Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 805.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

An Attempt to Detect the Disintegration of the Neutron

EXPERIMENTS performed by Kikuchi, Aoki and Husimi[1] were interpreted as evidence for the disintegration of the neutron. When neutrons from a heavy water target bombarded by deuterons were passed through various substances, electrons having energies up to 1 MeV. were observed, and it was suggested that these could be accounted for by the reaction :

$$n \rightarrow p + e + 1 \text{ MeV}.$$

The probability that this should happen during the interaction of a neutron with the field of any given nucleus was expressed in terms of a collision cross-section, varying from about 10^{-24} sq. cm. for heavy nuclei to about 10^{-25} sq. cm. for light nuclei.

We have failed to confirm this in two different types of experiments. The first set of experiments were made to detect the proton and the electron starting from a point in the gas in a Wilson cloud chamber. Experiments to determine the statistics of the neutron-proton collision were in progress, and the same apparatus was used in these experiments. A description of the apparatus and the method of measurement will shortly be published elsewhere[2]. Oxygen at about three atmospheres pressure was used in the chamber, so that any proton recoils obtained would be due to the water vapour. This number could be estimated from the previous experiments with the apparatus. 150 photographs were taken, and the number of recoils observed was 0·6 per expansion, and this is the number to be expected from the hydrogen in the water vapour. In no case was there an electron track starting at the beginning of a proton track. The condition of the chamber was such that electron tracks due to the X-radiation from the accelerating tube were clearly visible. The ranges of the recoil protons were measured, together with the angles they made with the direction of the source. In most cases these were consistent with the assumption that they were due to proton recoils from 2·5 MeV. neutrons. The number of pairs of proton and electron tracks to be expected, if the neutron disintegrates into a proton and an electron with a collision cross-section of 10^{-24} sq. cm., is 30 per expansion. Hence we conclude that the cross-section for the disintegration of the neutron is at least 1,000 times smaller than that suggested by Kikuchi.

The second experiment was an attempt to observe by a coincidence method the simultaneous production of a proton and an electron from a neutron. An intense source of neutrons was obtained by bombarding a target of $Al(OD)_3$ with deuterons accelerated through a potential of 70 kV. The ion source was of the type described by Tuve, Hafstead and Dahl[3]. Later, a still more intense source was obtained by using a heavy water target cooled with liquid air. By comparison with a standard radium-beryllium source, using a boron trifluoride chamber, the strength of the neutron source was found to correspond to about 600 millicuries. A small argon-filled ionization chamber connected to a linear amplifier was used to detect the protons produced in the argon or in the walls of the chamber, and a Geiger counter was used to detect any electrons produced in the chamber. The front of the ionization chamber was covered by an aluminium window of 2 cm. air equivalent stopping power, and was placed about 5 mm. from the front of the Geiger counter. From the geometry of the apparatus, it was estimated that 1/10 of any sufficiently energetic electrons produced in the ionization chamber would enter the Geiger counter. A 'scale of two' thyratron counter was arranged to count coincidences between the kicks in the two counters. The centre of the ionization chamber was placed 4–5 cm. from the neutron source.

The number of coincidences observed with and without the interposition of a brass sheet, capable of stopping the electrons, between the two counters were compared. 72 coincidences were observed without the brass and 70 with it present. The experiment therefore gives no evidence that the neutron disintegrates into a proton and an electron. From the dimensions of the apparatus it is estimated that the cross-section for the disintegration of the neutron, if it takes place, is less than 3×10^{-26} sq. cm.

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April 23.

[1] Kikuchi, S., Aoki, H., and Husimi, K., NATURE, **138**, 841 (Nov. 14, 1936). *Proc. Phys.-Math. Soc. Japan*, **18**, 727 (1936).
[2] Dee, P. I., and Gilbert, C. W., in course of publication.
[3] Tuve, Hafstead and Dahl, *Phys. Rev.*, **48**, 240 (1935).

Thermal Precipitation of Radioactive Substances

THE usual method of separating solid radioactive particles from the gas phase is precipitation by an electric field. This is the classical procedure for the collection of the active deposit of radon and thoron, and can also be applied to artificial radio-elements, such as radio-arsenic prepared in arsine by neutron bombardment[1]. The process depends on the presence of an electric charge on the particles ; and unfortunately, at least in the case of artificial radio-elements