(2) *Argon.*—By introducing the mixture of normal hexane vapor and argon into the discharge tube, the two doublets $C^{12}{}_3H_4-A^{40}$ and $C^{12}{}_3H_5-HA^{40}$ were photographed. The following mass differences of these doublets are obtained,

$$C^{12}{}_3H_4-A^{40}=679.3\pm 0.7, \quad (1)$$

$$C^{12}{}_3H_5-HA^{40}=693.0\pm 2.3. \quad (2)$$

From the results (1) and (2), the isotopic weight of A^{40} is as follows:

$$(1)\quad A^{40}=39.97637\pm 0.00057,$$

$$(2)\quad A^{40}=39.97500\pm 0.00062.$$

At present, we have no interpretation of the discrepancy between the mass differences of the above two doublets.

(3) *Iron.*—The wide and faint doublet $C^{12}{}_4H_8-Fe^{56}$ was photographed, from which we obtained 1235 ± 17 as its mass difference. The ion of Fe^{56} was considered to originate from the iron cathode. We obtain a provisional value 55.9572 ± 0.0012 as the isotopic weight of Fe^{56}. Its packing fraction -7.7 is smaller than Dempster's value -7.0 ± 0.4.[3]

T. Okuda
K. Ogata
K. Aoki
Y. Sugawara

Physical Laboratory,
Osaka Imperial University,
Osaka, Japan,
July 22, 1940.

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Electrostatic Generator with Concentric Electrodes

Our 2.6-million-volt generator has been described in previous issues of this journal.[1, 2] It was housed in a tank 20 ft. long and 5½ ft. in diameter, with a working pressure of 100 lb. per sq. in. With only high pressure air in the tank this generator was limited to approximately 2.2 Mv by sparking directly across the air gap. As Freon was added to the high pressure air the direct spark-over voltage rose, but at 2.6 Mv sparking set in along the charging belt and additional Freon then gave no improvement.

This apparatus was dismantled, the tank was provided with a large, removable end plate, and new apparatus was installed as shown in Fig. 1. In the new installation the apparatus is supported from one end only by three Textolite tubes, *T*, of 3¾ inches outside diameter and ⅜ inch wall thickness. This arrangement gives a charging belt length and a minimum insulator length (except for insulator *t*) almost twice as great as in the previous installation. The new tube consists of 62 sections, each 2½ inches long, compared to 53, 2½-inch sections for the old tube.

Electrodes *B* and *C* were expected to give improvement in the spark-over voltage for two reasons: First, they provide a more uniform gradient between electrode *A* and the tank wall; and second, test work indicated that high pressure air withstands higher gradients in a short gap than in a long gap.

Adjustable corona gaps provide potential distribution along the supporting structure and determine the potentials of electrodes *B* and *C* relative to the potential of *A*. Insulator *K* supports the hemispherical end of electrode *C*. Flexing of the structure by electrostatic forces would probably cause trouble if this electrode were supported only from its open end.

The potential of electrode *C* is measured by means of a generating voltmeter. This measurement also gives a rough indication of the total voltage. In a recent test run the ion beam was brought out into the air through an aluminum foil with an air equivalent of approximately 12 mm and the range of the proton beam, measured visually, was used to determine the generator voltage.

With an air pressure of 100 lb./in². in the tank, the maximum range of the proton beam was 18 cm (room temperature 27.2°C, barometric pressure 742 mm of Hg). After adding the air equivalent of the aluminum foil this gave a voltage of 3.5 Mv from the 1937 range curve of Bethe and Livingston. When 10 lb. (weight) of Freon was added, the maximum range of the proton beam was 27 cm, giving a voltage of 4.3 Mv. The voltage was limited by direct spark-over, although insulator *K* gave some trouble. With 15 lb. of Freon the maximum range was 29 cm (4.5 Mv). The voltage was then limited by sparking along insulator *K*. In previous tests it withstood higher voltage, but in recent

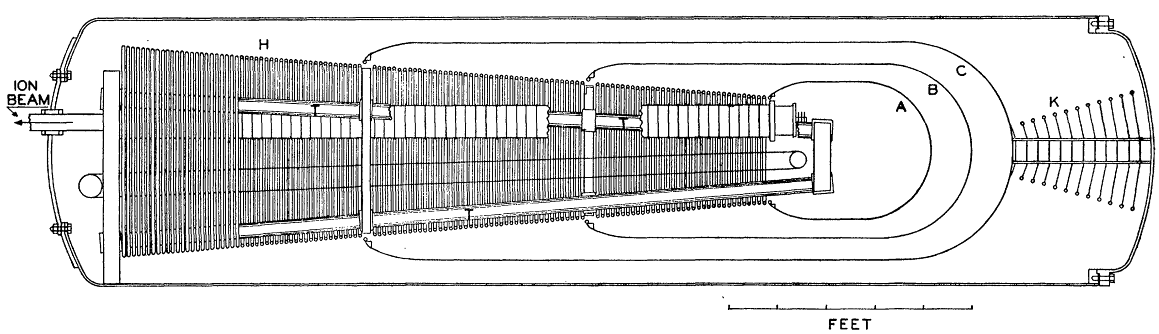

Fig. 1. *A*, *B*, *C*; aluminum shells ⅛ inch thick. *T*; Textolite tubes 3¾ inch outside diameter and ⅜ inch wall thickness. Each Textolite tube is equipped with aluminum rings, made up from ½-inch diameter rod, clamped tightly to the Textolite and spaced 1½ inches apart (not shown in the drawing). *H*; aluminum hoops supported by studs with saddle-shaped ends. One stud projects from each ring. *K*; Textolite tube equipped with metal diaphragms and a corona gap system for potential distribution. Porcelain rings for the accelerating tube are 2½ inches long, corrugated inside and outside. The separating electrodes are steel spinnings. Gaskets of rubber dam 0.01 inch thick make the seals. Springs apply a compressional force of 5000 lb. on the tube. Belt; cotton fabric, woven endless, 16 inches wide.

exposure to the atmosphere during hot, humid weather it soaked up too much moisture and drying treatments attempted so far have not been entirely successful.

The performance of the tube and charging belt indicate that they will be satisfactory for still higher voltage.

We are indebted to Dr. J. L. McKibben for many valuable suggestions and for much help in the design work. Results of his test work were utilized and contributed greatly toward the success of the generator. N. D. Crane and A. O. Hanson gave valuable help with construction work and the Wisconsin Alumni Research Foundation provided financial support.

R. G. Herb
C. M. Turner
C. M. Hudson
R. E. Warren

Department of Physics,
University of Wisconsin,
Madison, Wisconsin,
August 15, 1940.

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Internally Converted Gamma-Rays from Radioactive Gold

The electron spectrum of radioactive gold chemically separated from platinum bombarded with 9.5-Mev deuterons has been obtained with the magnetic spectrometer. A typical result with various peaks due to internally converted gamma-rays is shown in Fig. 1. It is evident that the spectrum of this element is very complex. The lower curve in this figure was taken 18 days after the upper one, and was obtained in order to evaluate the half-life of each electron group.

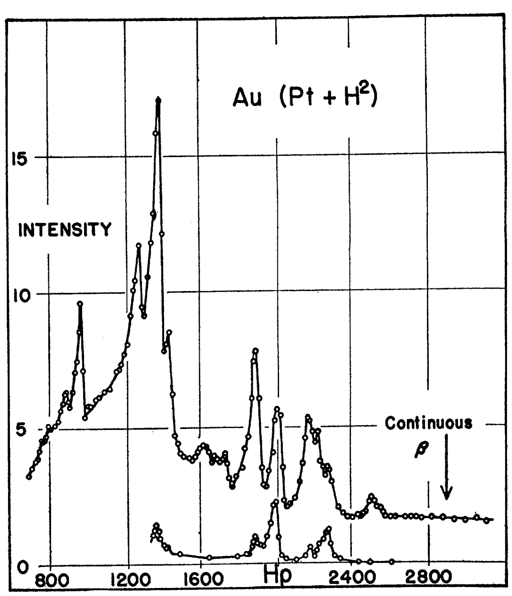

Fig. 1. Electron spectra of radioactive gold taken 18 days apart. The ordinates of the lower curve have been multiplied by 4 before plotting.

The results so far obtained may be summarized as follows: The activity of 164 days half-life shown[1] by absorption measurements to emit beta-particles of energy 0.45 Mev and gamma-radiation of energy 0.11 Mev is too weak for analysis in the spectrometer. The activity of half-life 5.6 days, which from absorption measurements was reported to emit beta-particles of energy 0.36 Mev and gamma-radiation of energy 0.41 Mev, is now shown to be due to a partially converted gamma-ray of energy 356±4 kev. The responsible isotope may be either Au^{196} or Au^{197*}. The other 4 peaks of $H\rho$ greater than 1800 oersted cm can be resolved into K- and L-conversion electron groups corresponding to gamma-ray energies of 331±3 and 410±4 kev, respectively. The half-life of these gamma-rays appears to be about 3 days which is somewhat longer than the value reported from an analysis of the decay curves taken with an ionization chamber. Early observations in the spectrometer confirm the existence of a positron emitter of short half-life. Further work with stronger samples must be carried out to analyze satisfactorily the electron groups of lower energy.

This investigation was made possible by a grant from the Horace H. Rackham Fund.

J. L. Lawson
J. M. Cork

Department of Physics,
University of Michigan,
Ann Arbor, Michigan,
August 16, 1940.

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The Photographic Registration of Heavy Particles Emitted During Bombardment

In order to observe the particles emitted from a target during its actual bombardment in the cyclotron, independent of the disturbing effects of the scattered primary particles and the neutron background, a magnetic spectrograph has been devised. The arrangement employed is shown in Fig. 1.

The primary beam of deuterons is incident upon a narrow strip of very thin foil of the element being studied, suspended at the center of a cavity in a cast lead block. Particles leaving the target at an angle of ninety degrees are collimated by a slit in the wall of the lead block. The strong field of the cyclotron together with an auxiliary field produced by a magnetic shunt on the gap of the large magnet, suffices to resolve the emergent particles. Their deflections are approximately proportional to $ne/(mE)^{\frac{1}{2}}$ where ne is the charge, m the mass and E the energy of the particle. The photographic plate is held in a light-tight carriage that can be set at any desired position on an accurately milled track. By placing immediately in contact with the plate during bombardment, a stepped aluminum foil it is possible to also observe the range of each group of particles. This gives sufficient information to determine the nature of the particle and its energy.

Preliminary observations have been made on aluminum, copper, palladium, gold and platinum, using foils about 0.00004 in. thick. Considering the geometry of the sample