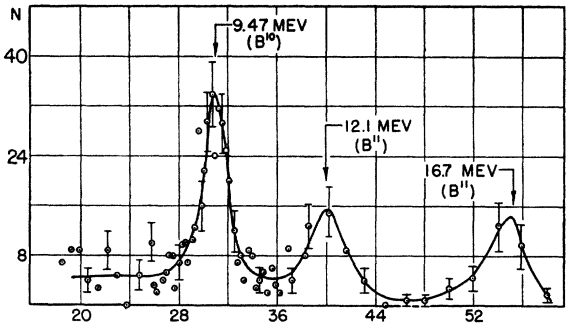

FIG. 2. Spectrum of gamma-rays emitted by a thick target of separated B^{10} isotope when bombarded by 1.2-Mev protons. In addition to the single line at 9.47±0.12 Mev from B^{10}, lines at 12.1 and 16.7 Mev from residual B^{11} are observable. The spectrometer radiator was 0.003-in. Pb.

obtain further information about the radiation from the 1077-kev resonance data were taken with a thin Be target (approximately 0.9 mg/cm^2) and a proton energy of 1.21 Mev. The results are shown in Fig. 3b, where a gamma-ray of energy 6.82±0.10 Mev is resolved from the 7.48-Mev line.

TABLE I. Order of magnitude of the relative yields of gamma-radiation from thick targets of Li^7, B^{10}, B^{11}, and Be^9.[a] (An estimate of the probable error is perhaps a factor of 2.)

Target	Proton energy (Mev)	Gamma-ray energy (Mev)	Relative yield (gamma-rays/proton)
Li metal	0.460	17.6 ±0.2 14.8 ±0.3	1.0 0.5
B^{10}	1.2	9.47±0.12	0.018
B_4C (normal boron)	1.2	16.70±0.17 12.12±0.12	0.11 0.23
B_4C (normal boron)	0.51	16.34±0.25 11.76±0.18	0.0022 0.009
Be metal	1.2	7.37±0.07 6.71	1.5

[a] The absolute yield of Li gamma-rays is given by W. A. Fowler and C. C. Lauritsen [Phys. Rev. **76**, 314 (1949)] as 1.90×10^{-8} gamma-ray per proton.

No attempt was made to measure accurately the yield of gamma-rays from B^{10}, B^{11}, and Be^9, but since the order of magnitude may be of interest, rough estimates of the yields relative to that of the 17.6-Mev lithium gamma-rays are given in Table I.

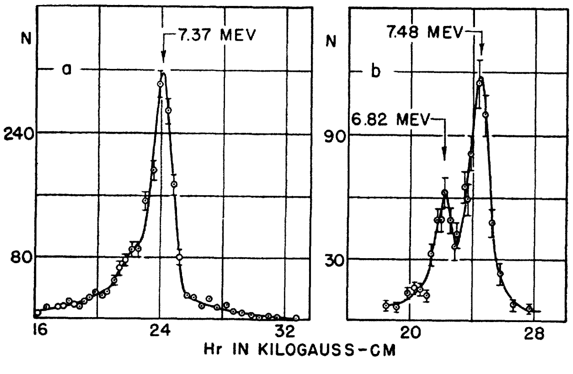

FIG. 3. (a) Gamma-ray spectrum from a thick Be target bombarded with 1.2-Mev protons. (b) Spectrum from a thin Be target (approximately 0.9 mg/cm^2) bombarded with protons of energy 1.21 Mev. Both curves were obtained with a 0.002-in. Cu radiator in the spectrometer. The slight increase in the energy of the "7.4-Mev" gamma-ray seen in curve b can be ascribed to an increase in the effective proton energy. Curve a shows radiation produced mainly by protons at the 0.99-Mev resonance, while the protons for curve b have an energy near 1.08 Mev.

I am indebted to Mr. Robert Rochlin for help in taking the data and to the AEC for loaning the B^{10} sample.

* This work was supported in part by the ONR.

† Now at the California Institute of Technology, Pasadena, California.

[1] R. L. Walker and B. D. McDaniel, Phys. Rev. **74**, 315 (1948).

[2] Fowler, Gaerttner, and Lauritsen, Phys. Rev. **53**, 628 (1938).

[3] W. F. Hornyak and T. Lauritsen, Rev. Mod. Phys. **20**, 191 (1948).

[4] Fowler, Lauritsen, and Lauritsen, Rev Mod. Phys. **20**, 236 (1948).

Superconductivity of Sn^{124}*

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May 19, 1950

OUR measurements[1] of the critical fields and superconducting transition temperatures of mercury isotopes are being extended to the isotopes of tin and thallium. We have obtained preliminary results with an enriched sample of Sn^{124}. This sample, kindly loaned to us by the AEC, contained 83.4 percent of Sn^{124} by weight, and had an average atomic mass, M, of 123.1. (The atomic mass of natural tin is 118.7.) Spectrochemical analysis revealed a total chemical impurity content of less than 0.01 percent. Elements detected were Mg, Pb, Si, Ag, Al, B, Cu.

The experimental method was essentially the same as that employed with the mercury[1] and consisted in observing magnetically the destruction of superconductivity. The specimen was about 50 mg in weight and was in the form of a wire cast in a Pyrex capillary.

TABLE I. Transition temperature of Sn.

Sample	M	T_c°K
Natural	118.7	3.715
Enriched in Sn^{124}	123.1	3.662

The results are given in Table I. The data for natural tin are taken from Laurmann and Shoenberg.[2]

It is seen that the effect of increasing the mass is to shift the transition temperature to lower temperatures, exactly as was found in the case of mercury.[1,3] On the basis of these meager data the shift in temperature is apparently 0.012°K per mass unit. In the case of mercury it was about 0.007°K per mass unit, obtained by using our data[1] and that of Serin, Reynolds, and Nesbitt.[4]

These measurements are being extended and will be reported in detail later.

* Supported by ONR.

[1] E. Maxwell, Phys. Rev. **78**, 477 (1950).

[2] E. Laurmann and D. Schoenberg, Proc. Roy. Soc. **A198**, 560 (1949).

[3] Reynolds, Serin, Wright, and Nesbitt, Phys. Rev. **78**, 487 (1950).

[4] Serin, Reynolds, and Nesbitt, Phys. Rev. **78**, 813 (1950).

Measurement of the Gamma-Ray Energy of K^{40}

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May 1, 1950

THE energy of the gamma-ray accompanying K-capture of K^{40} has been measured by a scintillation spectrometer in which NaI-Tl1 has been substituted for the usual anthracene so that the photo-electrons rather than Compton electrons are used to produce the light pulse in the phosphor.

Anthracene and the other organic phosphors give substantially only the Compton process with gamma-rays from 100 kev to 2 Mev and pair formation within the phosphor is very small even at 2.76 Mev.

Sodium iodide, thallium activated, on the other hand gives strong photoelectric effect in the iodine even at 2.76 Mev and pair production at this energy is prominent and can be seen as

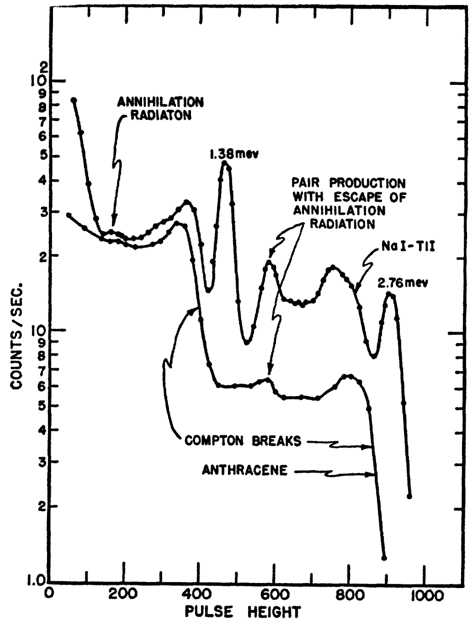

FIG. 1. Pulse-height distribution from the gamma-rays of Na^{24} in anthracene and NaI-TlI.

low as 1.5 Mev. Figure 1 shows the pulse distributions obtained both with anthracene and with NaI-TlI for the gamma-rays of Na^{24}. Pairs produced in the phosphor largely stop in it due to the large thickness of crystal (anthracene—2.4 g/cm^2, NaI—9.3 g/cm^2). If the quanta from the annihilation of the positron escape from the crystal a peak is produced at 1.02 Mev lower energy than the gamma-ray. This peak is large in the NaI curve; it is still visible on the anthracene curve but is about nine times smaller as expected.

The single gamma-ray of K^{42} at 1.51 Mev is shown in Fig. 2.

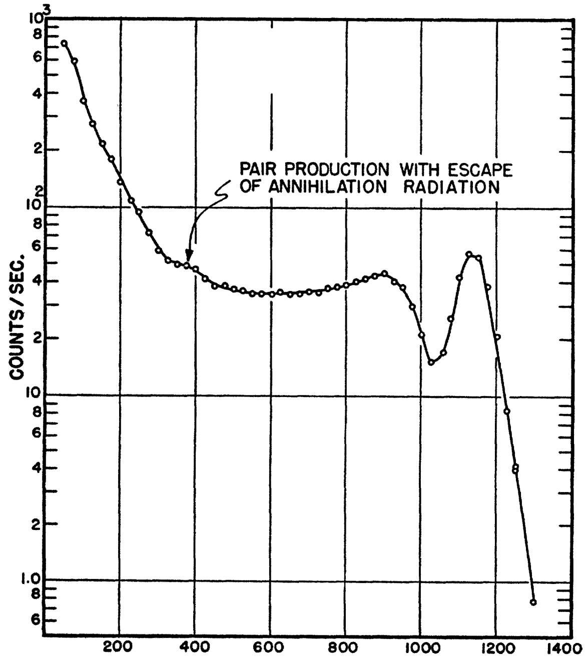

FIG. 2. Pulse-height distribution from the gamma-rays of K^{42} in NaI-TlI.

TABLE I. Comparison of gamma-rays.

Comparison substance	Reported gamma-energy	K^{40} gamma-energy
Na^{24}	1.380[a] 1.74[b](2.765)	1.464 1.47
K^{42}	1.51[c]	1.460 1.456
Zn^{65}	1.118[d]	1.466 1.461

[a] Robinson, Ter-Pogossian, and Cook, Phys. Rev. **75**, 1099 (1949).
[b] Pair production peak from upper gamma-ray.
[c] K. Siegbahn, Arkiv. f. Mat. Astr. o. Fys. **34B**, No. 4 (1947).
[d] Jensen, Laslett, and Pratt, Phys. Rev. **76**, 430 (1949).

This gamma-ray is very close in energy to that of K^{40}. The pair production peak at 0.49 Mev can barely be seen.

About 500 g of KCl was placed around the NaI crystal and a typical pulse distribution produced is shown in Fig. 3.

Table I shows the comparison of the K^{40} gamma-ray with that of Zn^{65}, Na^{24} and K^{42}. The mean energy is 1.462 ± 0.01 Mev. The mean value agrees well with our previous report[1] and that of Pringle, Standil, and Roulston.[2]

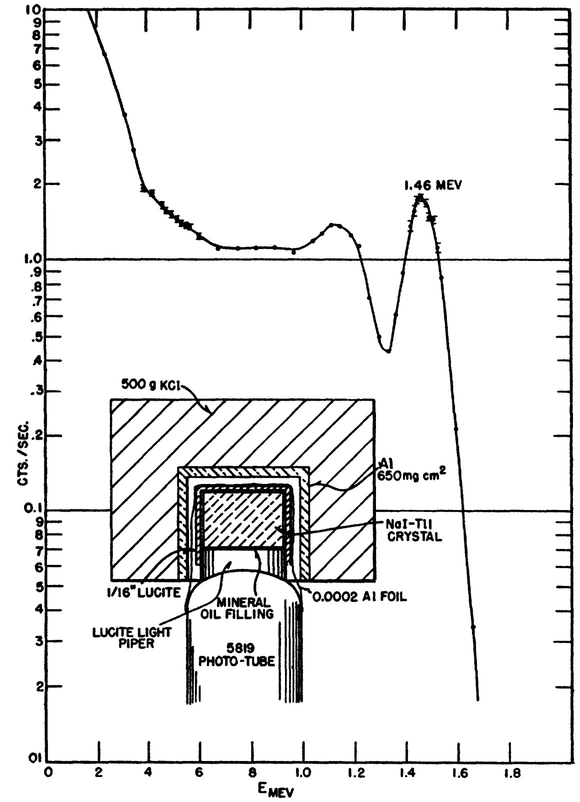

FIG. 3. Pulse-height distribution from the gamma-rays of K^{40} in NaI-TlI.

Examination of the curve between 0.4 and 0.6 Mev shows the presence of two weak overlapping peaks. One of them at 0.44 Mev is expected due to the production of pairs in the crystal as in the K^{42} spectrum. After subtracting this expected peak, a peak about 0.1 *c/s* high remains at the location for annihilation radiation. This annihilation radiation probably comes from the positron member of pairs produced in the 500 g sample and the shield walls and not from positron emission in K^{40}. It appears therefore that the ratio of positrons emitted to beta-rays is less than 2×10^{-5} for K^{40}.

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[1] P. R. Bell and J. M. Cassidy, Phys. Rev. **77**, 409 (1950).
[2] Pringle, Standil, and Roulston, Phys. Rev. **77**, 841 (1950).