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2.6 Folding Interactions in Scattering of $^{7}\vec{Li}$ by ^{120}Sn

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Recently, cross sections and polarization observables in scattering of $^{6}\vec{Li}$ and $^{7}\vec{Li}$ by nuclei have been analyzed by cluster folding (CF) interactions and double folding (DF) ones with remarkable successes in clarifying spin-dependent interactions and reaction mechanisms concerned[1,2]. As was shown in Ref.2, differences due to those of the interaction and the reaction mechanism are easily seen when the energy of the projectile exceeds the coulomb barrier. Here, we will theoretically investigate $^{7}Li+^{120}Sn$ scattering at E_{lab}=44 MeV, by using both of the CF and DF interactions. The measure of the coulomb-barrier effects will be characterized for the same projectile by E, the CM energy and A and Z of the target as $EA^{1/3}/Z$. This is 4.1 in the present case, which is much bigger than 2.5, the one for the $^{7}Li+^{58}Ni$ scattering at E_{lab}=20 MeV[1], where the projectile energy is almost the same as the coulomb-barrier height. The differences mentioned above will be more distinguishable in the present case. The third-rank tensor analyzing power has been measured in this case, the analyses of which are particularly interesting, because the data are the first observation of this quantity.

The analyses are performed by the coupled-channel method by taking into account for ^{7}Li the lowest $1/2^-$, $7/2^-$ and $5/2^-$ states in addition to the ground state . The CF interaction is calculated by folding t-Sn and α-Sn optical potentials[3], assuming the t-α cluster model for ^{7}Li[1]. The real part of the DF interaction is calculated by folding the M3Y inter-nucleon potential into relevant states of the target and the projectile, the imaginary part being obtained by multiplying a constant N_I to the real part[4]. In the standard calculation, spin-orbit interactions are neglected in the folding procedure. The calculated cross sections, vector analyzing powers and second- and third-rank tensor analyzing powers explain gross features of the preliminary data from Heidelberg[5] as is shown in Fig.1, where N_I=0.17. The theoretical successes in the third-rank tensor analyzing power is quite encouraging. In detail, the DF cross sections agree with the data better than the CF ones in both elastic and inelastic scattering. For other quantities, both interactions give different results but the superiority of one over the other cannot be identified by the present data.

In the CF calculation, a deeper α-Sn potential is examined but the results are not distinguishable from those of the shallow potential in all observables. The DF interaction is close to the shallow CF one but slightly different in both the depth and the shape at the region where interactions are effective for the scattering. Such rather delicate differences in the form factor yield appreciable differences in the cross sections observed in Fig.1. The effect of the virtual excitations of ^{7}Li which includes the coulomb excitation is quite large. Particularly, the contribution from the $5/2^-$ state is large in contrast to the small one in earlier analyses of $^{7}Li+^{58}Ni$ scattering[1]. Effects of the t-target spin-orbit interaction are investigated. They are quite small in the Ni target[1]. In the present case, the magnitudes of iT_{11} and T_{30} are decreased by the interaction by considerable amounts. This suggests these analyzing powers to be measures of spin-orbit interactions. More details will be published elsewnere.

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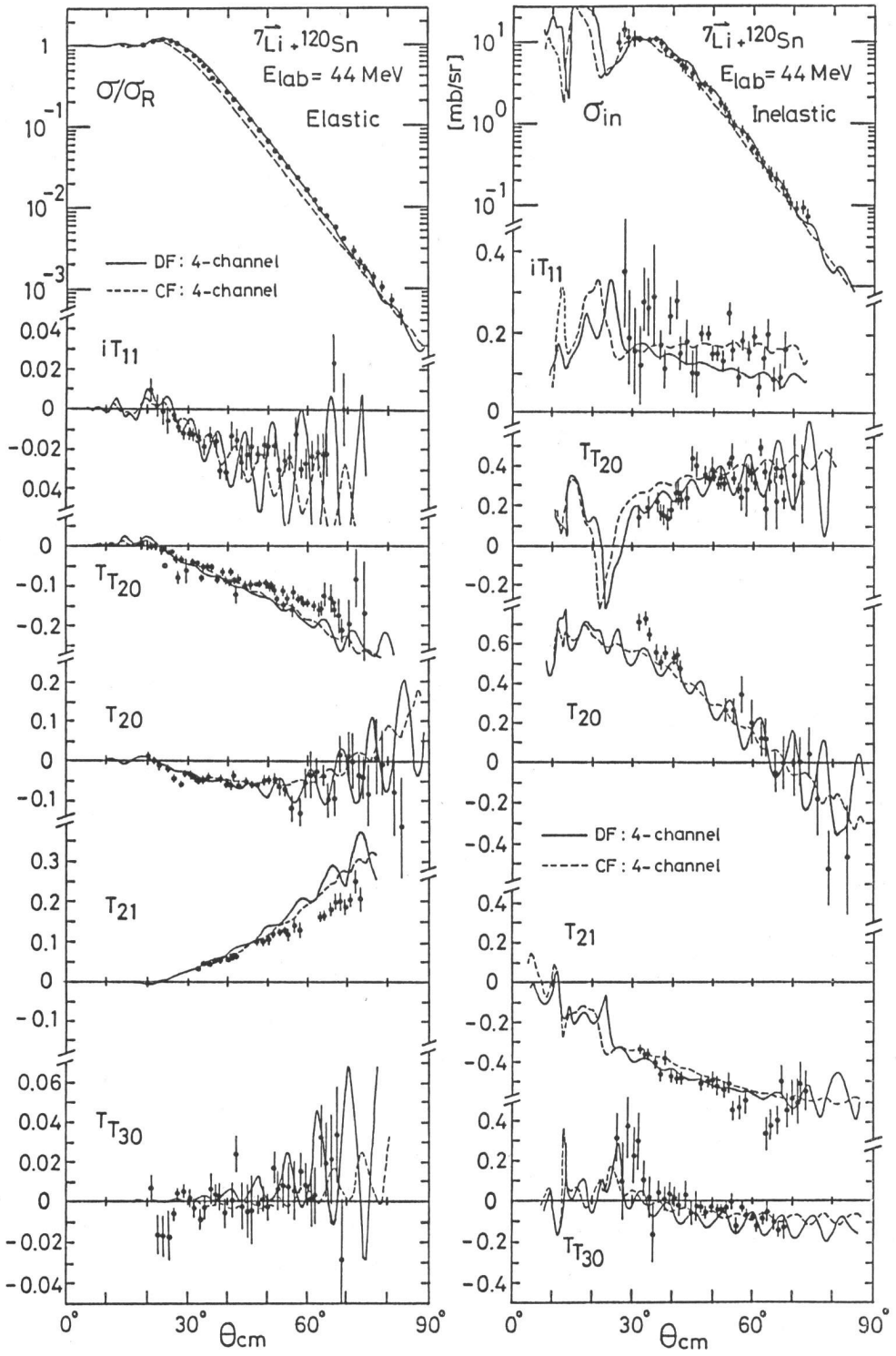

Fig. 1. Cross sections and vector and tensor analyzing powers in scattering of ^{7}Li by ^{120}Sn.