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Extraction of the weak magnetism form factor from precision spectrum shape measurements in Gamow-Teller transitions

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Precision spectrum shape measurements in nuclear beta decay can be used for testing the Standard Model and physics beyond it with accuracy being competitive with high-energy collider experiments. Such a comparison can be carried out in the framework of effective field theory. The most prominent and poorly known effect in the Standard Model is weak magnetism [1], the higher-order recoil correction induced by nuclear pion exchange. Knowledge of this factor allows for study of the QCD influence on beta decay and plays an important role in determining the significance of the reactor neutrino anomaly. Searches for physics beyond the Standard Model can be realized by exploring the Fierz interference term, also modifying the beta spectrum shape.

We performed precision measurements of the beta spectrum shapes for the pure Gamow-Teller decays of ^{114}In and ^{32}P. The measurements were carried out using the miniBETA spectrometer, which is a combination of a plastic scintillation energy detector and a thin gas detector for the tracking of low energy electrons.

In the talk, the motivation, principle of the measurement and the first weak magnetism and Fierz term extractions from the spectrum shape of the ^{114}In to ^{114}Sn transition [2] will be discussed. The preliminary result obtained from the ^{32}P to ^{32}S transition will be presented as well.

References:
1. N. Severijns, L. Hayen, V. De Leebeeck, S. Vanlangendonck, K. Bodek, D. Rozpedzik, and I. S. Towner, Physical Review C 107, 015502 (2023).
2. L. De Keukeleere, D. Rozpedzik, N. Severijns, K. Bodek, L. Hayen, K. Lojek, M. Perkowski, and S. Vanlangendonck, arXiv:2404.03140 [nucl-ex] (2024).

session

I. Nuclear Structure and Reactions

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