TABLE I. Reaction energies.

Reaction	Reaction energy (Mev)
$S^{32}(\gamma,d)P^{30}$	−19.15
$S^{32}(\gamma,n)S^{31}$	−14.8
$S^{32}(n,\alpha)Si^{29}$	1.2
$P^{31}(\gamma,n)P^{30}$	−12.35
$Si^{30}(d,n)P^{31}$	4.56
$Si^{29}(d,n)P^{30}$	3.38
$Al^{27}(\alpha,n)P^{30}$	−2.93
$Al^{27}(\alpha,p)Si^{30}$	2.26

The mass of Si^{30} is listed by Rosenfeld as 29.98310 ± 0.00032 m.u. A recent measurement by Duckworth[5] giving 29.98290 ± 0.00015 has substantiated this value. The present calculations have been based on the latter value.

The calculations were performed as follows:

$$\left.\begin{array}{l} Si^{30}\rightarrow P^{31}\rightarrow P^{30} \\ Si^{30}\rightarrow P^{30} \\ Si^{30}\rightarrow Al^{27}\rightarrow P^{30} \end{array}\right\}\rightarrow P_{wm}^{30} \text{ (weighed mean value)},$$

$$\left.\begin{array}{l} P_{wm}^{30}\rightarrow Si^{29}\rightarrow S^{32} \\ P_{wm}^{30}\rightarrow S^{32} \\ Si^{30}\rightarrow P^{31}\rightarrow S^{31}\rightarrow S^{32} \end{array}\right\} S_{wm}^{32} \text{ (weighed mean value)}.$$

Assuming approximately equal experimental errors in each reaction energy and decay energy used, a one-step calculation was given a weight of one, a two-step calculation a weight of one-half, etc.

The masses of the proton, deuteron, and α-particle were taken from Mattauch and Flammersfeld's tables, while a value of 1.008986 m.u. was used for the mass of the neutron.[6]

The weighed mean value of the mass of S^{32} obtained through these calculations is 31.98199 ± 0.00021 m.u.

This value is in fair agreement with the value 31.98167 ± 0.00017 listed by Mattauch and Flammersfeld, but differs by 0.00110 m.u. (1.02 Mev) from the spectrometric value of 29.98089 ± 0.00007 listed in Rosenfeld's tables.

The calculations also give 28.98568 m.u. for the mass of Si^{29} which is in excellent agreement with the value 29.98567 recently obtained by Duckworth.[7] These values do not agree with the value listed by Rosenfeld.

It is concluded that the measured mass of S^{32} is too low by 0.00110 m.u. and that the correct value is 29.98199 ± 0.00021 m.u.

[1] L. Rosenfeld, *Nuclear Forces* (Interscience Publishers, Inc., New York, 1948), p. 499.
[2] J. Mattauch and A. Flammersfeld, *Isotopenbericht* (1949), Table 3.
[3] McEllhinney, Hanson, Becker, Duffield, and Diven, Phys. Rev. **75**, 542 1949).
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[5] Duckworth, Preston, and Woodcock, Phys. Rev. **79**, 188 (1950).
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[7] H. Duckworth and R. S. Preston, Phys. Rev. **79**, 402 (1950).

Detection of Beta-Induced Scintillations from Crystals with a Photo-Sensitive Geiger-Mueller Counter*

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IN a previous communication,[1] the writers described experiments in which immediate fluorescent scintillations from crystals of NaCl-Ag were detected in a photo-sensitive Geiger-Mueller counter. The scintillations were produced when the crystals were irradiated by the alpha-particles of polonium. It was also stated that a long period ultraviolet *phosphorescence* was observed when the same crystals were bombarded by beta-particles. All of the above-discussed measurements were carried out with the use of the photo-sensitive scintillation Geiger counter, which was described as "relatively insensitive."

Since the time of the early alpha-particle measurements, the behavior of NaCl-Ag under beta-ray and gamma-ray bombardment has been observed in conjunction with a 1P28 photo-multiplier tube. Contrary to the experience with the scintillation Geiger counter, a copious emission of short decay-time fluorescent ultraviolet was observed when NaCl-Ag was irradiated by both beta-rays and gamma-rays. These pulses were not observed in the early scintillation Geiger counter because of insufficient quantum efficiency. Only the very large light pulses of the polonium alpha-particles could be detected. Consequently, a wire gauze photon counter was sensitized in the manner described by Scherb.[2] By repeated and prolonged discharges at liquid air temperature, an extremely responsive photon counter was obtained. Its sensitivity in the ultraviolet was several orders of magnitude greater than that of the photon counter used for the first alpha-particle detection.

This newly prepared scintillation Geiger counter was found to respond satisfactorily when it was coated with crystals of NaCl-Ag and irradiated by the beta-rays of RaE. The glass sidewalls of the photon counter were sufficiently thick to exclude even the highest energy beta-rays of RaE. Moreover, since the RaE was in equilibrium with its parent and daughter elements, 20 mg/cm² of aluminum were placed between the source and the counter to exclude the possibility of counting any alpha-particles from polonium. Aside from a faint gamma-ray background, coming perhaps from RaD, the entire counting rate arose from the ultraviolet scintillations produced in NaCl-Ag by the beta-spectrum of RaE. Using a relatively crude geometry, an efficiency of ten percent for beta-rays was obtained. This value can be improved upon tremendously. It is thought that an efficiency of one hundred percent can be reached.

To ascertain whether the counter would respond to fluorescent scintillations resulting from gamma-rays on NaCl-Ag, the ultrasensitive photon counter was placed in a double-walled jacket made of Corning 9741 glass. The space within the concentric cylinders was filled with NaCl-Ag crystals, forming a cylindrical layer of thickness 1.5 cm about the cathode of the counter. Using radioactive Sc^{46} as a source, the counter enclosed by the layer of crystals was irradiated by million-volt gamma-rays. Taking all precautions to maintain a constant geometry, a cylinder of thin black paper was slipped over the counter between the counter and the layer of scintillating crystals. No appreciable change in the counting rate was observed, indicating that even higher quantum efficiencies in the ultraviolet must be obtained before scintillations resulting from gamma-ray bombardment can be detected.

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The Scattering Lengths of the Deuteron

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THE angular variation of neutron scattering by deuterium gas has been measured. A new spectrometer, especially designed for such work, was used instead of earlier equipment.[1] Neutrons, of wave-length 1.063A, were selected by crystal diffraction from a well-collimated beam leaving the Chalk River reactor. They passed through a cell containing deuterium gas at liquid nitrogen temperature and 21 atmospheres pressure. Scattered neutrons were measured by a BF_3 proportional counter every eight degrees in the angular range 11.2° to 67.2°. Sixteen angular sweeps were made with gas in the cell, 1000 counts being taken at every stop so that 16,000 counts were taken at each angle. Background, which ranged from 10 percent to 15 percent, was determined with the cell evacuated.

The experimental counting rates were corrected for background, for hydrogen content of the deuterium, and for double scattering. The resulting quantities were transformed to relative differential cross sections by dividing by the effective scattering volume. Com-