Forbidden Beta-Spectra of Sb^{124} and I^{124} *

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IN a recent letter,[1] an attempt was made to fit the 2.291-Mev beta-spectrum of Sb^{124} with a linear combination of twice-forbidden factors instead of the once-forbidden p^2+q^2 factor previously proposed.[2] This suggestion arises, in part, from the apparently high comparative half-life ($\log ft=10.1$) for the transition.

It is interesting to note that in the decay[3] of I^{124}, the 2.2-Mev positron transition appears to be in the same excited state of Te^{124}. Taking account of the alternative modes of decay, including those by K-capture,[4] one finds that the comparative half-life for this transition corresponds to $\log ft=8.1$, with $\log(W_0^2-1)ft=9.5$. These values are quite in line with those found for other once-forbidden transitions involving a spin-change of 2. The spectrum of I^{124} is also fitted by the C_{1T}, p^2+q^2 factor.

According to the nuclear shell model, the state in Sb^{124} is best described as $I=3$, $+$, arising from the combination of a $g_{7/2}$ proton and an $s_{1/2}$ neutron. The state of I^{124} is also expected to be $I=3$, $+$, arising from a $d_{5/2}$ proton and an $s_{1/2}$ neutron. The resultant "L" state would then be 4 for the Sb^{124} and 2 for the I^{124}.

Although there seems to be some tendency[5] for the first excited state of an even-even nucleus to be $I=2$, $+$, this rule is not without exceptions. It is therefore not unreasonable, in view of the spectrum shapes, to assign $I=1$, $-$, to the 0.60-Mev level in Te^{124}.

The somewhat high comparative half-life for the Sb^{124} transition apparently results then from its being "ΔL-forbidden" in addition to its involving a parity change and a total angular momentum change of 2 units.

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A Search for Gamma-Rays from the 4.8-Mev Level in Li^7 *

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IN order to make a preliminary determination as to whether Li^7 in the 4.8-Mev excited state[1] decays by gamma-emission, a comparison was made between the gamma-spectrum from the reaction

$$C^{12}(p,p')C^{12*}\rightarrow C^{12}+\gamma+4.5 \text{ Mev}$$

and that from $Li^7(p,p')Li^{7*}$, $Q=-4.8$ Mev, using the 8-Mev protons from the MIT cyclotron. The gamma-spectrum was measured alternately from thin, unbacked carbon and lithium targets using a NaI-Tl scintillation counter located at 90° to the beam. The carbon gamma-spectrum showed a pronounced peak corresponding to the 4.5-Mev gamma-ray, whereas in the case of the lithium target there was no evidence of a gamma-peak in the 4.8-Mev region above a low background of very high energy gammas. The inelastic proton groups from the two targets were roughly equal in intensity, as measured in a double proportional counter. It appears that the preferred mode of decay for the 4.8-Mev level in Li^7 is not by gamma-emission but by particle emission —probably breaking up into He^4 and H^3.

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The Decay of Bi^{207}

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BISMUTH 207 has been prepared by bombarding lead foil with 25-Mev protons in the Harwell cyclotron and extracting the bismuth chemically as bismuth oxychloride. The decay of the bismuth isotopes was followed for 300 days and the Bi^{207} identified by its long half-life and the presence of lead K-radiation resulting from the K-capture decay.

Measurements using a NaI(Tl) scintillation detector show prominent γ-ray lines at 0.56 ± 0.03 Mev and 1.1 ± 0.05 Mev. These can probably be identified with the 0.565- and 1.063-Mev lines reported by Neumann and Perlman.[1] Although the resolution of the scintillation spectrometer is less than that of the β-ray spectrograph, the former has the advantage that the measured magnitude of the peaks is simply related to the γ-ray intensities provided that the γ-rays are only weakly converted. We conclude that the two lines are of equal intensity within the experimental error. This suggests that the two γ-rays are emitted in cascade, and coincidences between them were detected using two scintillation counters. A pulse-height analyzer operating on one counter was gated by pulses from the other, and the results show that at least half of the 0.56- and 1.1-Mev γ-rays are emitted in cascade.

Taken with the β-ray spectrograph measurements of Neumann and Perlman[1] these results give the ratio of K internal conversion coefficients. This is consistent with the level assignment given by Goldhaber and Sunyar[2] in which the 1.1-Mev γ-ray is $M4$ and precedes the 0.56-Mev γ-ray which is $E2$ (electric quadrupole). These γ-rays are presumably to be identified with those found by Campbell and Goodrich[3] in the 0.9-sec isomeric state of Pb^{207}.

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Positron Spectra of Certain Mirror Nuclei*

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THE positron energy end points and half-lives of the "mirror" nuclei Mg^{23}, Si^{27}, S^{31}, Cl^{33}, K^{37}, and Ca^{39} have been investigated with a scintillation spectrometer and pulse recording equipment. These nuclei were produced by (γ,n) and $(\gamma,2n)$ reactions induced by 70-Mev x-ray irradiation.

Most of these activities have been studied previously by cloud chamber and absorption techniques.[1–5] The present work provides confirmation of some earlier values, and yields the additional end points of K^{37} and Ca^{39}.

Except in the case of Mg^{23} where magnesium foil was used, sources were prepared from finely-powdered compounds, chosen so as to yield no short-lived high energy activities which might interfere with those of the isotopes being investigated. Each powdered compound was mixed with a small amount of Zapon lacquer, which acted as a binder, and was formed into a thin wafer. This was supported by 0.00025-inch-thick paper covering a $\frac{1}{8}$-inch opening in a source holder made of 0.005-inch thick nickel. The surface densities of the samples were 20–30 mg/cm². Background activity due to the source holder was always less than 2 percent of the activity being studied. Samples were irradiated at maximum beam energy for approximately one half-life of the desired activity.