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AND

Corrections for the Resolution and Radiator Foil in the Beta-Ray Spectrometer

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An iron-free magnetic lens beta-ray spectrometer has been constructed. The spectrometer is mounted with its axis parallel to the earth's magnetic field. The spectrometer chamber has been constructed of aluminum tubing in order to reduce electron scattering to a minimum. The spectrometer has been used for the determination of gamma-ray energies from Zn^{65} and Co^{60}.

In order to calculate the energies of the gamma-rays from the energies of the photoelectrons which are focused in the spectrometer, there are three corrections which must be applied. One correction is the binding energy of the electron in the shell of the atom from which it was ejected. A second correction is that due to the earth's magnetic field. This correction is made by adding a correction term, which is independent of the current in the coil, to the observed value of the current required to focus electrons of a particular momentum.

The third correction is due to the surface density of the radiator and the finite resolving power of the spectrometer. A method of determining these effects is discussed, assuming a triangular transmission curve and a rectangular momentum distribution of electrons emitted from the foil. Let P_m be the electron momentum before losing energy in the foil, P_{om} be the uncorrected momentum as measured by the spectrometer, K be the resolving power of the spectrometer, and a be the average momentum loss of electrons in passing through the entire foil. Then it is found that

$$\text{if } K P_{om} > \tfrac{a}{2} \qquad P_m = P_{om} + \tfrac{a}{2}$$

$$\text{if } K P_{om} < \tfrac{a}{2} \qquad P_m = P_{om}(1+K)$$

The energies of the gamma-rays of Zn^{65} and Co^{60}, as determined in this investigation, are given in Table 1.

TABLE 1

Gamma-ray energies of Zn^{65} and Co^{60}

Gamma-ray	Zn^{65} MeV	Co^{60} MeV
1	1.106	1.156
2		1.320

The probable error is estimated to be 1%.

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