^{8}Li(β)^{8}Be*(2α) HAMMER TRACKS IN PHOTOGRAPHIC EMULSIONS†

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The α-pair energy spectrum of 94 ^{8}Li(β)^{8}Be*(2α) hammer tracks observed in photographic emulsion and reported in the literature has been shown by Pickup and Voyvodic (1950) to agree with the results of Bonner *et al.* (1948), and Bennett, Bonner, Mandeville, and Watt (unpublished data 1948, see Bonner *et al.* 1948), who used cloud chambers to measure the pair energy spectrum up to

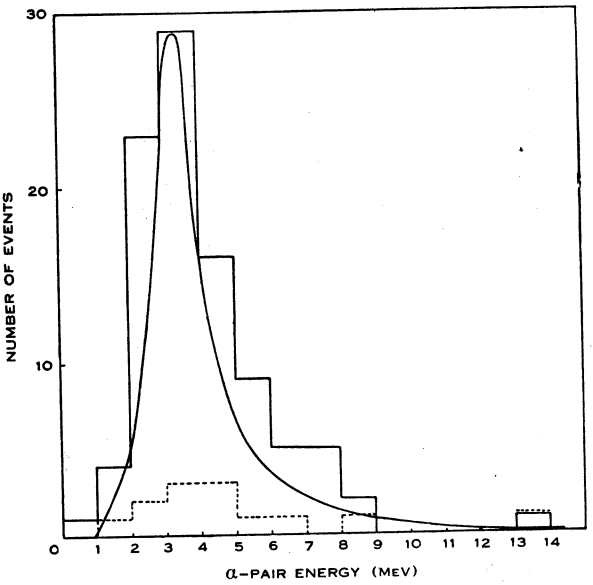

Fig. 1.—Energy spectrum of pairs from ^{8}Li(β)^{8}Be*(2α) hammer tracks.
– – – – The 13 events found in this laboratory.
——— The 107 events obtained by summing the results of Franzinetti and Payne (1948), Pickup and Voyvodic (1950), and Titterton (1950), together with the present results.
The smooth curve is drawn through the experimental results of Bonner *et al.* (1948) over the 0–10 MeV range and of Rumbaugh, Roberts, and Hafstad (1938) above the latter energy. It is normalized to agree with the solid line histogram at its maximum.

about 10 MeV. Smith and Chang (1938), using counters, observed α-particles up to an energy of $E_\alpha = 7 \cdot 75$ MeV, and Rumbaugh, Roberts, and Hafstad (1938) α-pairs up to an energy of $15 \cdot 8 \pm 0 \cdot 5$ MeV ; however, the number of disintegrations giving an α-pair energy greater than 9 MeV was $\leqslant 1$ per cent. From an

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analysis of the β-spectrum, Hornyak and Lauritsen (1950) have suggested that about 10 per cent. of the ^{8}Li transitions should go to ^{8}Be states at ~10 MeV and ~13 MeV. The small fraction of α-pairs with energies near these levels observed experimentally may be due to the states undergoing γ-ray transitions. Hammer tracks with α-pair energies greater than 9 MeV have not previously been reported as observed in photographic emulsions.

Thirteen hammer tracks have been found in 4000 stars in G5 plates exposed at approximately 80,000 ft and scanned by the cosmic ray group in this laboratory. The broken lines (Fig. 1) show the energy spectrum of the α-pairs; it includes one pair with an energy of 13 MeV from an ^{8}Li fragment emitted from a light nucleus.

The 13 α-pairs have been combined with the 94 previously reported to give the full-line histogram of Figure 1. This is consistent with the energy spectrum obtained by drawing a smooth curve through the cloud chamber results of

TABLE 1

ANALYSIS OF 13 ^{8}Li(β)^{8}Be*(2α) HAMMER TRACKS

α-Pair Energy (MeV)	Identification of β-Particles	β-Energy (MeV)	Angle between β and α	Angle between ^{8}Li and α	^{8}Li Energy (MeV)	Number of Evaporation Tracks in Star
1·8	Certain	7	88°	88°	23	3
6·1	,,	~1	62°	88°	20	16
3·3	,,	~2	17°	33°	18	8
5·2	Doubtful	—	—	82°	11	11
13·1	,,	—	—	76°	3	4
4·1	Certain	10	79°	62°	6	4
2·7	Not observed	—	—	75°	23	3
4·3	Doubtful	—	—	64°	20	8
3·9	Certain	~2	55°	71°	9	4
8·6	,,	>1	34°	47°	44	11
2·6	,,	8	76°	36°	24	14
3·3	,,	10	46°	88°	13	19
4·1	Not observed	—	—	47°	14	13

Bonner *et al.* (1948) up to 10 MeV and the counter results of Rumbaugh, Roberts, and Hafstad (1938) above that energy and normalizing the curve to agree with the block spectrum at its maximum.

In eight of the 13 events, the track of the ^{8}Li decay electron was clearly observable and, in a further three events, what was probably a low energy electron track was observed coming from the vicinity of the ^{8}Be break-up point. The absence of electron tracks in the other two cases could reasonably be attributed in one case to the proximity of the break-up point to the emulsion surface and in the other to β-emission in a direction unfavourable for observation. Table 1 sets out the data from the analysis of the 13 hammer tracks.

The β-α angular correlation of the hammer tracks coming from the 3 MeV state of ^{8}Be could be useful in deciding the spin and parity of ^{8}Li. Gardner

(1951) has shown that if the ^{8}Li has spin and parity $0+$ the β-α angular distribution should show a maximum near 45°, particularly for high energy β-particles. If the ^{8}Li spin and parity is $3-$, the distribution, whilst still anisotropic, should not have a maximum between 0 and 90°. The statistics of the present events are insufficient to distinguish between these cases but could be added to the results of other laboratories.

References

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