LETTERS TO THE EDITORS

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Neutron Experiments of the Physical Laboratory of Groningen

In the beginning of 1940, a few months before the occupation of Holland by the Germans, we started some neutron experiments in this Laboratory (see ref. 1). To determine neutron energies the well-known boron absorption method was applied. Following Frisch's example[2], boron was used not as a compound but in the pure amorphous state. This boron arrived in March 1940 in Groningen from the British Drug Houses, Ltd. As it yielded nearly the same results as a sample of amorphous boron from Merck (Germany) which we had still in the laboratory, we had not the slightest suspicion that our results could be spoiled by too high an amount of impurities.

That this was really the case could be anticipated as soon as the new results for the resonance energies of silver and other elements, which had been found by the time of flight method, had been published[3,4,5].

Prof. Wiebenga, who kindly made an analysis of the boron we used in our neutron absorption experiments, found an impurity content of not less than 39 per cent. From this it might be concluded that the resonance energies hitherto published from our laboratory should be multiplied by $(0{\cdot}61)^2 = 0{\cdot}37$. As has been shown by the authors cited above, however, the neutrons suppressed by cadmium have in the mean an energy of 0·041 eV. instead of being really thermal neutrons, as was generally assumed hitherto. We used Rasetti's value of $\sigma_B = 4{\cdot}7\ E^{-1/2}$ cm.^{2}/gm. [6], whereas the mean of the values found by the authors quoted in refs. 3, 4 and 5 is $6{\cdot}4\ E^{-1/2}$ cm.^{2}/gm. We therefore conclude that our resonance energies should be multiplied by a factor $1{\cdot}85 \times 0{\cdot}37 = 0{\cdot}69$ to reduce them to their scale. This gives for the resonance energy of silver $0{\cdot}69 \times 8{\cdot}2 = 5{\cdot}7$ eV., in excellent agreement with their results (5·8 and 5·1 respectively).

In a paper soon to be published in *Physica* we shall deal in more detail with the other numerical data of our papers. Here it may be remarked that the general conclusions we arrived at remain valid, since the same correction has to be applied to all resonance energies.

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[4] Bacher, R. F., Baker, C. P., and Daniel, B. D. M., *Phys. Rev.*, **69**, 443 (1946).

[5] Rainwater, J., and Havens, W. W., *Phys. Rev.*, **70**, 136 and 154 (1946).

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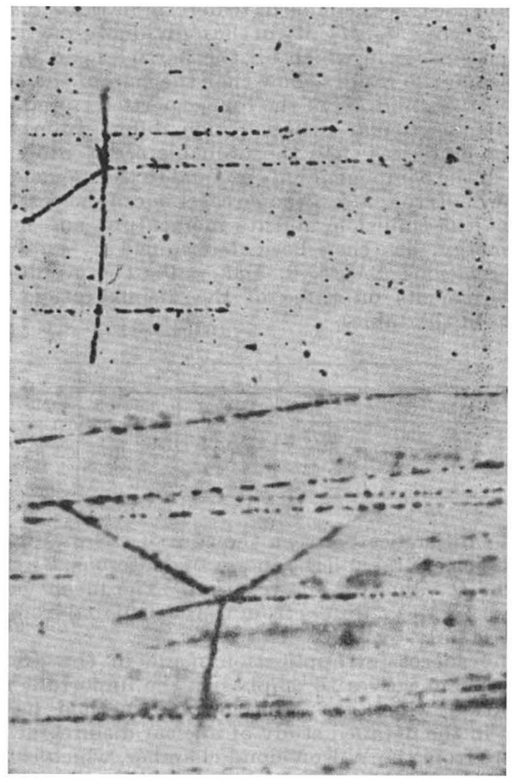
Disintegration of Nitrogen into Four α-Particles by Collision with Deuterons

We have recently exposed photographic plates, coated with the Ilford 'Nuclear Research' emulsions, to the 9 MeV. deuteron beam delivered by the Liverpool cyclotron. The deuterons were allowed to pass into the surface of the emulsion at a small angle of glancing incidence, and an exposure of less than 0·01 sec. was found to be sufficient to give a convenient number of tracks per unit area of the emulsion. In making measurements of the lengths of the tracks of the deuterons, we found, in addition to numerous forked tracks due to collision of deuterons with protons, examples of disintegrations produced by the entry of primary particles into nuclei of light elements, such as carbon, oxygen and nitrogen, present in the emulsion.



Two examples of a particularly interesting type of disintegration are shown in the accompanying photomicrograph. In the top photograph it will be seen that three deuterons have entered the emulsion, and that one of them has reacted with a nucleus and caused the emission of four particles. The lower photograph shows a similar event. The grain spacing in the tracks of the secondary particles is characteristic of α-particles and, since nitrogen is present in the gelatine, we attribute the disintegration to the reaction

$$N^{14}_{7} + H^{2}_{1} \rightarrow 4\ He^{2}_{4}.$$

The possibility of this reaction was first mentioned by Cockcroft and Lewis[1], who observed a continuous distribution of α-particles from nitrogen bombarded