

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

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In an earlier communication (Titterton and Brinkley 1952) evidence was given of the forbidden nature of the reaction ${}^6\text{Li}(\gamma, d){}^4\text{He} - 1.54$ MeV. Since that date Glenn (1952) has published a cross section measured at $E_\gamma = 2.76$ MeV. Based on finding two events in a photographic emulsion loaded with the separated isotope ${}^6\text{Li}$ he gives a figure

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

which is compatible with our limit

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

† Manuscript received January 28, 1954.

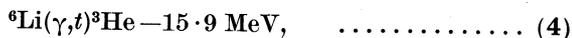
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Our measurements at 17.6 MeV using ${}^6\text{Li}$ -loaded emulsions irradiated with γ -rays from the 440 keV ${}^7\text{Li}(p,\gamma)$ resonance have now been extended. A new lower limit for the cross section for the 17.6+14.8 MeV components of the spectrum can be given as

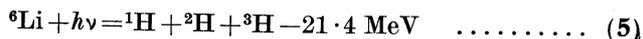
$$\sigma_{(17.6+14.8)} \leq (2 \pm 2) \times 10^{-30} \text{ cm}^2. \quad \dots\dots\dots (3)$$

This value is derived by assessing the irradiation in terms of the ${}^{12}\text{C}(\gamma,3\alpha)$ events found in the emulsions and accepting the cross section for this reaction at 17.6 MeV as $2.4 \times 10^{-28} \text{ cm}^2$ (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 ${}^6\text{Li}$ 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 (${}^4\text{H} + {}^2\text{H} + {}^3\text{H}$). The first two of these reactions have been observed (Titterton and Brinkley 1951) but, to date, the reactions



and



have not been reported.

For this reason, in the present experiment with ${}^6\text{Li}$ -loaded emulsions irradiated with the 17.6 and 14.8 MeV γ -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 ${}^3\text{He}$ track of 3 μ range collinear with a triton of range 8 μ . No events have been observed and again a cross-section limit can be obtained in terms of the ${}^{12}\text{C}(\gamma,3\alpha)$ cross section. It is

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

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

We wish to thank our observers, Mrs. M. Strautmanis and Misses S. Miller and L. Velioniskyte, who carried out the microscope work on this problem.

References

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