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Abstract

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CROSS SECTION FOR THE FORMATION OF Li^8 IN NUCLEAR EMULSION BY PROTONS WITH AN ENERGY OF 9 BeV

(Presented by Academician N. N. Bogolyubov, October 26, 1962)

The formation of the fragment Li^8 in nuclear disintegrations under the action of high-energy particles has been studied in numerous works; however, data on the cross section of this process in the energy region above 1 BeV are scarce. In work (1), in which the formation of multiply charged particles with $Z \geq 4$ on Ag and Br nuclei at an energy of 9 BeV was investigated, an estimate was made of the cross section for the formation of Li^8 and B^8, and it was found to be approximately 3 mb. The present work was carried out in order to refine this value.

NIKFI-R emulsions were irradiated at the synchrophasotron of the Laboratory of High Energies of the Joint Institute for Nuclear Research. To determine the cross section for the formation of Li^8, statistical material obtained in a search along the track for events of proton interactions with nucleons was used. The scanning of the emulsion layers along the track was carried out with an MBI-9 microscope at a magnification of $7 \times 60 \times 1.5$ by the method described in work (2). All rays of each event found along the track were examined at the same magnification and, in this way, all secondary charged particles stopping in the given layer were registered.

A total of 19,411 nuclear disintegrations were examined; of these, 109 contained one hammer-shaped track each, and in one disintegration two such tracks were found. According to work (3), practically all hammer-shaped tracks may be attributed to Li^8. After introducing a geometrical correction taking into account fragments that do not stop in a single layer, the number of Li^8 amounted to 133. To find from these data the cross section for the formation of Li^8 on the nuclei of the elements making up the nuclear emulsion (4), the value of the mean free path for interaction, 37.3 ± 0.7 cm, found in work (5), was used. Use of this value requires excluding from the total number of disintegrations found the single-prong events with a small angle ($\leqslant 5^\circ$) relative to the direction of the primary proton. However, since the scattering angles in single-prong events were not measured, the corresponding uncertainty was included in the total measurement error. The total number of single-prong events among the 19,411 disintegrations is 800.

The cross section for the formation of Li^8 in NIKFI-R emulsion by protons with an energy of 9 BeV was found to be 2.4 ± 0.6 mb. At an energy of about 1 BeV, according to works (6, 7), the cross section for the formation of Li^8 in emulsion is close to 2 mb.

It should be noted that, of the 109 nuclear disintegrations containing Li^8, only 15 have fewer than 7 black rays. This indicates that the disintegration of light nuclei with emission of Li^8 occurs in less than 14% of cases, i.e., the cross section for the formation of Li^8 on light nuclei in emulsion does not exceed 0.3 mb.

Thus, the cross section for the formation of Li^8 in nuclear emulsion in going from an energy of 1 BeV to an energy of 9 BeV remains practically unchanged.

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Note: Figure translations are in progress. See original paper for figures.