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Nuclear structure corrections for superallowed 0+−>0+ beta decay revisited

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Superallowed Fermi beta decay provides one of the most important tests of the fundamental symmetries underlying the Standard Model of electroweak interactions. The constancy of the absolute Ft value would confirm the conserved vector current hypothesis and allow to extract the vector coupling constant and Vud matrix element of the Cabibbo-Kobayashi-Maskawa matrix with the highest precision. At present, ft-values for fourteen 0+ beta transitions are known with a precision better than 0.1%. To extract the absolute Ft value of the data, a few radiative and a nuclear structure corrections should be applied. The latter, which is due to the isospin-symmetry breaking in nuclear states, still represents a great challenge for a theoretical model [1]. We present a new shell-model calculation of a correction to superallowed Fermi beta decay for sd-shell emitters. In this study, many-body states are constructed from modern sd-shell Hamiltonians. We focus on a radial overlap correction, accounting for the difference between proton and neutron radial wave functions due to the presence of the Coulomb and isovector terms in a nuclear mean-field potential. We use a phenomenological Woods-Saxon potential and a self-consistent Hartree-Fock with zero-range Skyrme forces, with various recently developed parameterizations, slightly adjusted on nucleon separation energy and charge radii. The results are compared with previous calculations ([1] and refs. therein). In our opinion, there is still some freedom in the selection of the WS parametrization and details of separation energy fits.

[1] J.C. Hardy and I.S. Towner, Phys. Rev. C 91, 025501 (2015).

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