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1.96 Polarization and Analyzing Power of the Reaction $^3He(^3He,p)^5Li$

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Two-nucleon transfer reactions with identical particles in the entrance channel are considered[1]. The reaction $^3He(^3He,p)^5Li$ is studied using polarized ^3He nucleus and leaving the ^5Li residual nucleus in its $3/2^-$ state. This reaction is proceeded at ^3He incident energy of 13.6 MeV. Theoretical calculations for the angular distributions and differential cross-sections are carried out for this reaction for polarized ^3He target nucleus in the entrance channel. These calculations are performed and compared with the experimental measurements. Also, the vector analyzing power and its angular distribution for this reaction has been calculated for polarized ^3He incident projectile. This angular distribution has been found that it is not antisymmetrical around the angle $\theta_{CM} = 90^o$. This result indicates that the two transferred nucleons does not be asked to have parallel spins, knowing the tensor polarization of the residual nucleus ^5Li and the polarization[2),3)] of the outgoing proton.

The angular distribution of the differential cross-sections are calculated theoretically for identical particles in the entrance channel and for polarized target nucleus. The angular distribution of the ^3He vector analyzing power of this reaction are calculated using polarized incident projectile, which is antisymmetric to $\theta_{CM} = 90^o$. Also, the polarization of the outgoing proton are calculated for unpolarized ^3He particles in the entrance channel. The present calculations are carried out following the sequential decay model of Heiss[1]. The ^5Li ($3/2^-$) is considered that it decays to the two free particles of alpha particle and a proton. Therefore, the tensor moments of ^5Li are calculated from the angular correlation of the emitted alpha particles with respect to the recoil axis of the ^5Li nucleus. Then, the tensor moments T_{00}, T_{20}, T_{21} and T_{22} are obtained at certain production angle by fitting the experimental data using the least-square fit analysis. These calculations are repeated for different production angles. Therefore, for the present reaction, in the present study, we used the S-matrix elements in the microscopic calculations[1] for channels up to partial values in both of the entrance and exit channels with ℓ_i and $\ell_f \leqslant 5$. The present calculations of the differential cross-sections and proton polarization are shown in Fig. 1. The present theoretical calculations are shown as the solid curves. These calculations are compared with the experimental measurements[4] shown by the points in Fig. 1. We see from Fig. 1 that the experimental data are reproduced by our present theoretical calculations. Also, the theoretical cal. of the angular distribution of the ^3He vector analyzing power are in good agreement with the experimental data. In spite the good agreement between the theoretical calculations and the experimental data shown in Fig. 1, there is a very little difference between them. This little difference could be explained that it is due to the high Q-value of this reaction. In the mean time, this little difference could overcomed by using more terms of the expansion in the theoretical calculations which is more extensive and need a very lengthly computing time. With this, we get a very close and good agreement between the theoretical calculations and the experimental data.

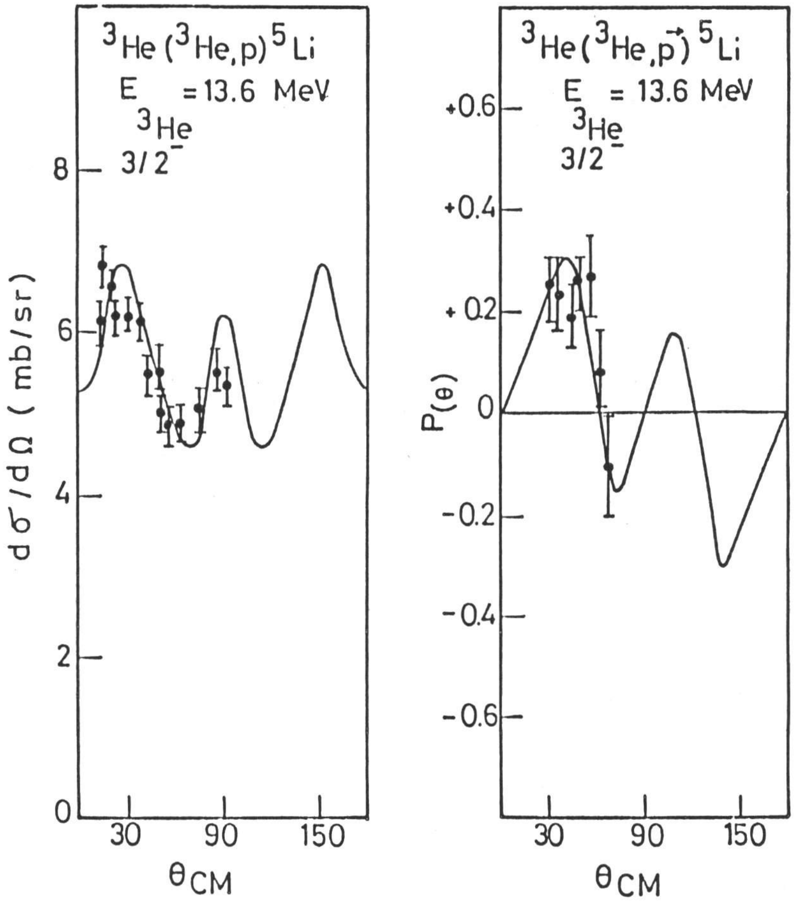

Fig. 1. The differential cross-sections of the $^3He(^3He,p)^5Li$ reaction and the proton polarization of the $^3He(^3He,p)^5Li$ reaction at ^3He incident energy of 13.6 MeV. The solid curves are our present calcutions.

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