# FORWARD-ANGLE VALUES OF POLARIZATION-TRANSFER (PT) COEFFICIENTS FOR THE $^{16}O\ (\vec{p},\vec{p}')^{16}O\ (4^-, T = 1)$ AND $^{28}Si\ (\vec{p},\vec{p}')^{28}Si\ (6^-, T = 1)$ REACTIONS

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Unnatural-parity transitions at extremely forward angles (at and near zero degrees) are characterized by the fact that the $D_{NN}$ value should be practically equal to the $D_{SS}$ value. This may be due to the circumstance that in this case the $\hat{N}$ direction is basically identical to the $\hat{S}$ direction [1] (owing to the symmetry around the scattering axis). Our calculations (Fig.) at $\theta_{c.m.} = 1^\circ$ with the program DWBA 91 from Raynal and with the Geramb *DD* forces (PH, solid curves) and the Nakayama–Love no*DD* interaction (NL, dashed curves) confirm this for the stretched isovector $4^-$, $T = 1$ (18.98 MeV) transition in $^{16}O$.

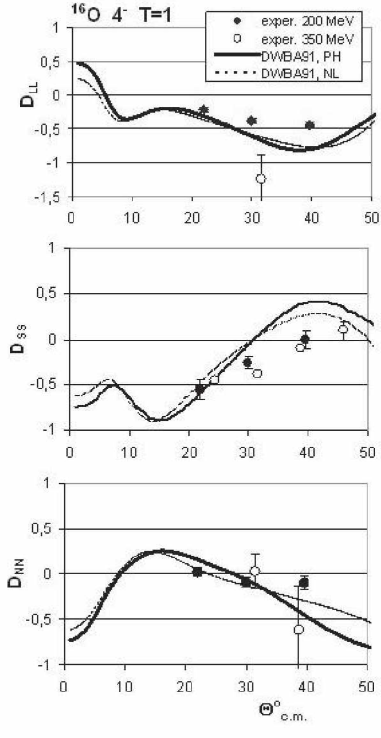


***Fig.*** *The calculations (curves) and experimental data (dots) are shown. The measurements at $E_p$ = 200 MeV (dark dots) are taken from [2] – $D_{ll}$, $D_{SS}$, and from [3] - $D_{NN}$. The measurements at 350 MeV (open dots) are from [4]. The angles for 350 MeV have been multiplied by the coefficient $\kappa = (350 / 200)^{1/2} = 1.32$. All the calculations have been made at $E_p$ = 200 MeV.*

In the case of the PH force, $D_{NN} = -0.73$, and $D_{SS} = -0.74$. The quantity $\Sigma$, as a linear combination of the PT coefficient $D_{ii}$ (called total spin transfer [1]), i.e. $\Sigma = [3 - (D_{NN} + D_{SS} + D_{LL})] / 4$, is equal to 1 for spin-flip ($\Delta S = 1$) transitions and 0 for non-spin-flip ($\Delta S = 0$) transitions, if the spin-orbit interaction is negligible. This may occur in the $(\vec{p}, \vec{p}')$ process at $\theta \approx 0^o$. In our calculations at $\theta = 1^o$, $\Sigma$ was equal to 1.00 for both PH and NL forces. The relation

$$D_{NN}(0^o) = \pm [1 + D_{LL}(0^o)] / 2 \quad (1)$$

is also well-known [1]. The plus sign in it refers to natural-parity, and the minus sign refers to unnatural-parity transitions. In our calculations at $\theta = 1^o$, this relation in a digital representation was as follows: $-0.730 \approx -0.734$ for PH force, and $-0.614 \approx -0.618$ for NL interaction.

Therefore, all the calculated combinations of the PT coefficients $D_{ii}$ at and near zero degrees are in a good agreement with the corresponding theoretical relations [1]. Moreover, the calculations using DWBA 91 provide a satisfactory description of the experimental measurements $D_{ii}$ (Fig.), obtained in the region of maximal differential cross sections.

We have also performed a similar study of the $T = 1$ stretched $6^-$ state at 14.35 MeV in $^{28}Si$, using PT coefficients from $(\vec{p}, \vec{p}')$ measurements at 200 MeV [3] and 500 MeV [5]. Our analysis, using the program DWBA 91 and PH forces, has revealed that $D_{NN}(0^o) = D_{SS}(0^o) = -0.52$. The quantity $\Sigma$ appears to be practically equal to 1 (0.98), and equation (1) in a digital representation gives the following: $-0.521 = -0.521$.

The main qualitative features of the measured and calculated PT coefficients for the $6^-$, $T = 1$ excitation (not shown) and these of the corresponding data for the $4^-$, $T = 1$ excitation (Fig.) in the region of maximal differential cross sections are principally of a similar character. This is also an important guide.

Therefore, we have confirmed the suggestion [5, 6] that $D_{SS}$, $D_{LL}$ and $D_{NN}$ should resemble each other for all isovector stretched states, since the characteristics of $D_{ii}$ depend primarily on the isovector stretched-state assumption and the sampled properties of the force. Thus, for pure stretched states of high spin, the qualitative shapes of $D_{ii}$ should be approximately independent of the nucleus and are similar over a wide range of energies. Lastly, we would like to emphasize that, as $D_{SS}$, $D_{LL}$ and $D_{NN}$ are very insensitive to the type of distortion used [6] all these common characteristics should become most apparent for scattering at and near $\theta_{c.m.} = 0^o$ in the excitation of all the $T = 1$ stretched states.


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