The Nuclear Energies of Aluminum and Beryllium

According to the theory recently suggested by the writer[1] the nuclei of the radioactive atoms have possible energies equal to multiples of 3.85×10^5 electron-volts. This idea was suggested by the fact that the gamma-ray, beta-ray and disintegration energies form many pairs with sums equal to multiples of 3.85×10^5 electron-volts.

When aluminum is bombarded by alpha-rays it emits protons and there are several alpha-ray energies for which the proton emission has maximum values. These alpha-ray energies probably correspond to energy levels of the aluminum nucleus. The values found for these resonance levels by Chadwick and Constable[2] are 52.5, 48.6, 44.9 and 40 with 10^5 electron-volts as unit. The differences between these energies are 3.9, 3.7 and 4.9 which do not differ from 3.85 by amounts greater than the possible errors.

In the same way when beryllium is bombarded by alpha-rays the emission of neutrons varies with the energy of the rays and has maximum and minimum values. The minimum values found by Kirsch and Slonek[3] occur at about 52.5, 48.5, 44, 40 and 37 and the differences between these values are equal to 4, 4.5, 4 and 3. These differences are not far from 3.85. The mean value is 3.88.

These results together with those for the radioactive atoms, suggest that the nuclei of the atoms of all the elements have possible energies equal to $3.85n$ or to $3.85n + c$ where $n = 0, 1, 2, 3 \cdots$ and c is a constant.

H. A. Wilson

Rice Institute,
Houston, Texas,
February 27, 1934.

[1] Wilson, Phys. Rev. **44**, 858 (1933).

[2] Chadwick and Constable, Proc. Roy. Soc. **A135**, 48 (1932).

[3] Kirsch and Slonek, Naturwiss. **4**, 62 (1933).

Radioactivity from Carbon and Boron Oxide Bombarded with Deutons and the Conversion of Positrons into Radiation

In a note to *Science* we announced that we had observed radioactivity from certain light elements after they had been bombarded with deutons of 0.9×10^6 e.v. energy, and, in particular, that we had been able to verify the prediction of Curie-Joliot and Joliot,[1] that carbon bombarded with deutons should yield the same radioactive end product as they obtained by bombarding boron with α-particles. The particles which we obtained from the bombarded carbon were identified as positrons having energies distributed from about 0.7×10^6 e.v. downward, by Dr. Carl D. Anderson and Seth H. Neddermyer, using a Wilson cloud chamber. We have since investigated this and some other processes more closely, and have determined the decay constants with more precision. We have also found that γ-rays are associated with the radioactivity in at least some of these processes.

The procedure is as follows: A target of the substance to be investigated is first bombarded for a suitable length of time, generally fifteen minutes, with an ion current of 10 microamperes, consisting principally of H^2, at 0.9×10^6 volts. The target is then removed from the tube and placed in the bottom of an ionization chamber, and the rate of production of ionization as a function of time is measured. The ionization observed is attributed to particles ejected from the target, and also to γ-rays, if such are present. In order to separate the effect contributed by γ-rays alone, a second ionization chamber is placed directly below the first. The walls and linings of the chambers are sufficiently thick to prevent charged particles from entering the lower chamber and giving a direct effect. Therefore any ionization recorded in the lower chamber is to be attributed to γ-rays, unless neutrons are present, which does not seem probable.

In Fig. 1 are plotted the log intensities for the two chambers against time after bombardment when a carbon target was placed inside the upper chamber. Curve I refers to the upper chamber and curve II to the lower chamber.

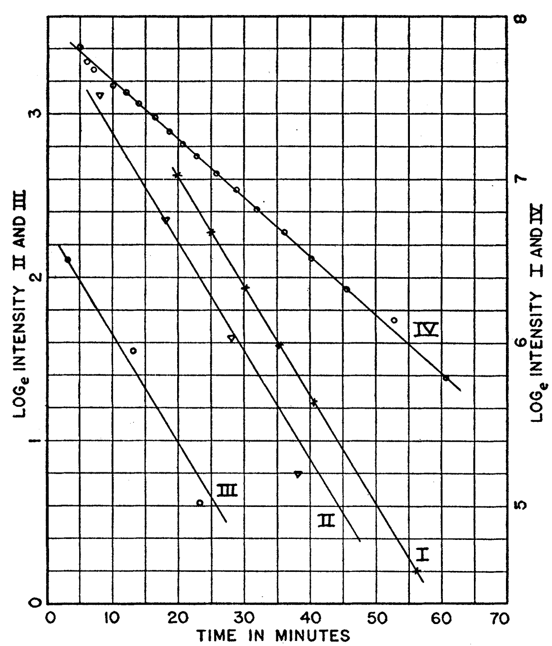

FIG. 1. Intensity of ionization as a function of time after bombardment due to: I, positrons from carbon target; II, γ-rays from carbon; III, γ-rays from carbon after 7.1 cm lead filtration; IV, positrons (?) from B_2O_3 target.

It is seen from these plots that the half period (10.3 minutes) is the same within the experimental error, whether determined from the rate of emission of positrons or from the γ-rays associated with the process. This would

[1] Curie and Joliot, Comptes Rendus **198**, 254 (1934).