JYFLTRAP : Q_{EC}-values of the superallowed decays of ^{50}Mn and ^{54}Co

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Following a successful measurement of the Q_{EC} values for $^{26}Al^{m}$, ^{42}Sc and ^{46}V [1], our collaboration with JYFLTRAP, an on-line Penning trap mass spectrometer at the University of Jyväskylä cyclotron facility, has begun a second experiment, to measure the Q_{EC} values for the superallowed decays of ^{50}Mn and ^{54}Co. These cases have become particularly interesting after the discovery that the corrected $\mathcal{Ft}$ value for ^{46}V was significantly higher than that for any other well known superallowed transition. The most obvious explanation of its unusual value is that the correction for isospin symmetry-breaking, which depends upon the nuclear structure of the parent and daughter nuclei, is missing some important components, and we have begun to examine this possibility theoretically [2]. What we have found so far is that by including the *sd*-shell with the *fp*-shell in our configuration space, we could remove the shift in the ^{46}V result but not without introducing shifts in the $\mathcal{Ft}$ values for ^{50}Mn and ^{54}Co as well. The currently accepted Q_{EC} values for ^{50}Mn and ^{54}Co are averages, each with an important contribution from a 30-year-old (^{3}He,t) Q-value measurement published by Vonach et al. [3] in the same paper in which their now-discredited value for the ^{46}V Q_{EC} value appeared. Perhaps their results for ^{50}Mn and ^{54}Co were wrong as well.

As we did in our previous experiment, we produced ^{50}Mn and ^{54}Co 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 possible 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] I. S. Towner and J. C. Hardy, *Progress in Research,* Cyclotron Institute, Texas A&M University (2005-2006), p III-39.

[3] H. Vonach *et al.*, Nucl. Phys. **A278**, 189 (1977).