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LETTER TO THE EDITOR

ON $^{7}Li(^{3}He, p)^{9}Be$ REACTION MECHANISM AT LOW ^{3}He ENERGIES

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The cluster-transfer analysis of the $^{7}Li(^{3}He, p)^{9}Be$ reaction for ^{3}He bombarding energies of 3.2, 4.5 and 10 MeV has shown[1] the importance of both direct and exchange mechanisms[2] in fitting the experimental data on angular distributions of protons. Having the data[3] on the same reaction for ^{3}He energies around 1 MeV, we are trying to understand here whether both direct and exchange mechanisms are important at low ^{3}He energies.

The direct mechanism

$$(d \oplus p) + {}^{7}Li \rightarrow ({}^{7}Li \oplus d) + p \qquad \text{(DI)}$$

is understood as ^{3}He stripping, while the exchange mechanism

$$^{3}He + ({}^{6}He \oplus p) \rightarrow ({}^{6}He \oplus {}^{3}He) + p \qquad \text{(EX)}$$

is understood as the heavy-particle ^{7}Li stripping. The angular distributions for both mechanisms were calculated using PWBA, which is a crude approximation at low energy, of course.

Setting the interaction radius at reasonable value of 5 fm, our calculations show:

- none of our two experimental curves for the angular distributions cannot be fitted by any combination of DI or EX mechanisms, if only $L = O$ is taken into account,
- both experimental curves, for $E_{3He} = 0.9$ MeV and $E_{3He} = 1.1$ MeV, are fairly well fitted if only DI mechanism is taken into account, but introducing both $L = 0$ and $L = 2$ waves (Fig. 1). It is obvious from Fig. 1 that both experimental curves show their maximal values at somewhat larger angles than the PWBA values. This feature is known, from the early stripping theories[4] to be characteristic effect of Coulomb field.

The fact that fits of Fig. 1 cannot be made better by inclusion of EX mechanisms shows the non-importance of EX mechanism at low ^{3}He energy. However, this should not be taken as a discrepancy with the conclusions[1] on importance of both DI and EX mechanisms at higher energies, since we expect the Coulomb field to suppress, with decrease of energy, much faster the EX process, which is

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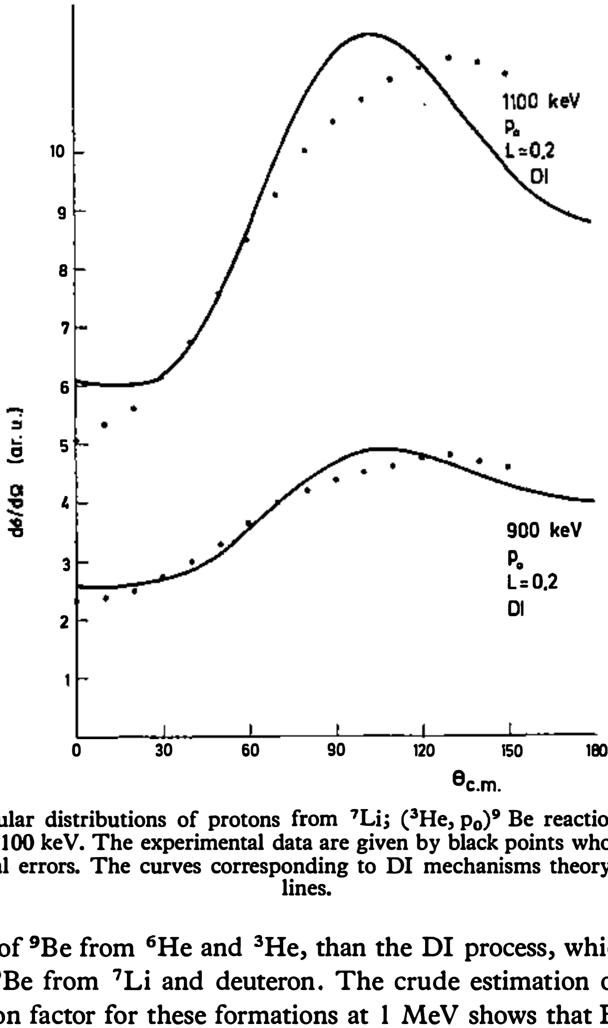

Fig. 1. The angular distributions of protons from ^7Li; (^3He, p_0)^9 Be reaction at ^3He energies of 900 keV and 1100 keV. The experimental data are given by black points whose sizes are larger than experimental errors. The curves corresponding to DI mechanisms theory are given as full lines.

the formation of ^9Be from ^6He and ^3He, than the DI process, which is essentially formation of ^9Be from ^7Li and deuteron. The crude estimation of the Coulomb field penetration factor for these formations at 1 MeV shows that EX mechanisms should be about 25 times weaker than DI mechanism. Therefore, our conclusion, from fits given in Fig. 1, on the non-importance of EX mechanism at low ^3He energy seems to be well-understood.

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