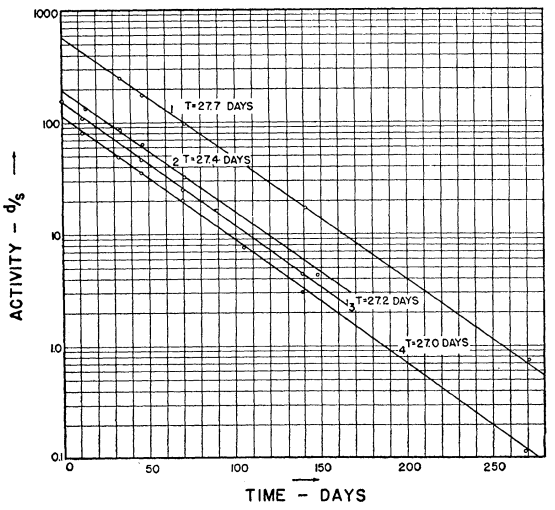

FIG. 1. Decay curves of $_{91}$ekatantalum^{233}.

of experiments. Under the same chemical conditions UX_2 (brevium) was separated from uranium practically quantitatively. A further search revealed a β-emitting isotope of ekatantalum (Et) from thorium irradiated with slow neutrons, with a period of 27.4 days. Since this isotope is excited by slow neutrons and the number of active atoms is quantitatively in approximate agreement with the number of active atoms of Th^{233} formed under the same conditions, it is presumed to be the daughter of Th^{233}.

A strong preparation of $_{91}Et^{233}$ was made by irradiating 7 kg of thorium nitrate in solution (kindly supplied by the Maywood Chemical Company) near the cyclotron for about 50 hours. It was concentrated by a factor of 350,000 by a procedure originally used for the isolation of protactinium.[5] A practically quantitative separation was effected using 20 grams ZrO_2 as a carrier. A final concentrate of 20 mg ZrO_2 was obtained by means of the spiral process[5] and contained initially about 10^{14} atoms of $_{91}Et^{233}$. This separation from Zr disproves the recent suggestion by Hahn and Strassmann[4] that their 25-day activity from thorium precipitated by zirconium phosphate may be an isotope of zirconium, and definitely proves that their "pre-fission" interpretation was correct.[6]

The decay of the sample has been followed for nearly a year, some of the curves being shown in Fig. 1. Curves 1, 3, and 4 were made through a thickness of 2 mils of aluminum between the source and ion chamber, while curve 2 was made through 10 mils. The mean value of the half-life from these and other measurements is 27.4 ± 0.4 days; decay curves through 1.5 and 4.5 g/cm^2 of lead showed the same period. The radiation as shown by cloud-chamber experiments consists of negative electrons[7] and rather strong γ-rays. As has been shown by absorption measurements and more accurately by E. Haggstrom,[8] the maximum energy of the electrons is somewhat less than 300 kev.

Further studies are being made of the decay products.

One of us (A. V. G.) expresses his appreciation to the John Simon Guggenheim Memorial Foundation for the grant of a fellowship. The aid of the Research Corporation is gratefully acknowledged.

[1] E. Fermi, E. Amaldi, O. D'Agostino, B. Pontecorvo, F. Rasetti and E. Segrè, Proc. Roy. Soc. **A149**, 522 (1935).
[2] I. Curie, H. v. Halban and P. Preiswerk, Comptes rendus **200**, 1841 (1935).
[3] O. Hahn and L. Meitner, Naturwiss. **17**, 320 (1935); L. Meitner, F. Strassmann and O. Hahn, Zeits. f. Physik **109**, 538 (1938).
[4] O. Hahn and F. Strassmann, Naturwiss. **28**, 543 (1940).
[5] A. V. Grosse, Ber. d. D. Chem. Ges. **61**, 238 (1928).
[6] A confirmation of this result has been obtained by G. T. Seaborg and J. W. Gofman at the University of California (private communication).
[7] We wish to thank Mr. G. Weil for making the cloud-chamber observations.
[8] E. Haggstrom, Phys. Rev. **59**, 322 (1941).
* Publication assisted by the Ernest Kempton Adams Fund for Physical Research of Columbia University.

Nomenclature of Nuclear Particles

C. MØLLER
Institute of Theoretical Physics, University of Copenhagen, Copenhagen, Denmark
December 10, 1940

FOLLOWING the original proposal of Belinfante,[1] the writer has in a recent note on the meson theory of nuclear forces[2] used the word "nuclon" as a common notation for the heavy nuclear constituents, neutrons and protons. In the meantime, however, it has been pointed out to me that, since the root of the word nucleus is "nucle," the notation "nucleon" would from a philological point of view be more appropriate for this purpose, and I am therefore glad to have the opportunity to call the attention of interested physicists to this point.

[1] F. J. Belinfante, *Theory of Heavy Quanta*, Proefschrift, s'Gravenhage, 1939.
[2] C. Møller, Phys. Rev. **58**, 1118 (1940).

Fission Products of Uranium by Fast Neutrons

Y. NISHINA AND T. YASAKI
Nuclear Research Laboratory, Institute of Physical and Chemical Research, Komagome, Hongo, Tokyo, Japan

AND

K. KIMURA AND M. IKAWA
Chemical Institute, Faculty of Science, Imperial University of Tokyo, Tokyo, Japan
December 23, 1940

IN continuing our work[1] on the fission of uranium produced by fast neutrons, we found in the following way that rhodium and ruthenium isotopes are also produced by fission.

The uranium oxide, U_3O_8, carefully purified and freed from its disintegration products, was exposed for about 12 hours to fast neutrons produced by bombarding lithium with 3 Mev deuterons of some ten microamperes from our cyclotron. From the irradiated sample, rhodium was separated as metal and ruthenium as sulphide. Each fraction which was carefully freed from the known fission products such as molybdenum, palladium, silver, cadmium, antimony, tellurium, iodine, caesium, barium, lanthanum, etc., was examined for its activity.

The rhodium fraction shows a decay curve of a single period 34 hours, while the ruthenium fraction gives two

periods, about 4 hours and 60 hours, respectively. Since the activity of ruthenium is weak, the determination of its periods is not exact and the above values are to be taken as provisional.

The 34-hour rhodium was found to be an electron emitter and the maximum energy of the β-rays, as determined by an absorption method according to Feather, comes out to be 0.5 Mev. Since the 34-hour period is not known for rhodium, its mass number must be larger than 105 and it is expected to transform itself into palladium. We therefore made the search for a radioactive palladium in the rhodium fraction after about 30 hours from its separation. As was expected from the simple decay curve of rhodium, we found no activity in the palladium fraction. We thus conclude that the decay product of the 34-hour rhodium is probably a stable palladium isotope Pd^{106}, Pd^{108} or Pd^{110}, unless it has either a very short or a very long period.

The above investigations were carried out as a part of the work of the Atomic Nucleus Sub-Committee of the Japan Society for the Promotion of Scientific Research. We acknowledge the assistance given by our laboratory colleagues in connection with the irradiation of samples.

[1] Y. Nishina, K. Kimura, T. Yasaki, M. Ikawa and H. Ezoe, Nature **146**, 24 (1940). Y. Nishina, K. Kimura, T. Yasaki and M. Ikawa, Phys. Rev. **58**, 660 (1940).