LETTERS TO THE EDITORS

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Fission Products of Uranium produced by Fast Neutrons

IN continuation of our experiments on the fission of uranium by fast neutrons, we have been studying decay periods of various isotopes. In this communication we give the results on silver and cadmium isotopes.

The uranium oxide, U_3O_8, carefully purified and freed from its disintegration products just before the experiments, was exposed to fast neutrons produced by bombarding lithium with 3 Mev. deuterons of several microamperes from our cyclotron, as described in our earlier note[1]. The exposure ranged from a few hours to some fifty hours, according to the object of the experiments. From the irradiated sample, silver was separated as iodide or chloride, cadmium as sulphide. Each fraction, carefully freed from the known fission products of uranium such as barium, lanthanum, antimony, tellurium, iodine, molybdenum, etc., was examined for its activity.

The decay curves of the silver fraction, which were obtained from samples exposed for some fifty hours, showed two periods, 7·5 days and 3 hours. The former activity is probably identified with ^{111}Ag [2,3] and the latter with ^{112}Ag [3].

The decay curves of the cadmium fraction, which was obtained from long exposures, showed apparently three periods, fifty minutes, several hours and 2·5 days. The first activity is possibly an isotope reported by Dodé and Pontecorvo[4]. The second one was proved to be ^{117}Cd by the identification of indium activity produced through its series transformation in the following way. Cadmium sulphide from a sample irradiated for 3 hours was dissolved in hydrochloric acid three hours after the initial separation of cadmium. The solution, after an addition of indium nitrate, was treated with an excess of ammonia. The precipitated indium hydroxide was filtered off and examined for the activity. Its half-period was found to be 2·1 hours, which is due to the known isotope of indium ^{117}In [5]. We thus conclude that the activity of the cadmium fraction is due to ^{117}Cd, the half-life of which turns out according to our measurements to be about 5·5 hours.

Similar procedure was taken with the 2·5-day activity. The cadmium sulphide from an irradiated sample of long exposure was left for about twenty hours before dissolution in hydrochloric acid, until the cadmium isotope ^{117}Cd and its daughter product died away. The indium fraction obtained in the same way as above was examined for activity, and a half-life of 4·5 hours was obtained, which we identify with the known radioactive isomer of the stable indium isotope $^{115}In^{*}$ [5]. As a consequence, we conclude the 2·5-day activity to be due to a cadmium isotope ^{115}Cd.

It should be mentioned that Be + D neutrons from our cyclotron, and also neutrons slowed down by paraffin, do not appreciably produce silver and cadmium activities as above mentioned. The details of the experiments will shortly be given elsewhere.

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Y. NISHINA.
T. YASAKI.
H. EZOE.

Nuclear Research Laboratory,
Institute of Physical and Chemical Research,
Tokyo.

K. KIMURA.
M. IKAWA.

Chemical Institute,
Faculty of Science,
Imperial University of Tokyo.
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Mass-Radius Relation for a White Dwarf Star

THE peculiar difficulty pointed out by Eddington regarding the ultimate fate of a white dwarf star led Fowler[1] to make the first application of Fermi-Dirac statistics to astrophysics in a fundamental paper which initiated a long series of investigations, particularly by Milne[2], in recent years. The starting point is the expression

$$a(\varepsilon)dt = \frac{gV(2m)^{3/2}}{4\pi^2 \hbar^2} \varepsilon^{1/2}\, dt, \qquad (1)$$

which represents (neglecting the effect of relativistic mechanics) the number of wave functions corresponding to eigen-values lying in the energy-range ε to $\varepsilon + dt$ for a *free* electron confined in a field-free region of volume V; this is assumed to hold for the stellar interiors though gravitational and electrical fields are present. For degenerate matter equation (1) leads to the well-known expression for the pressure

$$p = \frac{32\pi^3}{15} \frac{\hbar^2}{m} \left(\frac{3\rho}{4\pi g \mu m_H}\right)^{5/3}; \qquad (2)$$

which reduces the equation for mechanical equilibrium for a star to Emden's equation of index 3/2 giving the relation ("Emden-solution")

$$R = \frac{\alpha_0 L_0}{\mu^{5/3}} \left(\frac{\odot}{M}\right)^{1/3} \qquad (3)$$

between the radius R and the mass M of a white