10 triad.[8,9] If we assume that the state at 3.34 Mev in C^{10} is formed by the same nucleon configuration as the 2^+ state at 3.37 Mev in Be^{10}, then there is essentially no energy shift for this state.[10] On the other hand, the 5-Mev level(s) in C^{10} seem to indicate an appreciable energy shift of one or more of the 6-Mev levels in Be^{10}. This energy difference can perhaps be explained as a Thomas-Ehrmann shift.[11,12]

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[8] F. Ajzenberg and T. Lauritsen, Revs. Modern Phys. **24**, 321 (1952).
[9] Bockelman, Jung, and Wilkinson (private communications).
[10] I. Talmi and Professor Wigner point out that this is not surprising despite the difference in the amount of binding of the 3.4-Mev states in Be^{10} and in C^{10}, since the presumed 2^+ character of the levels would mean a sufficiently high centrifugal barrier in the case of C^{10} to outweigh the fact that the state is energetically almost proton-unbound.

[11] R. G. Thomas, Phys. Rev. **88**, 1109 (1952).
[12] J. B. Ehrmann, Phys. Rev. **81**, 412 (1951).

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Gamma-Ray Spectra Following the β Decay of Br^{82}, Sb^{124}, and I^{131}†

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Coincidences between the gamma rays following the β decay of Br^{82}, Sb^{124}, and I^{131} have been studied using the single scintillation crystal summing technique. A decay scheme for Br^{82} is proposed. The decay scheme of Sb^{124} proposed by Langer *et al.* is found to be consistent with our data as is the decay scheme of I^{131} proposed by Metzger and Deutsch and augmented by Emery.

Br^{82} [1]

The gamma rays following the beta decay of Br^{82} were studied by the gamma-summing technique described previously.[2] The normal gamma spectrum (source outside) and the summing spectrum (source inside) are shown in the upper and lower parts of Fig. 1, respectively. A comparison between the two curves reveals the following information.

(1) The sum peak with the highest energy occurs at 2.62 Mev, indicating that the highest excited energy level involved is at 2.62 Mev. Since only one mode of beta decay exists,[3] it is natural to assume that the 2.62-Mev level is fed by this beta activity. This greatly simplifies the task of deducing the decay scheme. Thus, any selected gamma transition must be in cascade with other gamma transitions such that their energy sum is 2.62 Mev. This leads to the following.

(2) The 1.455-Mev gamma ray must be in cascade with other gamma rays whose energies sum up to 1.16 Mev (=2.62−1.46). This is confirmed by the evidence that a sum peak does occur at 1.16 Mev. The only manner to fulfill this requirement is to put the 1.455-, 0.608-, and 0.545-Mev transitions in triple cascade. This is further evidenced by the fact that summing does appear between 2.0 and 2.1 Mev (=1.455+0.608 or 0.545 Mev).

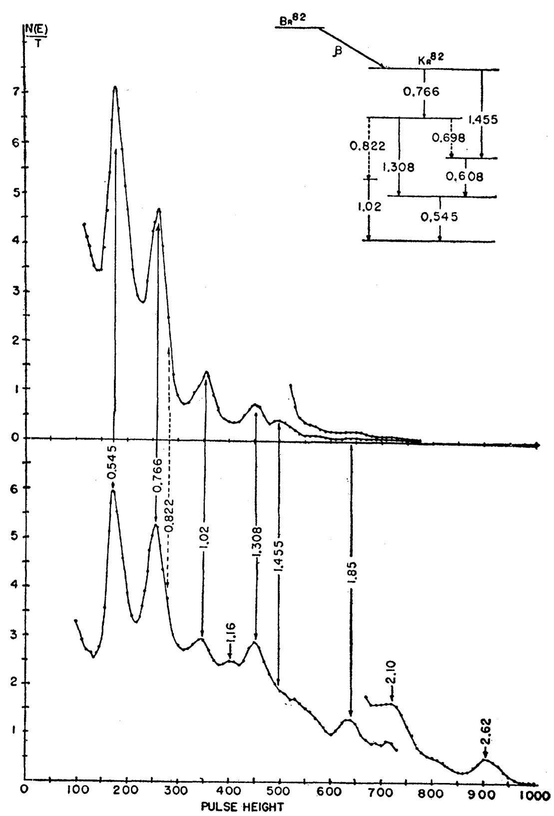

FIG. 1. γ-ray spectra of Br^{82}. Energies in Mev indicated at the top of the peaks. The upper curve is the normal spectrum and the lower curve is the summing spectrum. The counting time intervals on the upper ends of these curves were doubled.

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[1] Obtained from deuteron bombardment of bromine in the cyclotron.
[2] D. C. Lu and M. L. Wiedenbeck, Phys. Rev. **94**, 501 (1954).
[3] M. Deutsch, Phys. Rev. **61**, 672 (1942).

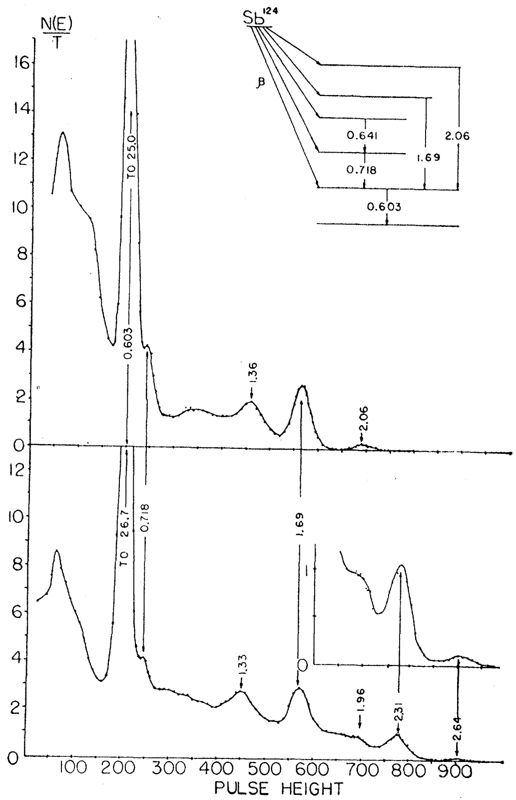

FIG. 2. γ-ray spectra of Sb^{124}. Energies in Mev indicated at the top of the peaks. The upper curve is the normal spectrum and the lower curve is the summing spectrum.

(3) Similarly, the 1.308-Mev gamma ray must be in cascade with the 0.766- and 0.545-Mev transitions. Intensity considerations[4,5] rule out the alternative 1.308+0.698+0.608-Mev cascade. This is further supported by the evidences that summing occurs at 2.10, 1.85 and 1.31 Mev.

(4) Similarly, the 1.02-Mev gamma ray must be in cascade with the 0.766- and 0.822-Mev transitions; this is supported by the appearance of the broadened strong sum peak at 1.85 Mev. The sum peak for the 0.766- and 0.822-Mev transitions at 1.59 Mev is not clearly resolved.

(5) The normal spectrum shows some possible indications of a weak gamma ray at 1.85 Mev, in agreement with a previous report by Meyers and Wattenberg.[6]

The above indications are sufficient for constructing the decay scheme shown in Fig. 1. The relative placement of the gamma transitions is, to a certain extent, dictated by the energy fitting that is necessary to accommodate the 0.822- and 0.698-Mev gamma rays which are not resolved in the present investigation but reported by previous investigators.[3–5] This decay scheme appears to be the only reasonable one that does not in one way or another contradict the accumulated evidences.

Sb^{124} [7]

Until quite recently, an uncertainty existed involving two alternative decay schemes of Sb^{124}. One of these, proposed by Langer, Lazar and Moffat,[8] is shown in Fig. 2. It contains gamma rays of 0.603, 0.64, 0.72, 1.69, and 2.06 Mev, and includes a triple cascade comprised of the 0.64-, 0.72-, and 0.60-Mev gamma rays. An alternative scheme proposed by Tomlinson[9] differs from the first one in that the 0.64-Mev transition is placed in cascade with the 0.603-Mev transition alone, and an additional weak 0.71-Mev transition is placed in triple cascade with the 0.72- and 0.603-Mev transitions. The existence of this 0.71-Mev transition was supported by the coincidence work of Metzger.[10] The existence of the 0.64- to 0.72- to 0.603-Mev triple cascade

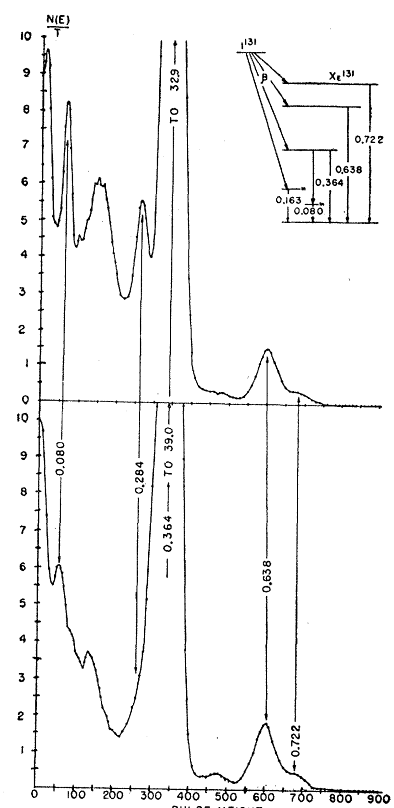

FIG. 3. γ-ray spectra of I^{131}. Energies in Mev indicated at the top of the peaks. The upper curve is the normal spectrum and the lower curve is the summing spectrum.

[4] Siegbahn, Hedgran, and Deutsch, Phys. Rev. **76**, 1263 (1949)

[5] B. Dzhelepov and A. Silantov, Doklady Akad. Nauk. S.S.S.R. **85**, 533 (1952).

[6] V. Myers and A. Wattenberg, Phys. Rev. **75**, 992 (1949).

[7] Obtained from Oak Ridge.

[8] Langer, Lazar, and Moffat, Phys. Rev. **91**, 338 (1953).

[9] E. P. Tomlinson, Indiana Conference on Nuclear Spectroscopy and the Shell Model, Technical Report, 1953 (unpublished), p. 31.

[10] F. R. Metzger, Indiana Conference on Nuclear Spectroscopy and the Shell Model, Technical Report, 1953 (unpublished), p. 32.

in the first scheme has since been established by Langer and Starner[11] through triple coincidence studies.

The present investigation using the summing technique was conducted shortly before the result of the triple coincidence measurements was published. It was hoped that the high efficiency of the summing technique for multiple coincidences might show whether the triple sum peak appears at 0.64+0.72+0.603=1.96 Mev or at 0.71+0.72+0.60=2.04 Mev. However, the normal spectrum shows the possible existence of a gamma ray at 1.36 Mev. This peak, when summed with the 0.603-Mev gamma ray, falls at 1.96 Mev and interferes with the observation of the triple sum peak. It is conceivable that when a larger crystal is used the present method will furnish independent information in this respect. The summing spectrum shown in Fig. 2 does show, however, a positive indication of the coincidence between the 2.06-Mev and the 0.603-Mev gamma rays.

[11] L. M. Langer and J. W. Starner, Phys. Rev. **93**, 253 (1954).

I^{131} [7]

The summing spectrum of the gamma rays following the beta decay of I^{131} is shown in the lower part of Fig. 3. The spectrum clearly indicates that the 0.284-Mev transition is in cascade with the 0.080-Mev transition. Because of the high efficiency of the crystal for detecting the 0.080-Mev gamma ray, the 0.286-Mev peak is greatly diminished through the summing effect. However, no such summing effect is observed for the 0.638-Mev or the 0.722-Mev gamma rays. This is a further confirmation of the decay scheme proposed originally by Metzger and Deutsch[12] and augmented by Emery.[13]

[12] F. Metzger and M. Deutsch, Phys. Rev. **74**, 1640 (1948).
[13] E. W. Emery, Phys. Rev. **83**, 679 (1951).

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Nuclear Levels in Ca^{43}†

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The nuclear levels in Ca^{43} have been studied in the decay of Sc^{43} by positron emission to Ca^{43}. Levels have been found at 0.369, 0.627, and 0.81 Mev. In an earlier experiment, the decay of K^{43} by negatron emission was studied by the authors and nuclear levels were found in Ca^{43} at 0.627, 1.00, 1.39, and 1.61 Mev. The levels have been given configuration assignments. Theoretical discussion of the $(f_{7/2})^3$ configuration is compared with experimental results.

I. INTRODUCTION

RECENTLY, the decay of K^{43} has been studied by the authors.[1] K^{43} decays by negatron emission to Ca^{43} and nuclear levels were found at 0.627, 1.00, 1.39, and 1.61 Mev. The spin of the ground state of Ca^{43} has been measured by Jeffries[2] and has been found to be 7/2 and of odd parity. Of the levels of Ca^{43} measured in the experiments on K^{43}, the ground state and that at 0.627 Mev were found to have odd parity, while those at 1.00, 1.39, and 1.61 Mev were shown to have even parity. Ca^{43} can be reached by the negatron decay of K^{43} or the positron decay of Sc^{43}. Since K^{43} has 19 protons and Sc^{43} 21 protons, the shell model predicts that the parity of the ground state of K^{43} will be even ($d_{3/2}$) and that of Sc^{43} odd ($f_{7/2}$). For this reason, and also since the spins of the two nuclei differ considerably, it is expected that different levels of Ca^{43} will be observed depending on which parent nucleus is investigated. Therefore, it was decided to reinvestigate the decay of Sc^{43} and to compare the results with those obtained from the decay of K^{43}.

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[1] T. Lindqvist and A. C. G. Mitchell, Phys. Rev. **95**, 444 (1954); **95**, 612A (1954).
[2] C. D. Jeffries, Phys. Rev. **90**, 1130 (1953).

II. DECAY OF Sc^{43}

(a) Previous Results

The radiations from Sc^{43} have been investigated by various authors. The most recent investigation by Haskins, Duval, Cheng, and Kurbatov[3] was carried out with a magnetic lens spectrometer and showed a half-life of 3.92±0.02 hr, two positron groups of 1.18 Mev (72 percent) and 0.77 Mev (28 percent), and a gamma ray of energy 0.375 Mev. Nussbaum, van Lieshout, and Wapstra,[4] using a scintillation counter, found a gamma ray of energy 0.375 Mev and a half-life of 4.0 hr.

[3] Haskins, Duval, Cheng, and Kurbatov, Phys. Rev. **88**, 876 (1952).
[4] Nussbaum, van Lieshout, and Wapstra, Phys. Rev. **92**, 207 (1953).