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1.53 Analyzing Power of the (d,p) Reactions Using Polarized Deuteron

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The direct stripping nuclear reactions using incident polarized deuterons are considered. These reactions are performed using vector polarized deuterons to investigate the structure of different nuclei. In this respect, the angular distributions, differential cross-sections, polarizations and vector analyzing powers are measured for the $(\vec{d},p)$ reactions using vector polarized deuterons [as well as tensor analysing powers are measured (in a forthcoming paper) for $(\vec{d},p)$ reactions using tensor polarized deuterons]. Optical model potentials[1] are used in the analysis of both of the deuteron and the proton elastic scattering to fit the corresponding experimental data. The resulting and obtained parameters of the optical model potentials are used and introduced in performing the DWBA calculations. The $(\vec{d},p)$ reactions are analyzed using the DWBA code which includes the D-state of the deuteron in a local energy approach. In the present calculations, the DWCODE programme[2] is used with deuteron D-state parameter $D_2 = 0.484$. In these calculations, the analyzing powers are reproduced quite well. The DWBA calculations describe the overall features of the experimental data quite well and achieves satisfactory fits to the experimental data. At forward angles, a j-dependence is shown from the analyzing powers of these transitions. All these j-values are confirmed by the tensor analyzing power data. The backward angle data is better reproduced and obtained by using different potentials for different transitions.

The present calculations of the angular distributions, differential cross-sections and analyzing powers of the $(\vec{d},p)$ stripping reactions are shown in the figure. These calculations have been performed for different target nuclei with mass number ranging between A = 16 and A = 208. In these calculations, we see that the main features of the cross-sections and analyzing powers are reproduced by using the DWBA calculations for the case of using target nuclei near closed shells. For the case of $(\vec{d},p)$ reactions on deformed target nuclei, some deviations of the experimental data from the usual DWBA calculations are observed. The transition amplitudes which contain corrections originating from the inclusion of tensor potentials are calculated with the DWBA code CHUCK[3]. Figure 1 shows the present calculations for the stripping reactions $^{28}Si(\vec{d},p)$ using incident vector polarized deuterons of 20 MeV. From the comparison and fitting between the present calculations and the experimental data[4], the transition amplitude is weighted with a spectroscopic coefficient of 0.68. The inclusion of the deuteron D-state parameter is very essential to reproduce the shape and magnitude of the T_{20} and T_{22}. This inclusion of the deuteron D-state gives best agreements between theory and experiment, and helps much in identifying the different values of the transferred orbital angular momentum. This parameter value of the D component in the deuteron wave function improves the form factor and the angular momentum coupling. Thus, we can conclude that the D component should be included in the residual interaction and also in the deuteron wave function. Also, the tensor polarization of the final nuclear state gives the entire different informations from the other quantities.

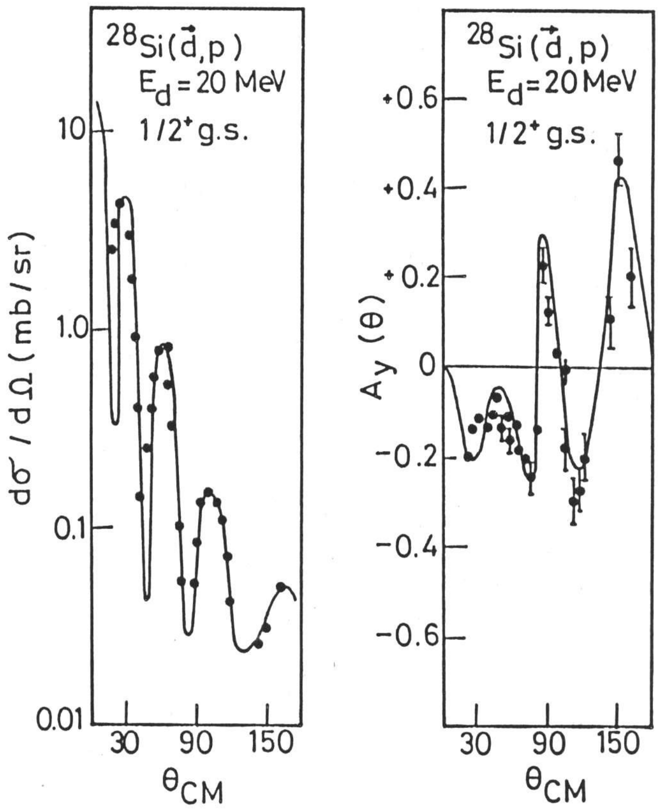

Fig. 1. The differential cross-sections and analyzing power distributions for the ^{28}Si($\vec{d}$,p) reaction at deuteron incident energy of 20 MeV. The solid curves are our present calculations.

References

1) F.D. Becchetti and G.W. Greenlees: Phys. Rev. 182 (1969) 1190.
2) J.D. Harvey and F.D. Santos: DWCODE, Internal Report, University of Surrey, Guildford, England, 1970.
3) P.D. Kunz: Code CHUCK, University of Colorado, U.S.A.
4) N. Seichert, H. Clement, R. Frick, G. Graw, P. Schiemenz and Sun Tsu-Hsun: in Polarization Phenomena in Nuclear Physics, Edited by: G.G. Ohlsen, R.E. Brown, N. Jarmie, W.W. McNaughton and G.M. Hale (AIP Conference Proceedings, No. 69, New York, 1981), p. 667.