two leptons) and hadronic (four quarks). At tree level, an operator of a given category contributes only to processes of the same category. However, when the SMEFT Hamiltonian is evolved down from the new-physics scale to low energies using the renormalization-group equations (RGEs), due to operator mixing this same SMEFT operator can generate operators of the other category at one loop. Thus, to search for a SMEFT explanation of a low-energy anomaly, or combination of anomalies, one must: (i) identify the candidate semileptonic and hadronic SMEFT operators, (ii) run them down to low energy with the RGEs, (iii) generate the required low-energy operators with the correct Wilson coefficients, and (iv) check that all other constraints are satisfied. In this paper, we illustrate this method by finding all SMEFT operators that, by themselves, provide a combined explanation of the (semileptonic) $b \rightarrow s\ell\ell$ anomalies and the (hadronic) $B \rightarrow \pi K$ puzzle.

Field of contribution

Phenomenology

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