AUTOIONIZATION OF THE K-SHELL IN THE BETA DECAY OF ^{64}Cu

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^{64}Cu decays by both K capture and beta decay, and no transitions to excited states of ^{64}Zn have been reported so far. Both decays are excepted to be accompanied by the emission of characteristic x rays of daughter atoms. Zinc K x rays are produced by autoionization process. It the K capture to beta decay branching ratio ε_K/β is known, the ratio of intensities of the K x rays of the respective daughter atoms $N_{K_\alpha}(Zn)/N_{K_\alpha}(Ni)$ allows us to calculate[1] the autoionization probability P_K by the relation

$$P_K = \frac{N_{K_\alpha}(Zn)}{N_{K_\alpha}(Ni)} \cdot \frac{\varepsilon_K}{\varepsilon^2} \cdot \frac{\omega_x(Ni)}{\omega_x(Zn)} \cdot \frac{f_{K_\alpha}(Ni)}{f_{K_\alpha}(Zn)} \cdot \frac{t(Ni)}{t(Zn)} \cdot \frac{\varepsilon^2(Ni)}{\varepsilon^2(Zn)}$$

ω_x is the fluorescent yields, ε is the detector efficiency, and f_K determines the contribution of K_α x rays to total K x rays. In order to allow for alternation of K_α x rays in the source, the transmission factor t is included.

Energy spectra of radioactive ^{64} source were measured by a high-resolution Si(Li) detector (180eV for 6.4keV gamma ray). Data were collected with a Canberra 1024-channel analyser. Experimental data are shown in Fig.1. The detector used could not resolve nickel K_α x rays from zinc K_α x rays and therefore zinc K_α x rays were measured. P_K was measured to be $(10.3\pm1.0)\times10^{-3}$. The only theoretical value available, based on the two-step model[2], predicts a value of 10^{-3}, which is in excelent agreement with our experimental results.

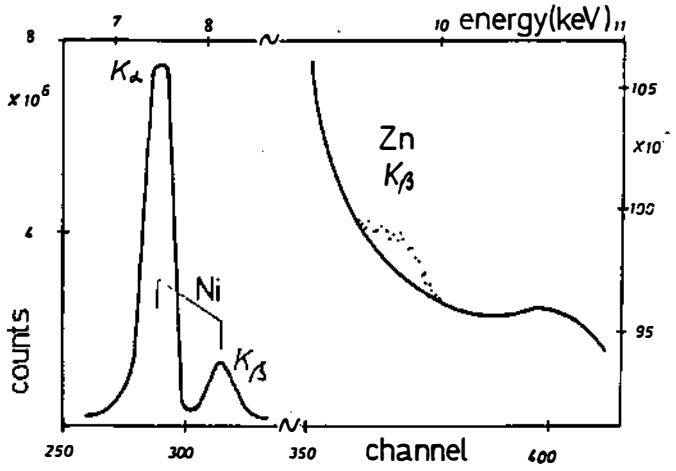

Fig.1.

References:
1) A. Ljubičić, D. Martel, R.T. Yones, B.A. Logan, Can. J. Phys. 52 (1974) 1152.
2) T.A. Carlson, C.W. Nestor, T.C. Tucker, F.B. Malik, Phys. Rev. 169 (1968) 29.