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Experimental Tests of Isospin Symmetry Breaking in Superaligned Beta Decay

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In the search for physics beyond the standard model, the unitarity test of the Cabibbo-Kobayashi-Maskawa (CKM) matrix is one of the most demanding. Superaligned β transitions between $J^\pi = 0^+$, $T = 1$ analog states currently provide the most precise value for V_{ud} , the up-down quark mixing element of the CKM-matrix. Since no axial current can contribute in first order to these transitions, they give a direct access to the vector coupling constant G_V of the weak interaction. The current value of V_{ud} is $\pm 0.03\%$ accurate [1] and is obtained from fifteen ft -values for superallowed β decays, all measured with a precision of 0.3% or better. There are four small theoretical corrections (all of the order of 1%) required in the V_{ud} extraction. The current result's error is dominated by these theoretical corrections. From the experimentalist's perspective, precision can be further improved by testing the reliability of the predicted corrections. A powerful experimental test comes from measurements of mirror pair superallowed transitions [1,2] In these transitions the predicted corrections are relatively large and the ratio of their ft -values is very sensitive to the model calculation of the isospin-symmetry-breaking corrections δ_{NS} and δ_C . The talk will focus on the experimental effort required, exemplifying with the mirror pair of superallowed $0^+ \rightarrow 0^+\beta$ transitions $^{34}\text{Ar} \rightarrow ^{34}\text{Cl}$ and $^{34}\text{Cl} \rightarrow ^{34}\text{S}$. [1] J. J. C. Hardy and I. S. Towner, Phys. Rev. C **102**, 045501 (2020) [2] V.E. Iacob *et al.* Phys. Rev. C **101**, 045501 (2020)