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Mirror beta transitions as an additional probe for V_{ud}

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Since the potential of mirror beta transitions to provide an independent determination of the V_{ud} quark-mixing matrix element was pointed out, about 15 years ago [1], many measurements of spectroscopic quantities have been performed and more detailed theoretical corrections have been addressed. These significantly improved the precision on the Ft -values of these transitions [2, 3]. In addition, several precise measurements of the asymmetry parameter have been reported and future measurements of other correlation parameters are being prepared. Although mirror transitions have (like neutron decay) the extra complication of requiring a correlation measurement to extract the axial vector-to-vector mixing ratio, the current precision on V_{ud} from nuclear mirror transitions is still comparable to that from free neutron decay and is a factor of about 3 larger than the precision of the value extracted from pure Fermi transitions.

In recent years, important progress was made in the calculation of the nucleus-independent radiative correction (R), in the nuclear structure-dependent radiative corrections (NS) as well as in isospin-symmetry breaking effects (C).

This progress will maintain nuclear mirror decays as a solid additional source for the determination of V_{ud} , along with superallowed pure Fermi transitions and free neutron decay. In this presentation we will discuss the current status and future prospects of these activities.

[1] O. Naviliat-Cuncic and N. Severijns, Phys. Rev. Lett. 102, 142302 (2009).

[2] N. Severijns, M. Tandecki, T. Phalet, I.S. Towner, Phys. Rev. C 78, 055501 (2008).

[3] N. Severijns, L. Hayen, V. De Leebeeck, S. Vanlangendonck, K. Bodek, D. Rozpedzik, I.S. Towner, Phys. Rev. C 107, 015502 (2023).

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