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Precise measurements of half-lives and γ-ray branching ratios of two mirror beta decays, 23Mg and 27Si, in order to study the weak interaction and test the standard model

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Beta decays are a fantastic tool to study the weak interaction described by the standard model, thus this model can be tested by precise measurements with nuclear beta decays. Among these tests, the conserved vector current (CVC) hypothesis and the unitarity of the Cabibbo-Kobayashi-Maskawa (CKM) quark-mixing matrix are of great interest. The CVC hypothesis assumes that the vector coupling constant, Gv, is a universal constant. Regarding the unitarity requirement of the CKM matrix, the quadratic sum of the elements of the top row should add up to unity: Σ(i=d,s,b)V_ui^2=1. In this equation, Vud is the main term, V_ud=(G_v/G_μ). To test these two properties, superallowed Fermi beta decays have yielded the highest precision [1]. However, there are three other possibilities to make these tests: neutron decay, pion decay and mirror beta decays. This last possibility has not been used for long because of the difficulty of determining corrected ft values, ☒t, and Gamow-Teller to Fermi mixing ratios [2]. Despite these difficulties, I will focus on an accurate determination of half-lives and γ-ray branching ratios for two mirror decays, 23Mg and 27Si. For that, measurements have been made at the IGISOL facility at the University of Jyvaskyla. Preliminary results will be presented and put into the international context of weak-interaction studies.

[1] J.C. Hardy and I.S. Towner, Phys. Rev. C 91, 025501 (2015).
[2] N. Severijns et al., Phys. Rev. C 78, 055501 (2008).

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