## ON THE PHOTODISINTEGRATIONS $^6$Li($\gamma$,$d$)$^4$He AND $^6$Li($\gamma$,$t$)$^3$He†

By E. W. TITTERTON‡ and T. A. BRINKLEY‡

In an earlier communication (Titterton and Brinkley 1952) evidence was given of the forbidden nature of the reaction $^6$Li($\gamma$,$d$)$^4$He $-1{\cdot}54$ MeV. Since that date Glenn (1952) has published a cross section measured at $E_\gamma = 2{\cdot}76$ MeV. Based on finding two events in a photographic emulsion loaded with the separated isotope $^6$Li he gives a figure

$$\sigma_{2.76} \leqslant (4 \pm 4) \times 10^{-30} \text{ cm}^2, \quad \ldots\ldots\ldots\ldots (1)$$

which is compatible with our limit

$$\sigma_{2.76} \leqslant (8 \pm 2) \times 10^{-30} \text{ cm}^2. \quad \ldots\ldots\ldots\ldots (2)$$

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‡ Research School of Physical Sciences, Australian National University, Canberra.

Our measurements at 17·6 MeV using $^6$Li-loaded emulsions irradiated with $\gamma$-rays from the 440 keV $^7$Li$(p,\gamma)$ resonance have now been extended. A new lower limit for the cross section for the 17·6+14·8 MeV components of the spectrum can be given as

$$\sigma_{(17.6+14.8)} \leqslant (2 \pm 2) \times 10^{-30} \text{ cm}^2. \quad \ldots\ldots\ldots\ldots (3)$$

This value is derived by assessing the irradiation in terms of the $^{12}$C$(\gamma,3\alpha)$ events found in the emulsions and accepting the cross section for this reaction at 17·6 MeV as $2{\cdot}4 \times 10^{-28}$ cm$^2$ (Glättli, Seippel, and Stoll 1952).

These low cross-section values are an interesting example of the isotopic spin selection rule $\Delta T = \pm 1$, not zero, for electric dipole transitions in a self-mirrored nucleus. In the experiments only $T=1$ states of the $^6$Li nucleus can be formed by electric dipole transitions and these cannot break up into the two $T=0$ constituents $(\alpha+\alpha)$. They could, however, break up into $T=\frac{1}{2}$ constituents, for example $(p+{}^5\text{He})$, $(n+{}^5\text{Li})$, and $({}^3\text{H}+{}^3\text{He})$ or into $({}^1\text{H}+{}^2\text{H}+{}^3\text{H})$. The first two of these reactions have been observed (Titterton and Brinkley 1951) but, to date, the reactions

$$^6\text{Li}(\gamma,t)^3\text{He} - 15{\cdot}9 \text{ MeV}, \quad \ldots\ldots\ldots\ldots (4)$$

and

$$^6\text{Li} + h\nu = {}^1\text{H} + {}^2\text{H} + {}^3\text{H} - 21{\cdot}4 \text{ MeV} \quad \ldots\ldots\ldots (5)$$

have not been reported.

For this reason, in the present experiment with $^6$Li-loaded emulsions irradiated with the 17·6 and 14·8 MeV $\gamma$-rays, a search has been made for the first of these reactions (4). It is energetically possible only with the 17·6 MeV component of the spectrum when it would yield events with a $^3$He track of 3 $\mu$ range collinear with a triton of range 8 $\mu$. No events have been observed and again a cross-section limit can be obtained in terms of the $^{12}$C$(\gamma,3\alpha)$ cross section. It is

$$\sigma_{17.6}\,{}^6\text{Li}(\gamma,t)^3\text{He} \leqslant (6 \pm 4) \times 10^{-30} \text{ cm}^2.$$

Such a low value of the cross section in the neighbourhood of the threshold is to be expected.

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*References*

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