On the Decay Scheme of $^{214}_{84}$Po.

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Summary. — New researches have been accomplished on the decay scheme of $^{214}_{84}$Po, and we have now used as well a photographic method as a method of opportunely discriminated coincidence countings. These methods have brought to the individuation of $\gamma$-$\gamma$ cascades existing in the $^{214}_{84}$Po decay spectrum. In consequence it has been possible to establish the energy level scheme for the $\gamma$-rays according to the known $\gamma$-ray spectrum and the cascades. The resulting scheme shows remarkable differences from those proposed in the past by other authors.

1. — Introduction.

We have quite recently studied (1), with an absorption method, the energies and the intensities of $^{214}_{84}$Po cascade $\gamma$-rays.

However, owing to the poor approximation of our experimental method, we could not establish if among the various decay schemes built taking into account the data of the long range $\alpha$-particles (2) and the $\gamma$-ray energies (3) there is one that satisfies univocally the experimental results.

Indeed the various decay schemes (4,4) do not present such a different behaviour in the absorption, to be revealed through our experimental results.

The mentioned decay schemes show a (1.76; 1.12) MeV $\gamma$-$\gamma$ cascade whose

intensity is \(\approx 0.20\) per every \(\beta\) disintegration of \(^{214}\text{Bi}\); otherwise the 0.61 MeV \(\gamma\)-ray, that decays with an intensity of 0.66 from the first excited to the ground state \(^{(5)}\), appears partially as a member of a \(\gamma\)-ray cascade only in the scheme suggested by J. Sérugue.

At the same time of our paper, a new report by A. H. Wapstra \(^{(6)}\) appeared on some experimental investigations about the \(\beta\)-decay from \(^{214}\text{Bi}\).

The author did not experimentally find a \(\beta\)-ray whose energy corresponds to a direct transition to the 0.61 MeV energy level; but he was brought to admit of its existence as he suggests in his partial decay scheme.

In this scheme the \((1.76; 1.12)\) MeV \(\gamma\)-\(\gamma\) ray cascade was no longer considered, because a \(\beta\)-ray with energy and intensity which could justify this cascade was not experimentally found.

All these results cannot be considered in agreement with each other.

Therefore we have been induced to study again the \(^{214}\text{Po}\) decay spectrum by means of experimental methods more suitable to the complexity of this problem.

2. - Experimental Apparatus.

In our measurements we have made use of the following apparatus, whose block-diagram is sketched in Fig. 1.

\(R_1\) and \(R_2\) are two \(\gamma\)-rays scintillation crystal (NaI-Tl)-phototube devices acting as \(\gamma\)-ray proportional counters with good resolving power.

The voltage pulses at the output of the phototubes, through a convenient preamplifier are applied to the grids of two pulse shapers \(F_1\) and \(F_2\) (asymmetrical univibrators).

The pulses, after a process of differentiation, are applied to the grids of a twin triode \(T_e\) which reveals the coincidence of two pulses \([\text{resolving time: } \tau = (1.72 \pm 0.05) \ 10^{-7} \text{s}]\).

\(C_1\) and \(C_2\) count the total numbers of \(\gamma\)-rays detected by \(R_1\) and \(R_2\), after having triggered the pulse shapers. These shapers are also used as integral discriminators.

\(C_3\) counts the total number of coincidences.

To obtain a good ratio between the effective and the accidental coincidence


\(^{(6)}\) A. H. Wapstra: Akademisch Proefschrift (Amsterdam, 1953).