The angular variation of r at high energies will be about the same as at $q=0.6$, and the intensity at 180° approaches zero with increasing energy. The previous approximate formula due to Mott[2] gives only the correct order of magnitude of scattering intensity for a heavy element such as mercury.

Our angular distribution agrees well with that observed by Barber and Champion,[3] the numbers in the angular ranges 20°–30°, 30°–60°, and 60°–180° being in the ratio 37 : 27 : 9 (theoretical) as against the experimental ratio 37 : 30 : 8. However, the disagreement between theory and experiment concerning absolute intensities still remains.

Our polarization values are about 10 percent less than those of Mott at the maximum, so that the theory still predicts an effect which has not yet been observed.

The angular distributions at small energies will probably be modified when shielding is taken into account.

Full details will be published later.

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August 21, 1939.

[1] N. F. Mott, Proc. Roy. Soc. **A135**, 429 (1932).
[2] N. F. Mott, Proc. Roy. Soc. **A124**, 438 (1929).
[3] A. Barber and F. C. Champion, Proc. Roy. Soc. **A168**, 159 (1938).

Helium and Hydrogen of Mass 3

We have now adjusted the shims of the 60-inch cyclotron so that it is possible to obtain a steady beam of 24-Mev He^{3++} ions.[1] We have compared the isotopic ratio He^3/He^4 of tank (gas-well) helium to that of spectroscopically pure (atmospheric) helium, and find that it is about twelve times as great for atmospheric helium as for the gas-well variety. The absolute values have been approximately determined with the aid of a thin-walled Victoreen *R*-meter. These ratios are 10^{-8} and 10^{-7} for the two types of helium. When the cyclotron chamber is filled with atmospheric helium, the He^3 beam has sufficient intensity to induce appreciable radioactivity in silicon. We have observed a 2.5-minute period with an initial intensity of 200 counts/minute, on a background of 30 counts per minute. The activity could be followed for four half-lives; it is probably P^{30} formed in the reaction.

$$_{14}Si^{28}+{}_2He^3\rightarrow{}_{15}P^{30}+{}_1H^1$$
$$_{15}P^{30}\rightarrow{}_{14}Si^{30}+e^+.$$

When the silicon was bombarded under identical conditions except for the substitution of tank helium for spectroscopic helium, the activity was reduced to a small value consistent with the abundance ratios given above.

Since we have shown that He^3 is stable, it seemed worth while to search for the radioactivity of H^3. We have therefore bombarded deuterium gas with deuterons, and passed the gas into an ionization chamber connected to an FP-54 amplifier. The gas showed a definite activity of long half-life. We have now shown that this gas has the properties of hydrogen by circulating it through active charcoal cooled in liquid nitrogen and allowing it to diffuse through hot palladium. The radiation emitted by this hydrogen is of very short range as was shown by the almost linear form of the intensity *vs.* pressure curve when the gas was pumped out of the chamber. When sufficient time has elapsed for us to make some statement regarding the half-life of this activity, we will submit the details of the work to this journal for publication.

We are indebted to Dr. S. Ruben for the use of his thin-walled counter and to Dr. A. Langsdorf for the loan of a d.c. amplifier. It is a pleasure to acknowledge the friendly interest of Professor E. O. Lawrence in these experiments, and to thank the Research Corporation for financial assistance.

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[1] L. W. Alvarez and R. Cornog, Phys. Rev. **56**, 379 (1939).

Intensity and Rate of Production of Mesotrons as a Function of Altitude

With the view of obtaining information on the intensity and on the rate of production of mesotrons as a function of altitude, we have performed the following free balloon experiment.

Four G-M counters were arranged with lead absorbers, as shown in Fig. 1. Counters 1, 2 and 3 constituted one threefold coincidence set and counters 2, 3 and 4 constituted the other. Since a particle which passes through either set of counters must penetrate at least 8 cm of lead, we are dealing here only with the penetrating component, i.e., mesotrons. The top set of counters can be actuated only by mesotrons which have originated outside of the equipment, whereas the lower set can be set off by either a mesotron entering from the outside or by one which is produced in the lead block *L*. If there is such a production of mesotrons in the lead block *L*, by a non-ionizing radiation, one should observe a greater number of counts in the lower set of counters than in the upper set.[1]

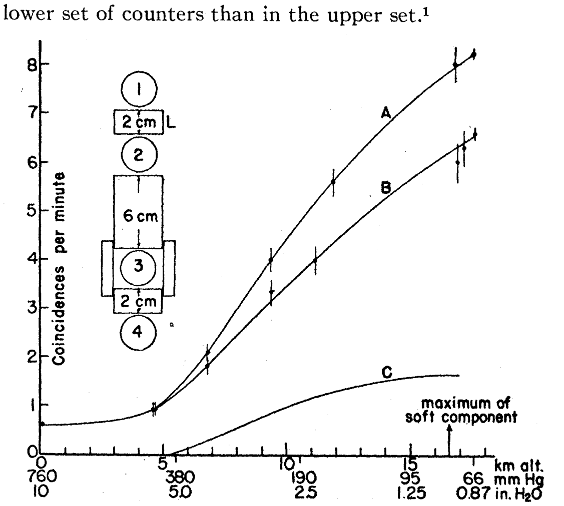

Fig. 1. Arrangement of counters and number of coincidences per minute in the lower (*A*) and upper (*B*) counters.