

An Isomeric State of Ga⁶⁵

BERND CRASEMANN*

Department of Physics, University of California, Berkeley, California

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A positron activity of 8.0 ± 0.5 minutes half-life has been assigned to an isomeric state of Ga⁶⁵ on the basis of chemical separation, cross bombardments, and excitation curves. Gamma rays of 52 ± 2 , 92 ± 4 , and 114 ± 4 keV were measured, which exhibited the 15-minute half-life of the previously known activity of Ga⁶⁵. No 8-minute gamma ray was found.

THE decay of an isomeric state of Ga⁶⁵, of half-life 8.0 ± 0.5 minutes, was observed in the chemically separated gallium fractions from copper foils that had been bombarded with alpha particles in the Crocker Laboratory cyclotron. To identify the activity, its excitation curve was determined, using stacked foils and scintillation counting. The result (Fig. 1) indicates that the 8-minute activity, like the known 15-minute activity of Ga⁶⁵, is produced by an $(\alpha, 2n)$ reaction on copper. It could, therefore, be due to Ga⁶⁵ or Ga⁶⁷. Additional experiments showed that the 8-minute activity was produced by deuteron bombardments of zinc, but not by proton bombardments of zinc. Since Ga⁶⁷ can be produced by the reaction $Zn^{67}(p, n)$, this possibility was eliminated and the 8-minute activity assigned to Ga⁶⁵.

A search for gamma rays connected with the decay of Ga⁶⁵ was undertaken with a scintillation spectrometer and with a thick-lens beta-ray spectrometer, scanning for internal conversion electrons and for electrons

ejected from a gold radiator. *K* conversion electron peaks were observed, associated with gamma energies of 52 ± 2 , 92 ± 4 , and 114 ± 4 keV. Each of these peaks decayed with a half-life of 15 minutes. Two of the observed gammas correspond to transitions previously described by Valley and McCreary,¹ who assigned gamma rays of 53.8 ± 0.5 and 117 ± 1 keV to 18.5-minute Ga⁷⁰. The half-life of Ga⁷⁰ was later found to be 20.3 minutes,² and it appears that Valley and McCreary were actually measuring the transitions in Ga⁶⁵. The observed half-life of the 92-keV transition shows that this is not the transition of similar energy known to occur in Ga⁶⁷.²

The shortness of the half-life made it difficult to determine the conversion coefficients of these gamma rays, but it was noted qualitatively that the 52-keV gamma is highly converted.

The absence of an 8-minute gamma ray makes it appear likely that the 8-minute level lies below the 15-minute level and is fed by one of the 15-minute gamma rays, most probably by the 52-keV transition. The 8-minute level decays mostly by positron emission, observed in a trochoidal analyzer.³ An excess of relative scintillation counting rate over the counting rate in the trochoid is ascribed to *K* x-rays from electron capture.

Since Ga⁶⁵ falls well outside the "islands of isomerism," it may be necessary to consider "core isomerism" to explain the existence of the 8-minute level. It is not yet possible, though, to construct a complete decay scheme for this isotope on the basis of the present data and previous measurements of its positron spectrum.⁴ The author now lacks the facilities for work on such short-lived activities and hopes that study of the decay of Ga⁶⁵ will be continued elsewhere.

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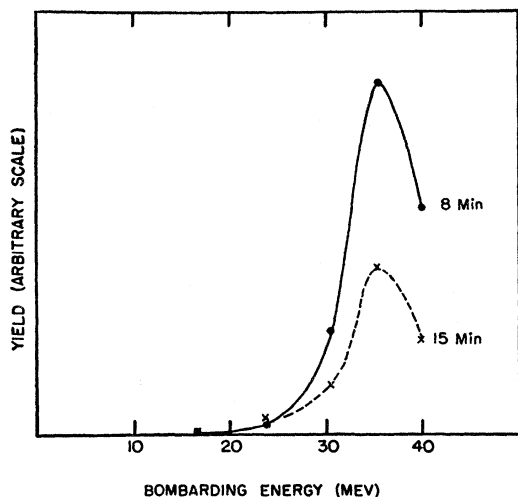


FIG. 1. Excitation curves for the production of 15-minute and 8-minute Ga⁶⁵ in the alpha bombardment of copper.

* Now at the University of Oregon, Eugene, Oregon.

¹ G. E. Valley and R. L. McCreary, *Phys. Rev.* **56**, 863 (1939).

² Hollander, Perlman, and Seaborg, *Revs. Modern Phys.* **25**, 469 (1953).

³ B. Crasemann, *Rev. Sci. Instr.* **24**, 470 (1953).

⁴ B. Crasemann, *Phys. Rev.* **90**, 995 (1953).