NOTIZEN

Energies of the 122 and 136 keV Lines of ^{57}Fe

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The 14.4 keV γ-line is convenient for the energy calibration of low-energy γ-transitions. The availability of high resolution Ge(Li) and Si(Li) spectrometers allows very precise measurements of the energies of γ-lines if the energies of suitable standards are known to a sufficient accuracy. The most precise figure for the energy of the 14 keV line has been obtained by BEARDEN [1] as 14.41247 keV. Although this value is probably correct to better than 2×10^{-5} it has not entered commonly used tables like the Table of Isotopes [2], where a figure of 14.36 ± 0.05 keV is listed in the table of Gamma-ray energy standards. Even in a recent reference [3], where an energy of 14.408 ± 0.005 keV has been given, the authors are probably not aware of Bearden's result. For π-^{4}He studies [4] which have been performed at CERN, a value for the 14.4 keV line is needed with an uncertainty less than 5 eV.

For this reason we have decided to measure independently its energy with the use of the old FRM curved crystal spectrometer [5] after it had been removed from the reactor, installed in the laboratory and equiped with the Wild T4 theodolite for manual measurements of the angle of reflection and with the first 5.76 m curved quartz crystal reflecting from the 110 planes and previously used at the Risö spectrometer [6]. Because of the thickness (4 mm) of the crystal it was completely hopeless to observe the Laue-reflection of the 14 keV line. Therefore, the third and fifth order reflections of the 122 and 136 keV lines from a 20 mCi source of ^{57}Co were recorded repeatedly so that the uncertainty of the measurement was essentially given by the accuracy of the theodolite. The spectrometer was calibrated with the $K\alpha_1$ line of Tm the energy of which has been determined as 50.7417 keV $\pm$ 0.8 eV by BERGVALL [7]. The calibration was performed with an accuracy of 1.5×10^{-5} so that the total calibration error amounts to 2.2×10^{-5}.

The resulting energies of the 122 and 136 keV γ-lines are 122.0638 keV and 136.4785 keV with relative energy errors of 1.5 eV and absolute energy errors of 3.0 eV and 3.5 eV, respectively.

From these data, the energy of the 14 keV line is found as 14.4147 keV $\pm$ 2.5 eV, in agreement with Bearden's result and consistent with the result of Konijn and Lingeman. Obviously, the energy error is mainly due to the relative energy errors of the 122 and 136 keV lines. It is worth noting that the energies of 122.060 keV $\pm$ 10 eV and 136.471 keV $\pm$ 10 eV determined for these lines in the Ge(Li) measurement of GREENWOOD, HELMER, and GEHRKE [8] are in very good agreement with the result obtained in this work. The quality of this agreement demonstrates the above mentioned need for very precise standards even for Ge(Li) or Si(Li) spectrometers.

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