Contribution ID: 13

Type: not specified

Recent studies of forbidden non-unique transitions

Tuesday 8 April 2025 16:45 (45 minutes)

As illustrated in a recent review of the log-ft values [1], only ~15% over more than 26,000 beta transitions present in the ENSDF database can be considered as well defined, i.e. with firm or probable single spin assignments of the initial and final nuclear states. About one third of these 15% are forbidden non-unique transitions, which energy spectrum shapes are sensitive to nuclear structure. It is noteworthy that the remaining ~85% of the transitions in the ENSDF database are assumed to be allowed in the evaluation process, namely for the calculation of the mean energies or the capture probabilities. Many more forbidden non-unique transitions are therefore hidden by our lack of knowledge on spins and parities of the nuclear levels.

In this contribution, we will present our recent inclusion of realistic nuclear structure within beta decay calculations, focusing specifically on the forbidden non-unique transitions. The predictions are compared to recent high-precision measurements of first (¹⁵¹Sm, ¹⁷⁶Lu), second (³⁶Cl, ⁹⁹Tc) and third (⁸⁷Rb) forbidden non-unique transitions. The sensitivity of the predictions to the Coulomb displacement energy, when applying the Conserved Vector Current hypothesis, and to the effective values of the weak interaction coupling constants will be highlighted.

[1] S. Turkat, X. Mougeot, B. Singh, K. Zuber, Atomic Data and Nuclear Data Tables 152 (2023) 101584

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Session Classification: Experiments/Methods/Nuclear Data