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.

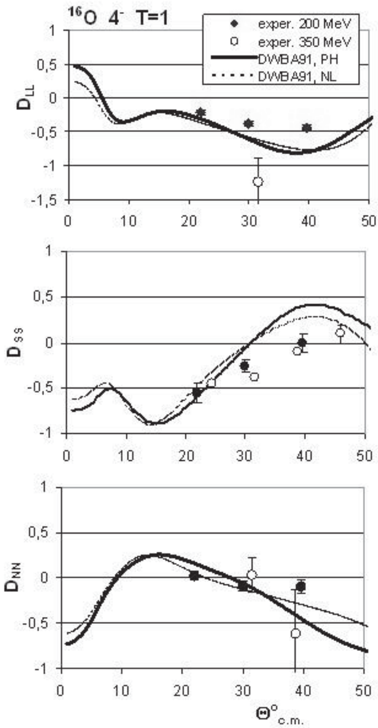

Fig. *The calculations (curves) and experimental data (dots) are shown. The measurements at E_p = 200 MeV (dark dots) are taken from [2] – D_{ll}, D_{SS}, and from [3] - D_{NN}. The measurements at 350 MeV (open dots) are from [4]. The angles for 350 MeV have been multiplied by the coefficient $\kappa = (350 / 200)^{1/2} = 1.32$. 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 Σ, 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 $\theta = 1^o$, Σ 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 ≈ – 0.734 for PH force, and – 0.614 ≈ – 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 Σ 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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