LETTERS TO THE EDITORS

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 555.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Deuteron Bombardment of Silver

WE have bombarded pure silver with a few microampere-hours of 9 Mv. deuterons from the Cavendish cyclotron and have used a Geiger counter for investigating the radioactive radiations. The activities observed are listed below in order of prominence.

(1) A negative electron activity of 2·4 min. is found by analysis of the composite decay curve given by irradiated silver foil, the corresponding intensity for a control sample measuring only the background neutron effect being negligibly small. This activity is to be ascribed to ^{108}Ag formed by the reaction: ^{107}Ag (d,p) ^{108}Ag.

(2) Chemical separation into silver and cadmium fractions has been performed, and the latter portion has been found to contain a 6·8 hour body emitting a soft negative electron radiation (absorption limit 15 mgm. per sq. cm. of aluminium), X-rays and a very weak γ-radiation. A body with corresponding properties has been found as a product of proton capture in silver[1], and arguments have been adduced suggesting that the activity is due either to a metastable excited state of one of the isotopes, ^{108}Cd or ^{110}Cd, electrons and cadmium X-rays resulting from an efficient internal conversion of the de-excitation γ-rays, or to K-electron capture in an unstable isotope ^{107}Cd or ^{109}Cd, giving rise to silver X-rays together with photo-electrons. Favouring the validity of the former interpretation in our case are the apparent entire absence of the positron emission which would probably accompany K-capture, and also a significantly closer correspondence of the X-ray absorption coefficient in aluminium to the value for cadmium K-radiation than to that for the silver line. The appropriate reaction is: ^{107}Ag (d,n) ^{108*}Cd, or ^{109}Ag (d,n) ^{110*}Cd.

(3) The silver fraction contains a 26-min. body emitting positrons with an absorption limit corresponding to 1·8 Mv. This body thus has properties similar to those attributed to ^{106}Ag[2]; we are, however, unable to find any trace of the 8-day period belonging to the other isomer of ^{106}Ag, and, in any event, the mechanism of the formation is obscure. A control sample given the same chemical treatment as the positive sample shows the background neutron effect to be negligible.

(4) The silver portion gives also a negative electron activity which decays with a half-life of at least several weeks.

(5) Short-lived activity in the silver foil has been sought by beginning measurements within a quarter-minute of a short bombardment, but no half-life less than the 2·4 min. can be detected.

A comprehensive account of this and cognate work will be published elsewhere.

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D. H. T. GANT.

[1] Delsasso, Ridenour, Sherr and White, *Phys. Rev.*, **55**, 113 (1939).
[2] Pool, Cork and Thornton, *Phys. Rev.*, **52**, 380 (1937). Pool, *Phys. Rev.*, **53**, 116 (1938). Pool and Campbell, *Phys. Rev.*, **53**, 272 (1938). Feather and Dunworth, *Proc. Roy. Soc.*, A, **163**, 566 (1938).

THROUGH the kindness of Messrs. Krishnan and Gant, I have been able to examine the radiations from a silver foil of 20 mgm./cm.^{2} bombarded with 9 Mv. deuterons, using the method of critical absorption previously adopted in the case of the fission products of uranium[1]. For the quantum radiations from the 6·8-hour body, a palladium foil of 24 mgm./cm.^{2} was considerably more transparent than a foil of molybdenum of only 14 mgm./cm.^{2}. This is in agreement with the findings reported above, although it does not allow a decision to be made as to whether the K-radiations of silver or cadmium are involved (it is hoped, later, to use an absorber containing ruthenium in order to examine this point more closely).

Concerning the long-period activity (4, above), the method of critical absorption likewise indicates an intense quantum radiation much more strongly absorbed by molybdenum than by palladium, and a harder γ-radiation is also present. The negative electrons of the long-period activity have been examined in a special low-absorption counter arrangement, and an absorption limit of about 12 mgm./cm.^{2} has been found for them.

It will obviously be interesting to examine all these radiations in more detail to see if any reason can be found why they are so closely similar to those emitted by the 6·8-hour cadmium isotope.

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August 25.

[1] Feather and Bretscher, NATURE, **143**, 516 (1939).

Fission of Thorium by Neutrons

SINCE March 1938, we have been engaged in the study of artificial radioactivity induced in thorium by fast neutrons. We have already reported[1] the production of uranium Y, which was obtained in the course of this investigation.

At that time we had examined the barium and lanthanum fractions from activated thorium and obtained nearly all the periods which Meitner, Strassmann and Hahn[2] found in their study of the artificial radioactivity of thorium, and which Hahn and Strassmann[3] and other authors later identified with those for fission products of uranium and thorium, although our agreements were not exact in some cases and some other periods were obtained in our experiments.

We did not, however, follow closely these lines of investigation, since our attention was directed to a radioactive substance, which was precipitated with bismuth and lead as carriers from hydrochloric acid solution by hydrogen sulphide. We spent much time on the chemical identification of this substance. Its chemical properties were not easy to ascertain, but it was still more difficult to understand the nuclear reactions concerned. Chemical properties suggested that either 'transuranic' or elements of lower atomic