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1.70 Deuteron Breakup Effect on the Polarized Deuteron Scattering

Y. Iseri, M. Yahiro*, M. Kamimura and M. Tanifuji**

Department of Physics, Kyushu University, Fukuoka, Japan
*Shimonoseki University of Fisheries, Shimonoseki, Japan
**Department of Physics, Hosei University, Tokyo, Japan

The purpose of the present paper is to investigate the deuteron (d) breakup effect on the $(\vec{d},d)$ scattering with the method of coupled discretized continuum channels (CDCC) <1> based on the p+n+target three-body model.

In the CDCC calculation, we take account of the d ground state with the p-n angular momentum of $\ell=0$ (S0) and breakup states with $\ell=0$ (S*) and 2 (D*), and restrict the p-n spin state to S=1. Therefore, we consider the total p-n angular momentum of I=1+ for S0 and S*, I=1+, 2+ and 3+ for D*. The p-n continuum with the p-n relative momentum $k \leq 1.0$ fm^{-1} is discretized into 4 bins with an equal width. The p-n interaction is assumed to be an ℓ- and I-dependent central potential with a one-range Gaussian form which is adjusted to reproduce the d binding energy and low-energy p-n phase shifts. As the nucleon-target potentials, the phenomenological ones at the half the d incident energy are adopted.<2>

Figure 1 shows the cross sections for ^{40}Ca$(\vec{d},d)^{40}$Ca at Ed=56 MeV calculated from CDCC including S0+S* and S0+S*+D*, and from the folding model including only S0. The CDCC calculation including S0+S*+D* successfully reproduces the experimental data<3>, while the folding-model one largely deviates from them. Thus, the d-breakup effect is important for the cross section.

Figure 2 shows results for the vector- and tensor-analyzing powers. The folding model reproduces gross features of the data on Ay, Ayy and Axx. This indicates that these observables are mainly brought about by the spin-orbit interaction which is obtained from a folding of the spin-orbit part of nucleon optical potentials with the d ground state wave function. On the other hand, the breakup effect is appreciable in Ay, Ayy and Axx at backward angles $\theta_d \gtrsim 50°$, but very small in Axz and X2=(2Axx+Ayy)/$\sqrt{3}$. Perturbation method for the non-central interactions can show that X2 and Axz are most relavant to the tensor type interaction, Axx and Ayy to both the spin-orbit and tensor-type interactions, Ay to the spin-orbit one, and the cross section to the central one.<4> These may infer that the d-breakup effect brings about the dynamical central and spin-orbit interactions.

We also show in these figures the result of the folding model (S0+D0) with the D-state admixture (D0) in the d ground state which is calculated from the Reid soft-core potential <5> for the p-n interaction. The effect of D0 is important for all tensor analyzing powers, expecially for the reproduction of these fine structures at forward angles.

In conclusion, the breakup effect is quite important for the cross section, Ay, Axx and Ayy, while the effect of D0 is inevitable for all tensor analyzing powers. It is, therefore, interesting to perform a calculation including both effects simultaneously. Such calculations are in progress.

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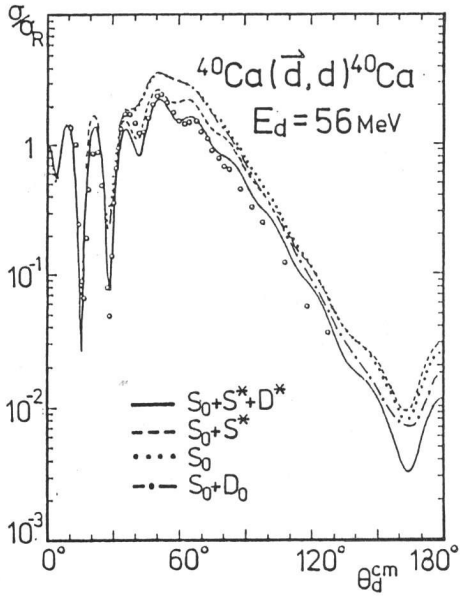

FIG.1

FIG.2