the 1.75-Mev level arises from the excitation of two protons to a $(g_{9/2})^2$ configiration, one may expect some additional forbiddenness. In such a transition, the 39th proton of Y^{90} must change from a $p_{1/2}$ to a $g_{9/2}$ state, in addition to the ordinary single particle transformation of a $d_{5/2}$ neutron into a $g_{9/2}$ proton. For this reason, a reduced intensity for the transition to the 1.75-Mev level may be expected.

Very precise measurements on the beta spectrum of Y^{90} gave no indication of any other group of beta rays between 0.5 Mev and the end point at 2.26 Mev. This fact, combined with the absence of any gamma radiation (other than bremsstrahlung) suggests that the 1.75-Mev level is the first excited state of the even-even nucleus Zr^{90}.

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[1] Kenneth W. Ford, preceding Letter [Phys. Rev. **98**, 1516 (1955)]. We are indebted to Professor Ford for stimulating discussions of the theoretical aspects of the problem.

New Element Mendelevium, Atomic Number 101*

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We have produced and chemically identified for the first time a few atoms of the element with atomic number 101. Very intense helium ion bombardments of tiny targets of 99^{253} have produced a few spontaneously fissionable atoms which elute in the *eka*-thulium position on a cation resin column.

The method of production utilized the following techniques. In a special position in the Crocker Laboratory 60-inch cyclotron a very concentrated collimated beam of 48-Mev helium ions (as much as 10 microamperes in an area $\frac{1}{32}\times\frac{1}{4}$ inch) was allowed to pass through a degrading absorber and then through a 2-mil gold foil (yielding 41-Mev helium ions). On the back side of the gold foil, approximately 10^9 atoms[1] of the 20-day 99^{253} were electroplated in the beam area. From this target the nuclear transmutation recoils were ejected in a narrow spray and caught on 0.1-mil gold foil adjacent to the target. The gold foil was quickly dissolved in aqua regia, the gold extracted with ethyl acetate, and the aqueous phase eluted through a Dowex-1 anion resin column with $6M$ HCl to complete the removal of gold and other impurities. The drops containing the actinide fraction were evaporated and the activity was then eluted through a Dowex-50 resin cation column with ammonium α-hydroxy-isobutyrate[2] to separate the various actinide elements from each other. The radiations from the various fractions were then examined with various types of counters.

The earliest experiments were confined to looking for short-lived alpha-emitting isotopes of element 101 such as 101^{255} and 101^{253} that would be expected from $(\alpha,2n)$ and $(\alpha,4n)$ reactions. For this purpose it was sufficient to look quickly in the gross actinide fraction as separated by the anion resin column alone. No alpha activity was observed that could be attributed to element 101 even when the time between the end of bombardment and the beginning of alpha pulse analysis had been reduced to 5 minutes. To ascertain that a proper recoil and chemical yield was being obtained, a small amount of Cm^{244} was included in the target so that the Cf^{246} and Cf^{244} produced by the helium ion beam would serve as a monitor.

Longer bombardments were then made, and a few spontaneous fission events were observed over a period of several hours in the actinide fractions. At this time the cation resin column procedure was then added to the chemistry so that we could distinguish between elements 101 and 100. The initial experiments were confined to fission counting of the *trans*-100 and the 100 fractions. Several experiments were consistent in their demonstration of spontaneous fissions occurring in both fractions. To determine more precisely the elution position of the element responsible for the *trans*-100 spontaneous fission activity a more elaborate experiment was undertaken. Three successive three-hour bombardments were made and in turn their transmutation products were separated quickly on a cation resin column. The isotope 99^{253} was added in each case so that together with the Cf^{246} produced it would help to calibrate the column run. Five spontaneous fission counters were then used to count simultaneously the corresponding drops of eluent from the three runs. The combined and normalized elution curve is shown in Fig. 1. That the drops did not correspond exactly in each run is indicated on the spontaneous fission histogram by the overlapping of the relative drop number limits of the activities that were placed in each counter. By combining the data from all experiments, the half-life of the spontaneous fission activity in the 101 and

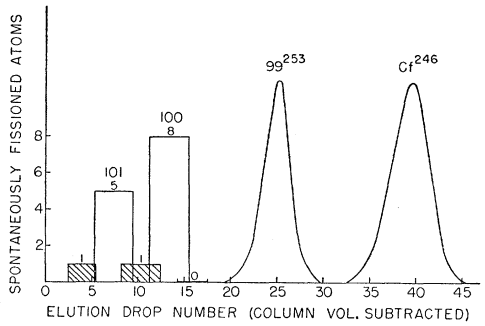

FIG. 1. Elution of elements 98–101 from Dowex-50 column with ammonium α-hydroxy-isobutyrate.

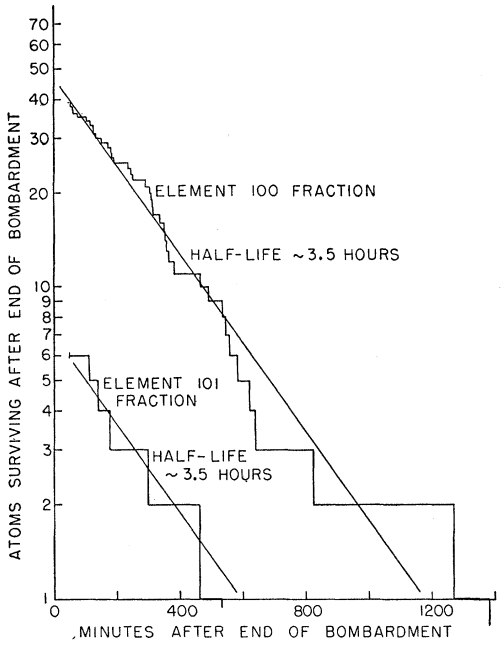

FIG. 2. Spontaneous fission decay curve of element 100 and element 101 fractions.

100 fractions was found to be approximately the same, perhaps 3 to 4 hours as shown in Fig. 2.

Obviously there is insufficient evidence to define the mass numbers concerned in this experiment. However, recent experimental observations of the spontaneous fission decay rates[3] of odd-nucleon types indicate that they are hindered by factors of thousands. If we then apply this principle to this experiment it is tempting to draw the following conclusions. By an (α,n) reaction on 99^{253} we have produced the isotope 101^{256} which decays by electron capture with a half-life of the order of a half hour to 100^{256}; this isotope then decays by spontaneous fission with a half-life of the order of 3 to 4 hours. (Since no alpha activity is observed we can rule out the 3.2-hour isotope 100^{254} as being responsible for the spontaneous fission activity on the basis of its known alpha-to-fission ratio of 1550.) In a total of eight separate experiments we have isolated only 17 atoms of 101 so it has not yet been possible to demonstrate this proposed genetic relationship between 101^{256} and 100^{256}. However, another experiment[4] has shown shown that 100^{256} does have a spontaneous fission half-life of about 3 hours.

The proof that these experiments resulted in the identification of element 101 is as follows:

1. Only the very heaviest elements decay by spontaneous fission with such short half-lives.

2. The elution position immediately ahead of element 100 shows that the chemical properties are those of an element heavier than 100, and probably 101 rather than 102.

3. By this method of production, it would not be possible to produce an element above 101.

We would like to suggest the name mendelevium, symbol Mv, for the new element in recognition of the pioneering role of the great Russian chemist, Dmitri Mendeleev, who was the first to use the periodic system of the elements to predict the chemical properties of undiscovered elements, a principle which has been the key to the discovery of the last seven transuranium (actinide) elements.

We should like to acknowledge the fact that this work was greatly facilitated by the reshaping of the magnetic field of the Crocker Laboratory 60-inch cyclotron so as to secure a more concentrated ion beam. This modification was successfully carried out under the expert supervision of G. B. Rossi. We should like to express our appreciation to C. A. Corum for his expert collaboration in the design of the special deflector channel probe used in these bombardments. To G. B. Rossi, W. B. Jones, and the crew of the 60-inch cyclotron, we extend our thank for their patience and careful manipulation of the machine which made the bombardments successful. We should like to thank T. O. Parsons, R. Silva, and A. Chetham-Strode for their considerable assistance. We should also like to express our appreciation to Professor J. G. Hamilton, director of the Crocker Laboratory, for his help and and cooperation and to Professor E. O. Lawrence for his continued interest in this program of research.

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[1] The 99^{253} target atoms were made by intense neutron bombardment of Cf^{252} and the subsequent beta decay of Cf^{253}. We would like to thank the personnel of the Materials Testing Reactor in Idaho for their very expeditious handling of this bombardment.

[2] Choppin, Harvey, and Thompson (unpublished information).

[3] Unpublished data in this laboratory.

[4] Choppin, Harvey, Thompson, and Ghiorso, following Letter [Phys. Rev. 98, 1519 (1955)].

Nuclear Properties of 100^{256}

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THE nuclide 100^{256} has been made by neutron irradiation of 99^{255} in the Materials Testing Reactor. One purpose of this experiment was to determine the most probable mass assignment of the isotope of element 101 which has been produced recently.[1]

Since the irradiated sample had been made earlier from Pu^{239} by successive neutron captures,[2] it was principally 99^{253}. A short bombardment and fast chemical separation of the 100 fraction from the 99 fraction was used to minimize the amount of 100^{254} which would grow in from its 36-hour 99^{254} parent. The