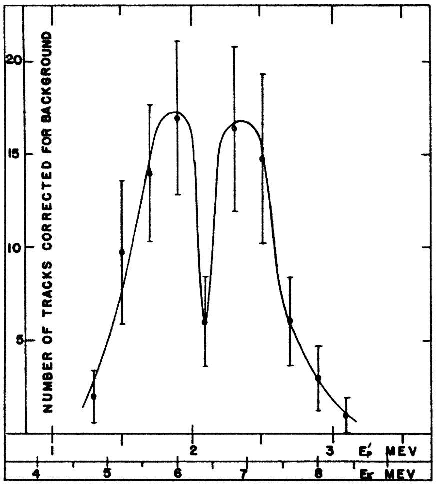

FIG. 2. Number of photo-proton tracks in nuclear emulsion from $D^2(\gamma n)H^1$ due to $F^{19}(p\alpha',\gamma)O^{16}$ gamma-rays, corrected for background, as a function of the photo-proton energy E_p'. The corresponding gamma-ray energy E_γ is also shown. R.m.s. errors are indicated.

with $\alpha > 15°$. No attempt was made to get accurate data on the tracks of length $< 20\mu$. Most of these may be caused by alpha-particles (from radioactive contaminations in the emulsions). In Fig. 2 the number of tracks of length $> 20\mu$ on emulsion A, corrected for background (from emulsion B), has been plotted against the energy of the photo-protons E_p'. The corresponding gamma-ray energy is also given, assuming the simplified relation:

$$E = 2E_p' + 2.2 \text{ Mev.}$$

The position of the two peaks obtained at about 6 and 7 Mev agrees with the recent results of Walker and McDaniel.[3] The relative intensities of the two peaks is ~ 1. Neglecting variations in the cross section for photodisintegration of the deuteron, this is compatible with a smooth extrapolation of the relative intensities as a function of proton energy as given by Walker and McDaniel.

Further work is in progress to improve the technique and to apply it to gamma-ray spectra.

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The Elastic Constants of Beta-Brass*

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THE elastic constants of β-brass have been measured at 25°C as part of an investigation of the elastic properties of solids at high pressures. Inasmuch as the present values differ markedly from the previously accepted values,[1] it seems worth while to report them at this time.

TABLE I. Adiabatic elastic constants of beta-brass.

Constant	Present	Previous
C_{11} (in dynes/cm^2)	1.279×10^{12}	0.520×10^{12} dynes/cm^2
C_{12}	1.091	0.335
C_{44}	0.822	1.730

Large single crystals of 3.5-cm diameter and 10-cm length were grown from the melt in graphite crucibles. Small sections of about 2-cm diameter and 2.5-cm length with faces parallel to (100) and (110) planes were cut from the large crystal. The orientations were determined by back-reflection diffraction pictures. Chemical analysis of the crystals gave a composition of 51.06 percent Cu, 48.94 percent Zn, by weight. The measured density of the crystals was 8.297 g/cm^3.

The elastic constants were measured at 12 mc using the pulsed ultrasonic technique employed by Huntington[2] and others. Using this technique with (100) and (110) crystals, independent measurements are obtained C_{11}, $\frac{1}{2}(C_{11}-C_{12})$, $\frac{1}{2}(C_{11}+C_{12}+C_{44})$, and C_{44} (twice), from which the three principal elastic constants C_{11}, C_{12}, and C_{44} may be calculated, with two internal checks. The results are shown in Table I compared with those of Good.

Computed shear modulus G and isothermal compressibility K are shown in Table II, compared with experimental values measured on polycrystalline β-brass.

The values of compressibility and shear modulus computed from the present constants are in good agreement with measured values. The measured value of G quoted in Table II is subject to some considerable uncertainty as a result of preferred orientation of grains in the specimens measured.

In addition, the theoretical difficulties in interpreting the previous anomalously large value for C_{44}, pointed out by Zener,[3] are removed.

The values of the elastic constants given in Table I have been corrected for slight misorientation of the crystal specimens. The internal consistency of the measurements in such that the two measured values of C_{44} check to within ±0.1 percent, and the two computed values of C_{12} to within ±0.5 percent.

The data are also corrected for the thickness of the quartz crystal transducer used in these measurements. In this connection, it may be remarked that previous investigators using this technique[2,4] have not discussed this

TABLE II. Compressibility and shear modulus of beta-brass.

Modulus	Present (calc.)	Previous (calc.)	Measured
K (in cm^2/dyne)	0.913×10^{-12}	2.52	0.913*; .93**
G (in dynes/cm^2)	0.387×10^{12}	0.740	0.342***

* P. W. Bridgman, Proc. Am. Acad. **70**, 285 (1935).
** R. F. Mehl and B. J. Mair, J. Am. Chem. Soc. **50**, 55 (1928).
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TABLE III. Young's modulus for beta-brass.

Modulus	Present (calc.)	Rinehart
E_{111} (in dynes/cm^2)	1.990×10^{12}	2.105
E_{110}	0.794	0.755
E_{100}	0.283	0.258

correction. If one assumes that it has not been made, it is of the right order of magnitude to explain the small but consistent discrepancy between the results of Galt and Huntington, and those of Durand.[5]

Values for Young's modulus in various directions computed from these data are compared in Table III to those measured by Rinehart[6] for single crystals of β-brass.

The differences between the values of Young's modulus as measured by Rinehart and the present computed values can be explained on the basis of a 4 percent difference in the value of the shear modulus $\frac{1}{2}(C_{11}-C_{12})$, which is extremely small for β-brass. Small differences in composition between Rinehart's specimens and those used in the present investigation may account for this discrepancy.

Because of the self-consistency among the present data and the good correlation between the calculated and measured values of the isothermal compressibility, the values for the elastic constants reported here appear to be preferable to those reported by Good. It is possible that the large discrepancy between the present value for C_{44} and that of Good, obtained using a composite oscillator technique, arises from the existence of an impure mode involving coupling between torsion and flexure in Good's specimen. Apparently, this effect, although known to Good, was not thoroughly investigated. Any error in Good's determination of C_{44} is, of course, reflected in his values for C_{11} and C_{12}, since he computed the latter from the former in conjunction with Rinehart's values for Young's modulus.

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The Beta-Decay Spectra of B^{12} and Li^8

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THE beta-spectra of Li^8 and B^{12} are of considerable interest partly because of the large energy changes involved and partly because of the light they may shed on the excited states of the residual nuclei, Be^8 and C^{12}. It has been known for some time that the decay of Li^8 leaves Be^8 in a broad excited state with about 3-Mev excitation, and the alpha-particles resulting from the decay of this state have been extensively studied.[1,2,3] Since B^{12} is presumed to decay primarily to the ground state of C^{12}, the shapes of the two spectra should be quite different near the high energy end, the Li^8 spectrum tailing off gradually to correspond to the alpha-particle distribution. Attempts to match the alpha- and beta-spectra of Li^8 have been inconclusive, largely because of the inadequate data available in the latter case. We have now studied the beta-spectra of Li^8 and B^{12} more intensively, using a magnetic lens spectrometer, in the region from 500 kev to well above their end points. The beam from an electrostatic accelerator was brought directly into the vacuum chamber of the spectrometer to bombard suitable targets for the production of the radioactive elements. Li^8 (0.89 sec. half-life) was prepared by bombarding a thin evaporated lithium metal deposit on a 9-mg/cm^2 copper foil, with 770-kev deuterons, employing the reaction $Li^7(d,p)Li^8$. B^{12} (0.025 sec. half-life) was similarly prepared through the reaction $B^{11}(d,p)B^{12}$ by bombarding a thin evaporated B_2O_3 deposit on a 9-mg/cm^2 copper foil with 1200-kev deuterons. The deuteron beam was periodically interrupted by means of a mechanical shutter operated on a 2-second cycle in the Li^8 studies, while an electrostatic deflector with a period of 1/60 sec. was used for the B^{12} experiments. The detector counter circuit was arranged to count only when the beam was off the target. This technique was adopted to eliminate the large neutron background from the prolific (d,n) reactions accompanying both main reactions and to eliminate background due to any prompt γ-radiation.

In order to check the effect of electron scattering in the spectrograph itself, the positron spectrum of N^{13}, produced by the reaction $C^{12}(d,p)N^{13}$, was run, using a thin soot target sandwiched between two layers of 0.2-mg/cm^2 Be foil.* A Kurie plot of the data yielded a straight line from

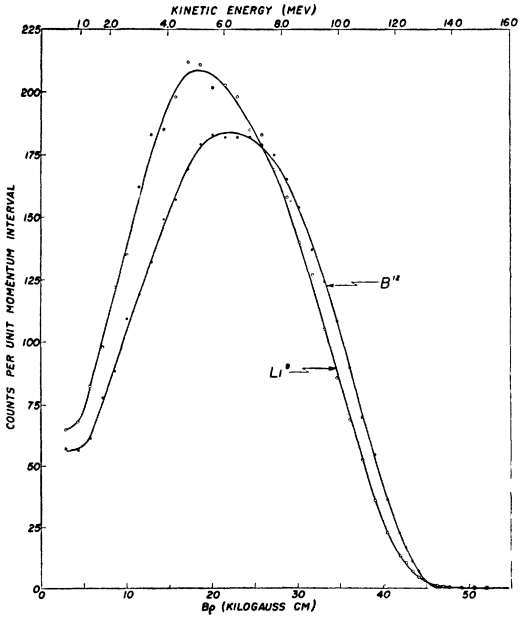

FIG. 1. Momentum spectra of electrons from Li^8 and B^{12}.