JYFLTRAP : Q_{EC}-values of the superallowed decays of ^{34}Cl and $^{38}K^{m}$

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We have already completed and published two successful measurements of the Q_{EC} values for superallowed $0^+ \rightarrow 0^+$ transitions from $T_z = 0$ nuclei using the JYFLTRAP Penning-trap mass spectrometer at the University of Jyvaskyla cyclotron facility in Finland. The first comprised the results for $^{26}Al^{m}$, ^{42}Sc and ^{46}V [1] and the second, ^{50}Mn and ^{54}Co [2]. Our collaboration has now performed a third experiment, to measure the Q_{EC} values for the superallowed decays of ^{34}Cl and $^{38}K^{m}$. The Q_{EC} values for these two transitions have previously been determined to a claimed high precision with (p,n) threshold measurements, and combined (p,γ) and (n,γ) Q-value measurements, the methods used in the past before Penning traps became available for on-line measurements. They have never been measured with a Penning trap. These two cases thus provide an excellent means to test carefully for any systematic discrepancies between reaction-based and trap-based measurements, a subject of some concern [3] when one combines both types of measurement in the determination of a world average.

As we did in our previous experiments, we produced ^{34}Cl and $^{38}K^{m}$ via (p,n) reactions. A powerful advantage of this approach is that, not only were the superallowed emitters of interest produced in the primary reactions but ions from the target material itself – the beta-decay daughters of these emitters – were also released by elastic scattering of the cyclotron beam. As explained in Ref. [1], with the JYFLTRAP system we can isolate a specific nuclide from the reaction products and measure the cyclotron frequency of its ions in the Penning trap. For each determination of a Q_{EC} value, the cyclotron frequency measurements were interleaved: first we recorded a frequency scan for the daughter, then for the mother, then for the daughter and so on. This way, most potential systematic effects could be reduced to a minimum or eliminated. For each measurement, data were collected in several sets, each comprising ~10 pairs of parent-daughter frequency scans taken under the same conditions.

The experimental data are still being analyzed.

[1] T. Eronen, V. Elomaa, U. Hager, J. Hakala, A. Jokinen, A. Kankainen, I. Moore, H. Penttilä, S. Rahaman, A. Saastamoinen, T. Sonoda, J. Äystő, J. C. Hardy, and V. Kolhinen, Phys. Rev. Lett. **97**, 232501 (2006).

[2] T. Eronen, V. -V. Elomaa, U. Hager, J. Hakala, J. C. Hardy, A. Jokinen, A. Kankainen, I. D. Moore, H. Penttila, S. Rahaman, S. Rinta-Antila, J. Rissanen, A. Saastamoinen, T. Sonoda, C. Weber, and J Aysto, Phys. Rev. Lett. **100**, 132502 (2008).

[3] J. C. Hardy, I. S. Towner, and G. Savard, Int. J. Mass Spectrometry **251**, 95 (2006).