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To cite this version:
V. Chuev, V. Davidov, B. Novatskii, A. Ogloblin, S. Sakuta, et al.. ELASTIC SCATTERING OF d, He3 AND α ON Li6. Journal de Physique Colloques, 1971, 32 (C6), pp.C6-163-C6-163. <10.1051/jphyscol:1971628>. <jpa-00214846>

HAL Id: jpa-00214846
https://hal.archives-ouvertes.fr/jpa-00214846
Submitted on 1 Jan 1971

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ELASTIC SCATTERING OF d, He\(^+\) AND \(\alpha\) ON Li\(^6\)

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Résumé. — Les sections efficaces de diffusion de d, He\(^+\), et \(\alpha\) sur Li\(^6\) ont été mesurées à environ 20 MeV dans le centre de masse. Les diffusions \((\alpha + \text{Li}^6)\) et \((\text{d} + \text{Li}^6)\) montrent fortement à l’arrière, ce qui n’est pas le cas pour la diffusion \((\text{He}^+ + \text{Li}^6)\).

Abstract. — The cross sections of the scattering of d, He\(^+\) and \(\alpha\) on Li\(^6\) are measured at the c. m. energy of about 20 MeV. The \((\alpha + \text{Li}^6)\) and \((\text{d} + \text{Li}^6)\) scatterings show a considerable backward peak contrary to the He\(^+ + \text{Li}^6\) scattering.

In the elastic scattering of heavy ions on light nuclei the transfer of several nucleons resulting in the increase of the cross section at large angles [1] is observed. The cross section of the backward scattering is particularly large when the transfer of a cluster, such as an \(\alpha\)-particle in the \(\text{C}^{12} + \text{O}^{16}\) interaction, is possible. Li\(^6\) ions show a well defined d + \(\alpha\) cluster structure, therefore in the scattering of \(\alpha\)-particles on Li\(^6\) the transfer of the deuteron accompanied by a strong rise in the cross section in the backward direction may occur. It is predicted [2] that the ground state wave function of the Li\(^6\) nucleus has an appreciable He\(^3\) + t component (about half as large as the \(\alpha + \text{d}\) component). In this case an increase of the cross section of the elastic scattering of He\(^3\) on Li\(^6\) at large angles must be expected, too.

In the present paper the cross sections of the scattering of \(\alpha\)-particles, He\(^3\) and deuterons on Li\(^6\) (Fig. 1) at the c. m. energies of 21.9 MeV, 22.7 MeV and 14.7 MeV, respectively, were measured. The cross section of the \(\alpha + \text{Li}^6\) scattering exhibits diffraction patterns in the whole range of angles and has a strong peak in the backward direction. The backward peak cross section is about 100 times as large as the Rutherford cross section. This result is in agreement with the suggestion that in the \(\alpha + \text{Li}^6\) scattering the deuteron exchange takes place. In the \(\text{d} + \text{Li}^6\) scattering the cross section is also found to increase with the angle, which can be accounted for the \(\alpha\)-particle exchange. The cross section value of the backward peak is somewhat lower than in the former case. This can be possibly due to the large mass of the cluster transferred.

The He\(^3\) + Li\(^6\) scattering exhibiting diffraction structure at small angles almost monotonously reduces to 180\(^\circ\). No backward peaking is seen. By its absolute value the cross section of the He\(^3\) + Li\(^6\) scattering is appreciably lower in the backward hemisphere in comparison with the \(\text{d} + \text{Li}^6\) and \(\alpha + \text{Li}^6\) scatterings. This implies that the mechanism of the triton cluster exchange does not manifest itself in the He\(^3\) + Li\(^6\) scattering.

Thus, some experiments revealed the cluster structure of Li\(^6\) = He\(^3\) + t [3] and others showed the lack of it (the present work and Ref. 4). In this regard it strongly differs from the Li\(^6\) = \(\alpha + \text{d}\) configuration to which experiments of both kinds are sensitive.

References