Using $T_{49}=24\,360$ years,[7] $T_{40}=6600$ years,[8] and $T_{51}=470$ years,[9] the ratio N_{51}/N_{41} after 2.39 years was found to be 0.1359 $\pm$0.0009. From Eq. (1) this gives T_{41}, the half-life of Pu^{241} for β^- decay to Am^{241}, as 13.0$\pm$0.2 years. The uncertainty quoted is twice the standard deviation calculated from the experimental results. This allows for possible experimental errors involved in the chemistry, but does not include the uncertainties in the half-lives used in the calculation.

[1] Seaborg, James, and Morgan, *The Transuranium Elements: Research Papers* (McGraw-Hill Book Company, Inc., New York, 1949), Paper No. 22.1, National Nuclear Energy Series, Plutonium Project Record, Vol. 14B, Div. IV.
[2] Thompson, Street, Ghiorso, and Reynolds, Phys. Rev. **80**, 1108 (1950).
[3] G. C. Hanna and B. G. Harvey (to be published).
[4] J. E. Hand, Los Alamos Laboratory Report LADC-1210, 1952 (to be published).
[5] M. Lounsbury, Proc. Roy. Soc. Canada **46**, 28 (1952).
[6] R. B. Shields, Proc. Roy. Soc. Canada **46**, 28 (1952).
[7] J. C. Wallman, Ph.D. thesis, University of California, Berkeley, 1951 (to be published).
[8] Inghram, Hess, Fields, and Pyle, Argonne National Laboratory Report ANL-4653, 1951 (to be published).
[9] B. G. Harvey, Phys. Rev. **85**, 482 (1952).

Excitation of a 16-Microsecond State in Ta^{181} by Capture of Bremsstrahlung*

HUGH N. BROWN† AND ROBERT A. BECKER
Department of Physics, University of Illinois, Urbana, Illinois
(Received February 24, 1953)

A TWENTY-TWO microsecond isomeric state of Ta^{181} has been investigated extensively by others by means of delayed coincidence techniques[1] involving the beta-particles from Hf^{181}. The gamma-ray energies have been obtained from spectrometer-conversion data[2] and from delayed-coincidence, scintillation-spectrometer measurements.[3] The decay scheme is not generally agreed upon, but the main branch involves three gamma-rays, two near 133 kev and one of 481 kev.

In the present work, an isomeric state of tantalum was formed by the reaction $Ta^{181}(\gamma,\gamma')Ta^{181m}$ using bremsstrahlung from the small betatron. A 0.015 inch-thick tantalum target was placed in the x-ray beam, and the gamma-radiation detected in a NaI(Tl) crystal placed, out of the beam, about one inch away from the sample. The pulse-height distribution was observed in a ten-channel differential analyzer, sensitive for a period of 50 to 75 microseconds following each x-ray burst. The start of the "on" period could be delayed by a continuously variable amount in order to measure the decay rate of the counts between the bursts.

Although the crystal was shielded from the direct beam by 16 inches of lead, scattered radiation from the target produced a considerable amount of light in the crystal. This overloaded the amplifier, and it was necessary to reduce the gain of the photomultiplier during each burst. This was done by applying a ten-microsecond negative gate to the first dynode.

With an "on" period of 75 microseconds, the pulse-height spectrum shown in curve (a) of Fig. 1 was obtained. The ordinates are the sum of two runs at delays of 13 and 30 microseconds. Upon comparing with the 280-kev gamma from Hg^{203}, curve (b), the Ta photopeak is seen to correspond to about 130 kev.

The presence of a target, whatever its composition, affected the background of the crystal. This background consisted of delayed scintillations (half-life 200 to 250 microseconds) arising from x-rays scattered into the crystal by the target. Such effects have been observed by others.[4] Here it is apparent (see curve (c), obtained with a tungsten target of the same dimensions as the tantalum) that the background was not serious near 130 kev.

Evidence for radiation near 500 kev was also observed. No well-defined photopeak was found, however, owing to much poorer statistics.

A decay curve of pulses corresponding to energies between 88 and 226 kev was plotted. The time delays were measured on an oscilloscope whose sweep was calibrated to within two percent. The half-life, after background correction, was 16$\pm$3 microseconds. The uncertainty is due only to statistical errors. It is assumed that this 16-microsecond state is identical to the metastable state reported previously.[1]

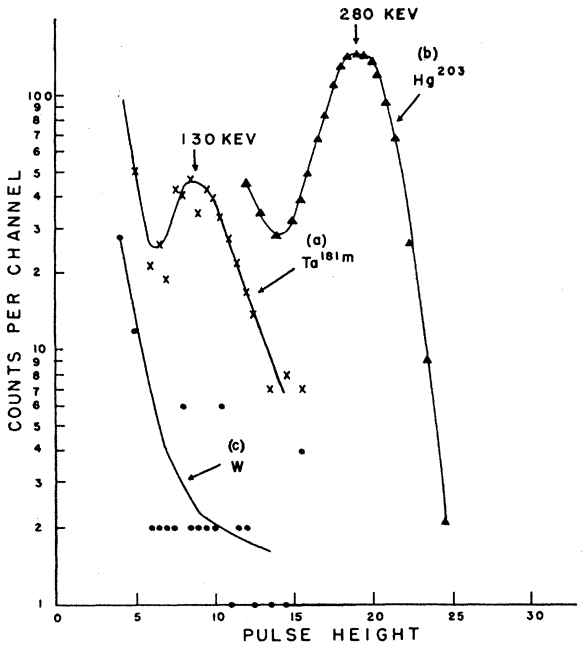

FIG. 1. Pulse-height spectrum of delayed gamma-rays from Ta^{181m}.

All measurements were made at 6.5-Mev maximum energy, below the neutron threshold of lead because of the otherwise large neutron background. This low bombarding energy seriously reduced the beam intensity. The Ta^{181m} activity, ideal because of the short lifetime and because a 100 percent isotope is involved, was just above the threshold of detection. An activity with half-life four times or more that of Ta^{181m} would not have been detectable with the geometry used. Improved geometry and neutron shielding may allow the detection of longer-lived transitions, although it is expected that delayed background pulses from the scintillation crystal would cause trouble.

* Aided by the joint program of the U. S. Office of Naval Research and the U. S. Atomic Energy Commission. The U. S. Atomic Energy Commission is also to be thanked for the Hg^{203} employed in this work.
† National Science Foundation Predoctoral Fellow.
[1] S. De Benedetti and F. K. McGowan, Phys. Rev. **74**, 728 (1948); Bunyan, Lundby, Ward, and Walker, Proc. Phys. Soc. (London) **61**, 300 (1948).
[2] Cork, Stoddard, Rutledge, Branyan, and LeBlanc, Phys. Rev. **78**, 299 (1950).
[3] F. K. McGowan, Oak Ridge National Laboratory Report ORNL-952, 1951 (unpublished).
[4] J. A. Jackson and F. B. Harrison, Phys. Rev. **89**, 322 (1953).

Spin and Parity of the 2.3-Mev Excited State of Te^{124}†

FRANZ R. METZGER
Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania
(Received February 20, 1953)

IT has been reported[1] that the gamma-rays emitted in the disintegration of Sb^{124} do not show any directional correlation. Definite conclusions cannot be drawn from this isotropy as several γ–γ cascades contribute to the observed coincidence rate.