The single case in which a heavy particle, probably a proton, is emitted may be either that of the capture of a negative μ- or π-meson. If it is indeed a π-meson, the result would not be unexpected from photographic plate evidence, and further the event observed is similar to that observed by Valley[4] in argon gas in which he interprets the meson to be most probably a negative π. The possibility that the Al nucleus occasionally receives enough energy in capturing a negative μ-meson to emit a proton cannot be eliminated and further investigation of the possibility is planned.

* Supported by Joint Program of the Office of Naval Research and the Atomic Energy Commission.

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Radioactive Gadolinium and Terbium Isotopes

F. D. S. Butement
Atomic Energy Research Establishment, Harwell, Berks., England
March 3, 1949

An investigation by Krisberg and Pool[1] of the activities produced by the neutron activation of gadolinium showed three β-emitter products with half-lives of 3.5 min., 18 hr., and 5.5 d. The two latter periods were also reported in deuteron-bombarded gadolinium. There was not, however, sufficient evidence definitely to assign the activities to elements or mass numbers. Seren, Friedlander, and Turkel[2] measured approximate activation cross sections, σ, for thermal neutrons in gadolinium, for half-lives of 20 hr., 8.6 d., and 9.5 hr. (It seems likely that the latter is due to a trace of europium.)

An investigation of these activities has been made, including determinations of σ by a pile activation method similar to that of Seren *et al.*,[2] and chemical separations on an ion-exchange column as used by Ketelle and Boyd.[3] Beta- and γ-energies were determined by the usual technique of absorption in Al, Cu, and Pb.

The results for neutron activation of gadolinium oxide are summarized in Table I.

TABLE I. Results for the neutron activation of gadolinum oxide.

Half-life	Element	σ, barns in natural Gd	Radiation energy Mev β	γ
218±5 sec.	—	0.18	—	—
18.0±0.2 hr.	Gd	1.1	0.95	0.055, 0.38
6.75±0.1 d.	Tb	0.16	0.52	0.05 (no harder γ)

The identity, within experimental error, of σ for the 218 sec. and 6.75 d. activities suggests that they must be assigned as follows.

$$\mathrm{Gd}^{161} \xrightarrow[218\ \mathrm{sec.}]{\beta} \mathrm{Tb}^{161} \xrightarrow[6.75\ \mathrm{d.}]{\beta} \mathrm{Dy}^{161}\ \text{stable.}$$

The value of σ for the 18 hr. Gd shows that it cannot be an isomer of Gd^{161}, and this activity is presumably, therefore, to be assigned to Gd^{159}.

Investigation of proton- and deuteron-bombarded gadolinium showed that the 5.5 d. activity, regarded by Krisberg and Pool[1] as being the same as that produced on neutron activation, is actually a mixture of two activities with slightly different half-lives. One is the 6.75 d. Tb described above. The other has a half-life of approximately 5.9 d. and emits low energy electrons and γ-rays of energy 1.1 and ~0.3 Mev. Its radiation characteristics seem to distinguish it from the 5.1 d. Tb^{153} found by Wilkinson and Hicks,[4] which could also hardly be produced, in the intensity found, from the low abundance (0.2 percent) Gd^{152}. It is probably, therefore, a new Tb isotope, decaying by orbital electron capture, and having a mass number of 156–157–158. A more detailed account will be published later.

Acknowledgment is made to the Director, Atomic Energy Research Establishment, for permission to publish these results. The writer is indebted to Dr. A. E. Kempton and Mr. F. Morgan for providing facilities for cyclotron irradiation and ion-exchange separation, respectively.

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The Beta-Spectrum of A^{41}

H. Brown and V. Perez-Mendez
Pupin Physics Laboratory, Columbia University, New York, New York
March 3, 1949

A BETA-RAY spectrometer of the semicircular focusing type has been constructed for the investigation of the spectra of radioactive gases. The radius of curvature is 13.4 cm. Detection is by means of a thin mica (1.4 mg/cm²) end-window counter. A source chamber containing the gas fits into the spectrometer chamber, being separated from it by a 2.5 mg/cm² cellophane window; the chamber backing is $\frac{1}{32}$" Al. The first defining slit is about 3 cm from the nearest part of the gaseous source, whose equivalent thickness was about 0.7 mg/cm². Calibration of the spectrometer was by means of photoelectrons from Cu^{64} annihilation radiation, with the source being placed at the same position as was the first slit in the case of the gaseous source. The distribution of electrons leaving the first slit in the gaseous case was assumed to be the same as that leaving the solid source for that portion of the beam which can reach the counter. This design eliminates single scattering into the beam except from the window, the first slit and a small section of the backing. The large average distance (2 to 5 cm) of the gaseous emitter from any of these scatterers should reduce scattering when compared to a solid source of the same total equivalent thickness as the source and window used. We regard the spectra obtained as less reliable below 300 kev, because scattering in that region becomes more pronounced.

Using a gas-flow probe,[1] spectroscopically pure argon was bombarded by 8 Mev deuteron beams of about 15–25 microamps. for 40–50 minutes to produce A^{41} by a (d, p) reaction (other activities were negligible); the gas was then transferred to the source chamber. A monitor counter, magnetically shielded by an iron cylinder, was placed next to the filling line, about 5 cm from the source chamber. The ratio of spectrometer counts to monitor counts (after subtraction of respective backgrounds) gave the spectrum, with a resolution of about 2.5 percent; the monitor simultaneously gave a decay

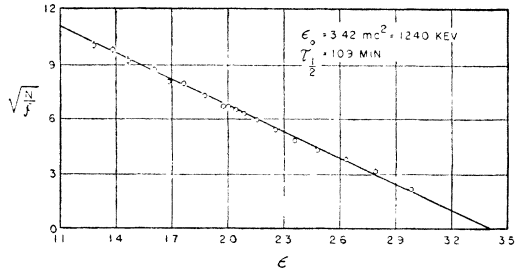

FIG. 1. Kurie plot of the A^{41} spectrum. ϵ is the total (rest+kinetic) energy in units of mc². N is the number of electrons per unit momentum interval. f is the Fermi function $\eta^2 F(Z, \eta)$. $(N/f)^{\frac{1}{2}}$ is plotted in arbitrary units. Where the statistical error is greater than the size of the points, it is shown by vertical lines.