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1.47 The 1f7/2 transfer in $(\vec{d},p)$ and $(\vec{d},n)$ near E_d = 23 MeV, a problem for DWBA[+])

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Within a study of $(\vec{d},p)$ reactions with vector polarized deuterons of the Munich tandem accelerator at incident deuteron energies near 20 MeV from various nuclei ($^{16,18}O$, ^{28}Si, ^{36}A, ^{36}S, $^{40,48}Ca$, ^{54}Cr, ^{90}Zr, ^{144}Sm, ^{209}Pb)[1,2] we obtained neutron transfer data for nearly any neutron single particle configuration. For transitions with large spectroscopic factors standard DWBA calculations using global optical potential sets for the entrance[3,4] and exit channel[5] in general reproduce the main features of $\sigma(\theta)$ and $iT_{11}(\theta)$ data. In most cases an improved fit of transitions with a given l,j value can be obtained by optical potential parameter adjustment, this however often (e.g. for transitions in ^{144}Sm) worsens the description for other (l,j) values indicating shortcomings of the standard DWBA procedure.

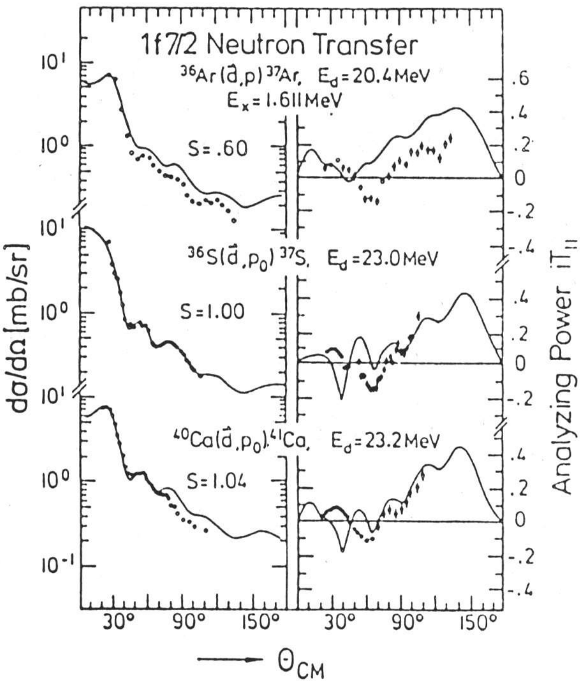
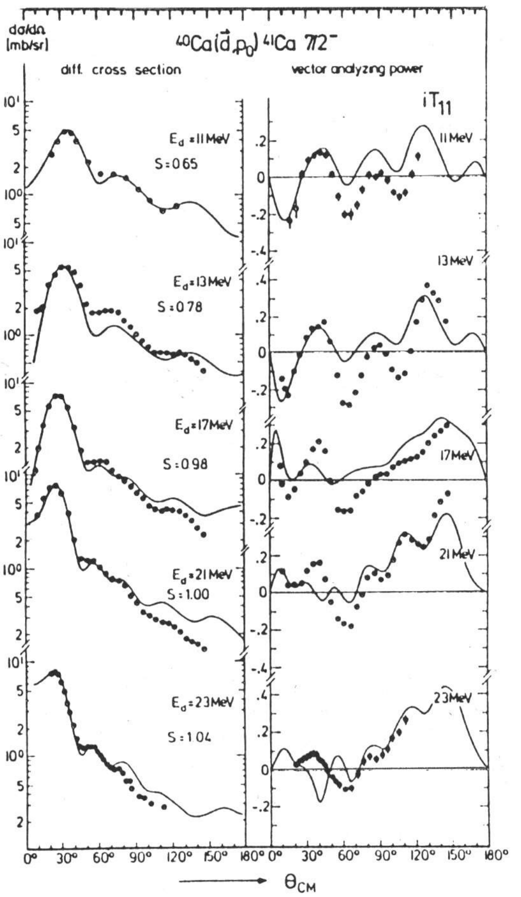


Fig. 1. Transfer data with DWBA curves

A very pronounced deviation we observe for the 1f7/2 transfer near E_d = 20 MeV. Fig. 1 displays data for ^{36}Ar, ^{36}S and ^{40}Ca targets. They have nearly identical angular distributions, the indicated DWBA curves fail significantly to reproduce $iT_{11}(\theta)$ in the θ = 20° to 70° range. Systematic variations of optical potential parameters, bound state form factors, non locality correction factors, inelastic transfer admixtures and the inclusion of D-state effects have been without success. The indicated DWBA curves are representative for the kind of reproduction one may obtain with different choices of potentials.

The measured energy dependence of this effect is shown in fig. 2, the data at 11 MeV are taken from ref. 7. The experimentally observed $iT_{11}(\theta)$ behaviour in the 20° to 70° region is nearly constant from E_d = 11 to 23 MeV, the quality of the DWBA description decreases with increasing energy. The curves are calculated with potentials[5,6] adjusted at each energy (increasing W_D of the exit channel) to reproduce $\sigma(\theta)$. This change is not significant for the poor reproduction of $iT_{11}(\theta)$.

We additionally measured $^{40}Ca(d,n)$, fig. 3 shows data taken with the Munich TOF facility[8] with an energy resolution of 1 MeV FWHM. The cross section determination was crude and likely to be wrong within a factor of two even in the relative scale, whereas $iT_{11}(\theta)$ as a rela-



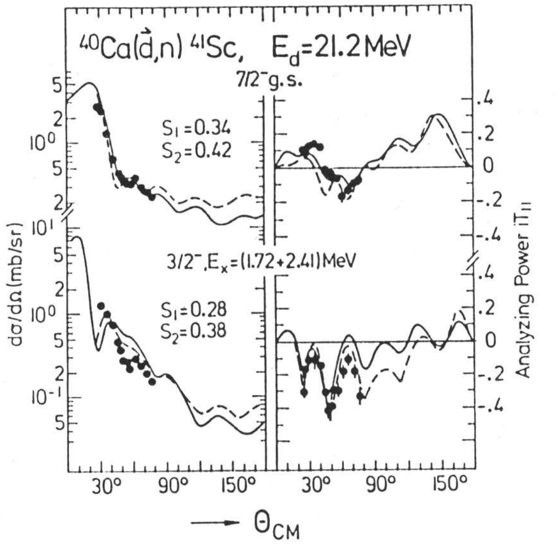


Fig. 3. Neutron TOF data, the solid and the dashed DWBA curves are calculated with potentials of ref. 4 and 3, respectively

Fig. 2. Energy dependence, the E_d = 13 to 21 MeV data are measured with the Q3D, the E_d = 11 MeV are from ref. 7

tive quantity is considered to be determined more accurate. Remarkable is again the satisfying description of $iT_{11}(\theta)$ by DWBA with potentials of refs. 4,3,9) for the p3/2 proton transfer (as in the case of (d,p) and the rather poor fit of the 1f7/2 transfer.

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