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Polarization Transfer Measurement for (d,p) Reactions on ^{12}C and ^{28}Si at E_d = 56 MeV

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Beside an interest as a spectroscopic tool, the (d,p) reaction provides a good test of reaction theories. Its distorting potentials and form factors have been also tested and established. But the recent study on the (d,p) reaction[1)] reported that the DWBA prediction did not always reproduce the experimental data, because the contribution of the nuclear interior is not treated properly by the DWBA. It is important to survey the contribution from inside the nucleus. Polarization transfer measurement is very effective for this purpose because the relation between the polariztions of incident and outgoing particles reflects directly the influence of the interaction encountered inside the nucleus.

Polarization transfer coefficients $K_y^{y'}$ and $K_{yy}^{y'}$ were measured for the (d,p) reactions on ^{12}C and ^{28}Si. The experiment was carried out at the Research Center for Nuclear Physics, Osaka University using a vector- and tensor-polarized deuteron beam accelerated up to 56 MeV by the AVF cyclotron. The beam bombarded a target of carbon or silicon sheet of several ten mg/cm^2 thick. The polarization of outgoing protons was measured by the spin transfer spectrograph DUMAS. The detail of DUMAS may be given in another contributed paper for this symposium. The outgoing protons were analyzed by their momenta at the first focal plane and then they were focused again at the second focal point where a target stack of the proton polarimeter was positioned. The polarization was determined by the asymmetry of the yields of left/right detector sets of the polarimeter.

Measurement was performed in the angular range from 5° to 40° with 5° steps. Transitions to ($\frac{1}{2}^-$; 0.000 MeV) and ($\frac{1}{2}^+$;3.088) of ^{13}C and ($\frac{1}{2}^+$; 0.000),($\frac{3}{2}^+$; 1.273),($\frac{5}{2}^+$; 2.028) and ($\frac{7}{2}^-$; 3.623) of ^{29}Si were observed with a good separation to the other levels. A typical position spectrum at the first focal plane is shown in Fig. 1. The obtained angular distributions of $K_y^{y'}$ and $K_{yy}^{y'}$ for some levels are shown in Fig. 2 through 4. Other polarization observables i.e. A_y , A_{yy} and $P_{y'}^0$, were also measured at the same time.

Preliminary result of an ordinary finite range DWBA calculation[2)] is also illustrated in the figures. The distorting potentials and form factor parameters were taken from references[1,3)]. It is seen that the deuteron D-state contribution is emphasized in $K_y^{y'}$ of $\frac{1}{2}^+$ transition while it is not so distinct in higher transition or in $K_{yy}^{y'}$. A remarkable j-dependence is seen between the angular distribution of $\frac{3}{2}^+$ and $\frac{5}{2}^+$ in $K_{yy}^{y'}$ but not in $K_y^{y'}$. Further analysis is now in progress.

References

1) K. Hatanaka et al., Nucl. Phys. A419 (1984) 530.
2) P. D. Kunz, program code DWUCK5, unpublished.
3) K. Hatanaka et al., Nucl. Phys. A340 (1982) 93; H. Sakaguchi et al., Phys Rev. C26 (1982) 944; H. Ohnuma and T. Kubo, private communication.

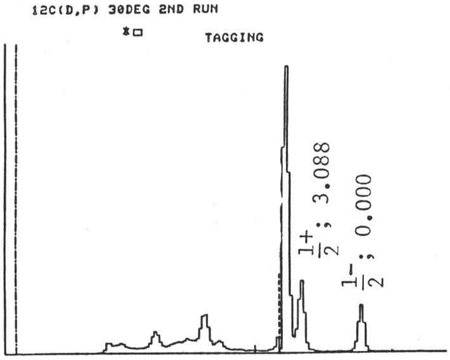

Fig. 1. An example of position spectra at the first focal plane. In this case, several low-lying peaks of ^{13}C are seen.

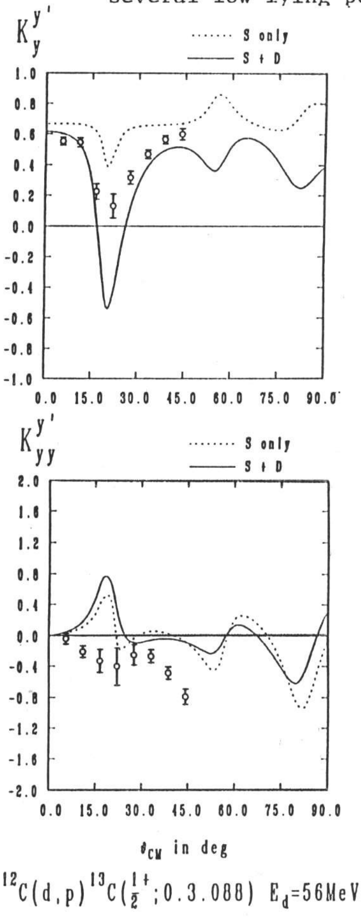

Fig. 2.
Measured $K_y^{y'}$ and $K_{yy}^{y'}$ angular distributions for the $^{12}C(d,p)$ $^{13}C(\frac{1}{2}^+$; 3.088 MeV) reaction. Lines represent the finite range DWBA prediction with (solid line) or without (dotted line) the deuteron D-state.

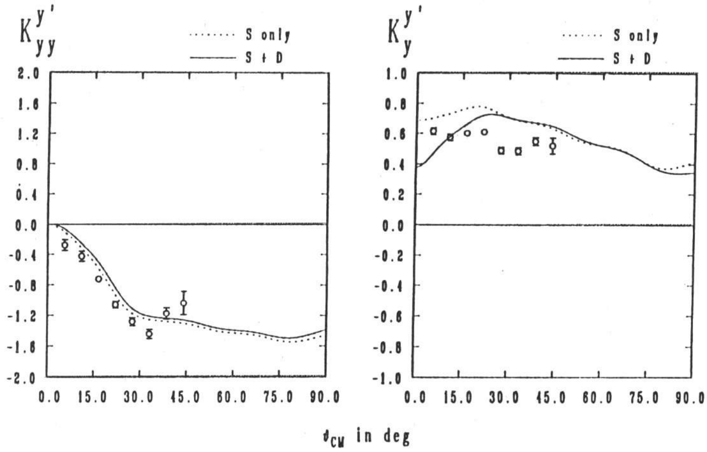

Fig. 3. Same as Fig. 2 but for the $^{28}Si(d,p)^{29}Si(\frac{3}{2}^+$; 1.273 MeV) reaction.

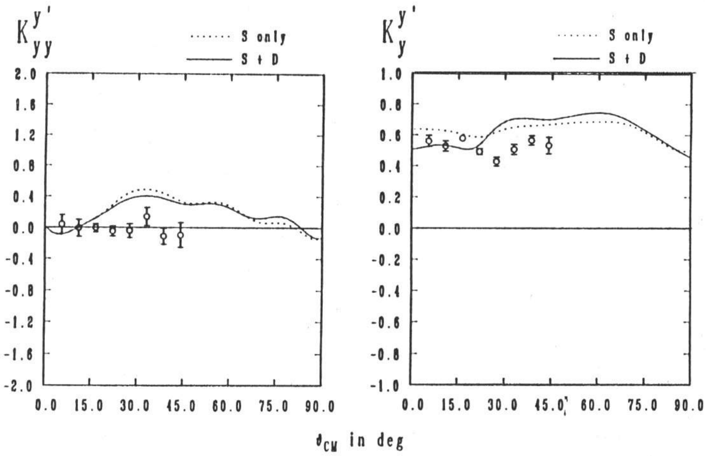

Fig. 4. Same as Fig. 2 but for the $^{28}Si(d,p)^{29}Si(\frac{5}{2}^+$; 2.028 MeV) reaction.