Abstract ID : **52**

Effective Field Theory approach for radiative corrections to superallowed beta decays

Content

Radiative corrections are essential for an accurate determination of the V_{ud} element of the Cabibbo-Kobayashi-Maskawa quark mixing matrix from superallowed β decays. In view of recent progress in the single-nucleon sector, the uncertainty is dominated by the theoretical description of nucleus-dependent effects, limiting the precision that can
currently be achieved for V_{ud}. In this work, we provide a detailed account of the electroweak corrections to superallowed β decays in effective field theory (EFT), including the power counting, potential and ultrasoft contributions, and factorization in the decay rate. We present a first numerical evaluation of the dominant corrections in light nuclei based on quantum Monte Carlo methods, confirming the expectations from the EFT power counting, and we discuss strategies how to extract from data the low-energy constants that parametrize short-distance contributions and whose values are not predicted by the EFT.
We finally discuss how to extend the formalism to Gamow-Teller decays.

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Status: SUBMITTED

Submitted by **MEREGHETTI, emanuele** on **Monday, 17 March 2025**