

# PECULIARITY OF NUCLEAR REACTIONS INDUCED BY LOOSELY BOUND CLUSTER NUCLEI

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Reactions involving loosely bound nuclei have many special features that have vigorously been discussed in recent years in a number of studies (for example, [1]). These features include the enhancement of interaction cross sections in the subbarrier energy region. This effect is especially pronounced for clustering nuclei (for example,  $^{6,7,9,11}\text{Li}$ ) [2], as well as neutron-halo nuclei (for example,  $^{6,8}\text{He}$ ) [3]. Transfer, breakup, and complete fusion reactions are dominant interaction channels for such nuclei. Processes in which the breakup of loosely bound nuclei in the field of a heavy nucleus is followed by the fusion of the residual nucleus with the target nucleus have been the subject of numerous theoretical and experimental investigations.

Excitation functions are measured for complete-fusion, total cross section and transfer reactions induced by the interaction of  $d$ ,  $^{6,8}\text{He}$  and  $^{6,9,11}\text{Li}$  with  $^{206}\text{Pb}$ ,  $^{209}\text{Bi}$ , and  $\text{Pt}$ . Data obtained for fusion reactions induced by  $^{6,8}\text{He}$  ions deviate from the predictions of the statistical model of compound-nucleus decay at projectile energies in the vicinity of the Coulomb barrier height. A strong enhancement of cross sections for fusion reactions induced by the interaction of  $^{6,8}\text{He}$  with target nuclei is observed. The cross sections for reactions of cluster transfer, neutron transfer from  $^3, 6, 8\text{He}$ , and deuteron transfer from  $^{6,9}\text{Li}$  at deep sub barrier energies are also found to be enhanced. These results are discussed from the point of view of the effect of the cluster structure of nuclei on the interaction probability at energies in the vicinity of the Coulomb barrier height [4].

The energy dependence of total cross sections of reactions  $^6\text{He} + \text{Si}$  and  $^{6,9,11}\text{Li} + \text{Si}$  in the beam energy range  $5 \div 40 \text{ A}\cdot\text{MeV}$  has been measured. For the reactions  $^{9,11}\text{Li} + \text{Si}$  new data in the vicinity a local enhancement for  $20 \text{ A}\cdot\text{MeV}$  of the total cross section was obtained. Theoretical analysis of possible reasons of appearance of this peculiarity in the collisions of nuclei  $^{6,8}\text{He}$  and  $^{9,11}\text{Li}$  with  $\text{Si}$  nuclei has been carried out including the influence of external neutrons of weakly bound projectile nuclei [5].

The results of the present study are of paramount importance for solving astrophysical problems — in particular, for obtaining deeper insight into the mechanism of the production of light elements in the Universe.

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