Frequency of $^8$He Nuclei Among Hammer Tracks in Nuclear Emulsion.

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(ricevuto il 17 Luglio 1967)

Summary. — Charges of hammer tracks produced by 1.5 GeV/c K$^-$-interactions with emulsion nuclei have been determined using the track-width measurement technique. It has been found that nearly 13% of the hammer tracks are due to $^8$He fragments.

1. — Introduction.

While studying the problem of the existence of various isotopes, ZEL'DOVICH (1) pointed out that there was a large probability of the existence of an $^8$He nucleus. Subsequently the stability of the $^8$He nucleus against particle emission has been discussed by several authors (2-4).

There are two modes of decay proposed for the $^8$He nucleus:

1) Beta decay of $^8$He nucleus proceeds to the ground state of $^8$Li which with further $\beta^-$ emission goes to $^7$Be and then to two alphas:

$$^8\text{He}(0^+) \xrightarrow{\beta^-} ^8\text{Li}(2^+) \xrightarrow{\beta^-} ^7\text{Be} \rightarrow 2^4\text{He}.$$  

2) Second mode of decay goes not to the ground state of $^8$Li but to an excited state which decays into $^7$Li and a neutron

$$^8\text{He}(0^+) \xrightarrow{\beta^-} ^8\text{Li}(1^+) \rightarrow ^7\text{Li} + n.$$  

According to Poskanzer et al. (5) the probability of the first kind of decay is 88% whereas that of the second kind is 12%.

The first possible observation of $^8$He was reported by Lozhkin and Rimskii (6) on the basis of ionization characteristics of two hammer tracks in emulsion. Later on there was some other experimental evidence (5, 7, 10) for the existence of $^8$He.

It is evident that in emulsion the first mode of decay mentioned above gives rise to a hammer track similar to the tracks of $^7$Li, $^9$Li and $^7$B fragments. In most of the studies regarding the evaporation process the hammer tracks have been attributed to charge three and five nuclei ignoring the contamination of $^8$He. It is the aim of the present work to find out the frequency of $^8$He nuclei among hammer tracks.

In order to discriminate $^8$He fragments from the other unstable fragments producing hammerlike tracks, the following characteristics can be employed:

i) The presence of an electron pair at the decay vertex; this unambiguously establishes the identity as $^8$He nucleus.

ii) During survival the ionization of the fragments of different charges would be different, permitting discrimination by ionization or track width measurements.

In the present study we made observations on 110 hammer tracks, produced by the interactions of 1.5 GeV/c $K^-$-mesons with nuclei of L4 hyper-sensitized emulsions.

The hammer tracks were recorded while scanning the stack for hyperfragments. In order to detect the presence of electrons the decay vertices of all the 110 hammer tracks were searched carefully under magnifications of $\times 1500$ and $\times 750$ by two independent observers for electron tracks. 80% of the events had one electron at the decay vertex whereas none was found to display the electron pair characteristics of the $^8$He fragments. Thus no information could be derived from the decay stars and, therefore, the track width measurement technique was employed to sort out $^8$He fragments from the sample of hammer tracks. Track width measurements were made on all the hammer tracks satisfying the following criteria:

a) The projected range of the track should be $\geq 20 \mu\text{m}$.