We are indebted to Professor S. S. Sidhu of the University of Pittsburgh for the x-ray grain size determinations and to Mr. J. Sayre of this laboratory for the electron micrographs.

* Research work carried out under the auspices of the AEC.
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** Calcite: narrow dimension 0.45° and 17°, wide dimension 5.9° and 112° CaO: narrow dimension 0.96° and 7.6°, wide dimension 5.6° and 43.6°
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[3] A. Guinier, Ann. de Physique **12**, 161 (1939).

Angular Distribution of Protons from Photo-Disintegration of the Deuteron

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In an earlier letter[1] experiments were reported in which the angular distribution of protons from the photo-disintegration of the deuteron by ^{24}Na γ-rays (2.76 Mev) was measured by means of a battery of porportional counters arranged in parallel. The counters were filled with deuterium to such a pressure that the range of the protons was about four times the counter diameter.* By this arrangement, protons moving parallel to the axis of the counters produce much higher pulses than do protons moving perpendicular to the axis, since the latter traverse only part of their range before hitting the walls of the counters. Hence, by counting pulses of maximum size we get the number of protons moving in directions almost parallel to the counter axis, and the angular distribution is obtained by a series of countings for various values of the angle between the direction of the incident γ-rays and the counter axis.

The result of the experiments was given in the earlier letter[1] as $\sigma_0/\sigma_{90}=0.18$, but a closer consideration has shown that the influence of the finite solid angles was somewhat underestimated. The author is indebted to Mr. Kofoed-Hansen for pointing out that, if the differential cross section follows the relation

$$\sigma_\theta=(a+b\sin^2\theta)\sigma_{90°},$$

the number of protons counted directly will obey a similar law, in which θ is replaced by the angle between the axis of the counters and the axis of the γ-ray beam, and the values of the constants are slightly altered. Actually, the proton number was found to follow such a law and, by taking the corrections into account, we finally get

$$\sigma_\theta=(0.15+0.85\sin^2\theta)\sigma_{90°}$$

and

$$\sigma_0/\sigma_{90°}=0.15\pm0.03.$$

This value gives for the ratio between the cross sections of the photomagnetic and the photoelectric effect

$$\sigma_m/\sigma_e=0.26.$$

These results agree, within the limits of error, with the theoretical expectations. For example, from the Møller-Rosenfeld theory L. Hulthén,[2] when using the value of 2.18 Mev for the threshold of the process, finds $\sigma_0/\sigma_{90°}=0.126$ for the γ-rays of the frequency used in the experiments. When the new value for the threshold,[3] 2.24 Mev, is used, the ratio is calculated to be $\sigma_0/\sigma_{90°}=0.14$, in close conformity with the experimental value. The present measurements, however, are not sufficiently accurate to discriminate between the results to be expected from various assumptions regarding the type of nuclear forces. In order to obtain a greater accuracy further experiments with an improved arrangement are in preparation.

[1] N. O. Lassen, Phys. Rev. **74**, 1533 (1948).
* By a misprint in the letter (reference 1), the range was given as ¾ of the counter diameter instead of 3-4 times the counter diameter.
[2] L. Hulthén, private communication.
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Gamma-Rays from Na^{24} and V^{48}

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In connection with some other investigations in this department, the gamma-radiations from Na^{24} and V^{48} have been measured on a 14-cm radius of curvature semicircular beta-ray spectrometer.[1] Since the other measured values of these radiations have been obtained using lens spectrometers,[2-4] the confirming evidence herein offered is perhaps of interest. In the present work the K and L lines of all gamma-rays are distinctly visible, and the gamma-ray energies obtained from the K lines are in very good agreement with previously reported values (see Fig. 1).

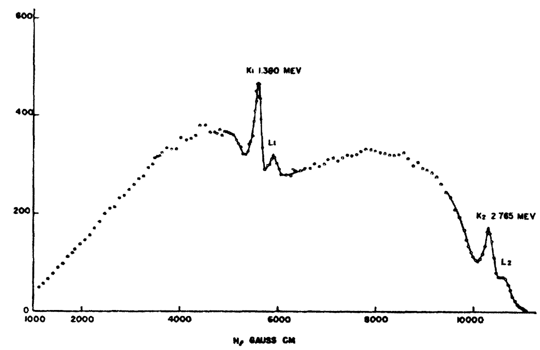

Fig. 1. The Compton and photoelectron spectrum produced from a 50 mg/cm² uranium radiator by the gamma-rays from Na^{24} in a semicircular magnetic spectrometer. Both K and L peaks are visible. Energies of 1.380 Mev and 2.765 Mev are derived from measurements on the K lines of the spectrum.

Calibration of the smaller multi-layer flip coil used to determine the magnetic field was made with a large single-layer flip coil whose total effective area was known quite accurately. It gives good agreement with the accepted value for the annihilation radiation, as can be seen in Fig. 2.

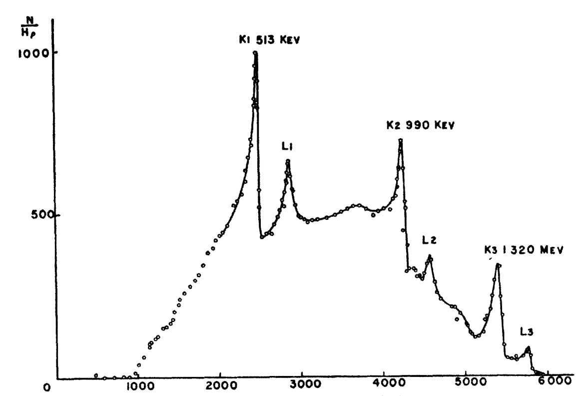

Fig. 2. The Compton and photoelectron spectrum produced from a 50-mg/cm² uranium radiator by the gamma-rays from V^{48}. Gamma-ray energies are 0.990 Mev and 1.320 Mev. The energy of 0.513 Mev given to the annihilation is that derived from the absolute calibration of the instrument mentioned in the text, and is within experimental error of the theoretical value.

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[2] L. G. Elliott, M. Deutsch, and A. Roberts, Phys. Rev. **63**, 386 (1943).
[3] K. Siegbahn, Phys. Rev. **70**, 127 (1946).
[4] W. C. Peacock and M. Deutsch, Phys. Rev. **69**, 306 (1946).